EQUITY IMPLICATIONS OF INSECTICIDE TREATED NETS (ITN) DISTRIBUTED FOR FREE OR WITHOUT CO-PAYMENT: COVERAGE AND UTILIZATION OF ITNS AMONG UNDER FIVE CHILDREN IN KISARAWE AND MPANDA DISTRICTS.

By

George Mugambage Ruhago

A Dissertation submitted in (partial) fulfillment of the requirement for the award of a degree of Master of Arts Health Policy and Management

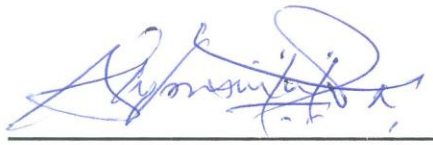
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CERTIFICATION

The undersigned certifies that he has read and hereby recommends for acceptance a dissertation entitled: **Equity implications of Insecticide Treated Nets (ITN) distributed for free or without co-payment: coverage and utilization of ITNs among under five children in Kisarawe and Mpanda Districts** in partial fulfilment of the requirements for award of a degree of Master of Arts Health Policy and Management of the Muhimbili University of Health and Allied Sciences.



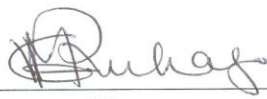
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DEDICATION

This work is dedicated to both my parents my Late Father Wilson Ruhago and my mother Jocelyn Sambwe for bringing me into this world. Particularly to my mother for all sacrifices she made to make sure I attained education. I owe it all to them.

ABSTRACT

Background

In Tanzania, the distribution and therefore coverage of insecticide-treated nets (ITNs) is unequatable. Arguments about the most effective and equitable approach of distributing ITNs are centered on whether to provide ITNs free of charge or continue with the existing social marketing strategies. The Government has decided to provide free ITNs to all under five children in the country, it remains in focus if that strategy will achieve effective coverage and utilisation.

This study examined the equity implication of ownership and utilization of ITNs, among households of different socioeconomic quintiles in a district with free ITNs as compared to a district without free ITN distribution.

Methods

A cross-sectional household survey was conducted in two districts Mpanda in Rukwa Region (with free ITN roll out) and Kisarawe in Coast region (without free ITNs). Heads of 314 household were interviewed 158 in Mpanda and 156 in Kisarawe. Concentration index and regression analysis were performed and concentration curve drawn to establish inequalities on ownership and utilisation of ITNs.

Results

Ownership of ITNs increased from 29% in 2007/08 national survey to 90 post roll out of free ITNs in Mpanda, and utilization increased from 13% to 77% almost reaching the Roll Back Malaria and MDG targets of 80% coverage and use. Inequality was considerably lower in Mpanda, with nearly perfect equality in use (concentration index 0.009) and ownership (concentration index 0.010). In Kisarawe ownership of ITNs remained low 53% nearly similar to 2007/08 national survey 48%, with marked inequality concentration index 0.132. Only 42% of under five slept under ITN in Kisarawe district with pro rich concentration index of 0.027.

Conclusion

The results shed some light on the possibility of reducing inequality in ownership and utilization of ITNs and attaining Roll Back Malaria and Millennium Development Goals, through the provision of free ITNS to all underprivileged groups. This has the potential to decrease burden of disease hence reduction of disparity in disease outcome.

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LIST OF ABBREVIATIONS

ANC	Ante Natal Clinic
AIDS	Acquired Immune Deficiency Virus
DMO	District Medical Officer
DHMT	District Health Management Team
EPI	Expanded Programme on Immunization
GAVI	Global Alliance on Vaccine and Immunization
GDP	Gross Domestic Product
GFATM	Global Fund on HIV/AIDS and Malaria
HIV	Human Immunodeficiency Virus
IHI	Ifakara Health Institute
ITN	Insecticide Treated Bed Nets
IRS	Indoor Residual Spraying
LLIN	Long Lasting Insecticide Nets
MEDA	Mennonite Economic Development Associates
MDG	Millennium Development Goals
MOHSW	Ministry of Health and Social Welfare
NMCP	National Malaria Control Programme
NOMA	Norad's programme for master studies
PMI	President Malaria Initiative
PSI	Population Service International

TB	Tuberculosis
THMIS	Tanzania HIV/AIDS and Malaria Indicator Survey
WB	World Bank
WHO	World Health Organization
UNICEF	United Nations Children Fund

DEFINITION OF OPERATIONAL TERMS

An insecticide-treated net- ITN

- A "permanent net" A factory-treated net that does not require any further treatment or Long Lasting Insecticide Net (LLIN) **or**
- A "pre-treated net" A net that has been pre-treated, but requires further treatment, obtained within the past 12 months **or**
- A net that has been soaked with insecticide within the past 12 months

Coverage - Households with at least one insecticide-treated net (ITN).

Equity - Equal access for equal needs irrespective of income and other socio-demographic factors.

Household – A group of individuals who takes a meal together, with male or female as head of the household.

Mosquito Bed net – In this study it means an ITN or any net

Utilization - Children under age five who slept under an insecticide treated net (ITN) the night before the interview.

Key variables

Dependent Variable – Inequality in ownership and utilisation of ITNs

Independent variable – socioeconomic status

CHAPTER ONE

1.0 INTRODUCTION

1.1 Background to the study

This study concerns equity implications of different distribution strategies for insecticide treated mosquito nets in Tanzania, with a particular focus on their coverage and utilization. Malaria is the most prevalent parasitic disease in the world. There are an estimated 247 million malaria cases with 3.3 billion people at risk of malaria worldwide. Over half of the cases are in Africa south of the Sahara causing nearly a million deaths of which over 80% afflict children under five years of age [1].

Tanzania is one of the countries with the highest burden of malaria, ranked third in the world, after Nigeria and Democratic Republic of Congo [1]. The disease is endemic in almost all parts of the country, with more than 90% of the population (39 Million People) at risk of getting malaria [2]. Children under five years of age are the most affected group. Children that survive death from malaria episodes may suffer from other complications such as anaemia and cerebral malaria, that affects long-term development [2, 3]. Malaria consumes an estimated 3.4% of GDP per year [4]. The estimated loss at household level is mainly due to expenditure on treatment, transport and other expenditure associated with illness including loss of productivity.

At the Abuja Summit in April 2000, Tanzania among other nations committed itself to protect 60% of its population at high risk malaria by 2005[5]. Also Millennium Development Goals (MDGs), the Roll Back Malaria Partnership, and the US President's Malaria Initiative (PMI) aim at scaling up coverage of Insecticide Treated Nets (ITNs) use to at least 80% among young children and pregnant women by 2010[1, 6, 7].

The Tanzania government through its National Malaria Control programme has initiated a new approach to distribution of ITNs to under five children through a "catch up" campaign and "keep up" strategy. The programme is jointly funded by Global Fund to Fight HIV/AIDS, TB and Malaria, The World Bank, and Presidents Malaria Initiative (PMI) by more than 40 million USD. The "catch up" programme will distribute 5.6 million long lasting insecticide nets (LLINs) to all children aged 1-5 years by mid 2009. UNICEF through its "Malaria No more" will add 1.6 million nets.

Immediately after the "catch up" campaign the "Keep up" strategy will start country wide lasting for 2 years, aiming at promotion of LLINs use, with a subsidized voucher scheme that will cover up to 90% of the total cost of ITNs. To complement that, a major scale up of communication activities through mass media and community based sensitization to affect behaviour change will be undertaken.

1.2 Statement of the problem

Malaria is the number one killer disease and leading in terms of health facility attendance in Sub Saharan Africa, increasing a burden to the already overstretched health system. In Tanzania, the number of clinical malaria cases is estimated to be 17-20 million cases per

year resulting in more than 100 000 deaths, 80% of which are in children under 5 years of age [3].

WHO [1] suggests a number of control methods that have been widely practiced, such as case management (including diagnostic services strengthening), increased availability of ITN at community level through subsidy and commercial market outlet, indoor residual spraying (IRS) and Malaria prevention in pregnant women through anti-malarial prophylaxis in the form of Intermittent Presumptive Treatment (IPT).

ITNs have emerged as a prominent cost effective tool in combating malaria, with an estimated cost per Disability Adjusted Life Year (DALY) averted of between $19 and $85 [8], and has been found to reduce child mortality by 17% and clinical episodes by 50% [9]. However, fifteen years post evidence of the ability of ITN in reducing child mortality and morbidity, coverage and use of ITN in Tanzania is still low. According to the Tanzania demographic and Health survey data of 2004-2005 ITN coverage was 47% and 13% in urban and rural areas respectively. Average rate for under five children who slept under ITN was only 16%, with variation of use among urban areas (40%) compared to rural areas (10%) [10].

A more recent survey, Tanzania HIV/AIDS and Malaria Indicator Survey (THMIS) of 2007/08, shows that ITN coverage in rural areas is low (33%) compared to urban areas (59%). Utilization is even lower with an average of 26%, with disparities among rural and urban areas: while rural area use is 21%, in urban areas use is more than 49% [11]. The Abuja declaration and Millennium Development Goals require that those at risk of malaria

be protected against the disease. The Tanzania National Health Policy recognizes children under age five and pregnant women as high-risk groups that should be protected from malaria by sleeping under ITNs. Yet, accessibility of ITNs remains a challenge among rural and most poor households.

A number of strategies in distribution of ITNs have been employed; the two commonly practiced methods are social marketing (subsidized delivery) and commercial market (private-unsubsidized delivery). Free delivery has only been implemented in small areas mainly through research projects and charity.

The current most practiced distribution strategies are not addressing the needs of the vulnerable groups, especially the poor, as both methods depend on commercial retailers. It has been revealed that majority of commercial retailers are concentrated in urban areas or areas of relative wealth within a rural area [12]. This strategy leaves a majority of the poor population who lives in rural areas unattended, which further deepens inequalities in accessing ITNs as the most poor population have a tendency to live in remote part of rural areas without any commercial centre nearby and most of them cannot afford subsidized ITNs. As a result today the coverage and use of ITN tend to favour the well off urban population. However it is the most poor households who tend to be associated with the highest number of malaria episodes as compared to the least poor [13].

In order to redress inequity in access and utilization of health interventions, the government of Tanzania in collaboration with development partners have adopted a "catch

up" strategy of directly providing free long lasting insecticide nets to children between 1 and 5 years of age[3].

The strategy to distribute free ITNs in Tanzania is expected to achieve equity and reaching a higher level of coverage in the population within a short time. This is what the "catch up" campaign in Tanzania wants to achieve, given the fact that it is only a year before reaching the 2010 goal of protecting 80% of vulnerable groups. A majority of areas in Tanzania and other Sub-Sahara Africa Countries are far lower than one third of the target.

A meta analysis of 17 studies conducted in Sub Saharan Africa revealed that the highest level of household ownership of ITNs was achieved through free delivery (63%). Though ITNs use by underprivileged groups (pregnant women and children under five years) had been acquired through private unsubsidized market 68% [14]. Studies done in Kenya and Tanzania revealed low utilization of freely distributed ITNs [15, 16].

Although free distribution of ITNs increases ownership, this may not necessary increase use. It is a common assumption that a purchased commodity tends to be more highly valued by a consumer compared to one obtained for free. Hence expectation that ITNs acquired for free will be less utilized compared to those purchased through unsubsidized market price or subsidized social marketing.

While free distribution may increase coverage, it is the use that reduces episodes of malaria and decreases the demand for malaria treatment. Therefore for increased coverage to be a success it should go hand in hand with increased utilization. Will free ITNs be valued and

used compared to ITNs provided by market channels? And who will value free ITNs or ITNs from the market, among the poor and relatively rich people?

Few studies from Tanzania have focused on the direct comparison of coverage and utilization between delivery systems, hence conclusions on the relative merits of each delivery systems are difficult to make [14]. It is important to conduct a study in two areas, one with free distributed ITNs and one without free ITNs in order to determine ownership and the subsequent utilization rates of freely provided ITNs compared to the purchased ones among the poor and less poor accordingly.

1.3 Significance of the study

The problem of low coverage and utilization of ITNs still exists, especially among under five children in poor households and the consequences resulting from malaria illness are alarming.

Therefore conducting a study that compares coverage and utilization of ITNs in a district where the main ITN delivery is through both social marketing and commercial sector but without free ITNs and a district currently covered with free distributed ITNs, is important in order to determine degree of inequality in ITNs ownership and utilisation.

The study findings will be useful for policy makers and other stakeholders in formulation of evidence based targeted interventions that will achieve high ITNs coverage and increased utilization, as well as minimizing inequality. This study is expected to contribute

to a better understanding of how to achieve an overall improvement in ITN use for malaria control in Tanzania.

1.4 Research Questions

- Is there a difference of ITN ownership and utilization among children below five years in areas where ITNs are provided for free compared to areas where ITNs are not provided for free?
- Is there a difference between ITN ownership and utilization among different socioeconomic groups in areas where ITNs are provided for free compared to areas where ITNs are not provided for free?

1.5 Broad objective

To examine inequalities in ownership and use of mosquito nets distributed for free or through market mechanisms to household with children under the age of five years in Kisarawe and Mpanda Districts.

1.6 Specific objective

1.6.1 To determine the ownership of ITNs among households with under five children in Kisarawe and Mpanda Districts.

1.6.2 To determine utilization of ITNs among households with under five children in Kisarawe and Mpanda Districts.

1.6.3 To determine the socioeconomic profile of households with under five children in Kisarawe and Mpanda Districts.

1.6.4 To compare ITNs inequalities in ownership and utilization under the two different distribution mechanisms in Kisarawe and Mpanda Districts.

CHAPTER TWO

2.0 LITERATURE REVIEW

2.1 Malaria, ITNs and poverty

Malaria preys on everyone, but especially the poor and keeps them poor; poverty prevents people from buying ITNs for preventing malaria and medicine to cure the deadly disease. A study done in south eastern Tanzania revealed that emergencies from malaria attack plunge poor families into debt, from which they can't recover; particularly in the rainy season, when malaria prevalence is highest but liquidity is lower [17].

It is well established that there are affordable and effective interventions such as use of ITNs that can reduce number of deaths among children below five years of age in sub-Saharan Africa. But such important tools have failed to reach community wide coverage especially in the poorest household mainly located in rural vicinity.

The household costs of ITNs (estimated to be US$ 5 to 7) have posed a major impediment in increased coverage of ITNs for many poor households [8]. Analysis of data from nationally representative surveys in 26 African countries revealed that coverage of ITNs is strongly concentrated in the least poor households [18].

There are concerns regarding how best to target; the most common basis for targeting is biological and economical vulnerability to malaria [19]. The biological vulnerable are mainly pregnant women and children under five years of age. Economic vulnerability is

not clearly defined and rarely practiced as a basis for targeting. But there is a strong evidence that a household malaria episodes is associated with reduced household socioeconomic status [13].

2.2 ITNs distribution

Much of the public discourse is focused on the design of a distribution system of ITN that will achieve fairness. There is a debate on whether ITNs should be distributed freely; through heavily subsidized methods and social marketing or through commercial markets. Those in favour of free provision argue that it is possible to achieve a high coverage within a short period of time and those advocating use of cost sharing through social marketing emphasize the possibility of sustainability after donor funding withdrawal. They insist on using existing donor funds for social marketing so as to encourage householders to become accustomed to spending their own money to buy nets and insecticides [8, 20].

However, there is general agreement that subsidized access to ITNs should be provided on a large scale and in the long term, but disagreement exists over how these methods of providing subsidies should be deployed [18]. Both free distribution and social marketing have their advantages and disadvantages. While the former is criticized for lack of sustainability after donor withdrawal, social marketing has a disadvantage of inaccessibility by the poor due to costs involved. Hence a dilemma exists on which method can promptly reach the most poor.

A study done in Nigeria revealed that people with a lower socio economic status had lowest likelihood of purchasing mosquito nets and willingness to pay for ITNs[21]. ITN distribution programmes needs to take into account diversity of ability to pay in different socio-economic groups, if they are to ensure equity in access to ITNs. People with recent experience with malaria episode has been associated with increased willingness to pay for ITNs [22]. Poor people are the ones mostly affected by malaria, hence more likely to demand for ITNs than their less poor counterpart.

Provision of free untreated bed nets bundled with insecticide in Lindi Region, southern Tanzania, showed that in households with under-5 year children, possession of ITNs increased from 17% prior to the campaign to 37% three months post campaign [23]. Despite increased ITNs coverage, the differences in coverage levels between households with low and high social economic status, as well as between urban and rural locations were significant [12, 23].

A study done in Kenya compared three different approaches to distribution of ITNs to children aged below five years between 2004 and 2006. Commercial sector nets (2004) coverage for the most poor was 2.9%, versus 15.6%, for the least poor with a concentration index of 0.281. Heavily subsidized nets through clinics (2005) coverage for the most poor were 17.5% versus 37.9%, for the least poor with a concentration index of 0.131. Free mass distribution (2006) coverage was 66.3% for the most poor compared to 66.6% for the least poor, with a concentration index of 0.000. Socioeconomic inequity in net coverage sequentially decreased from a concentration index of 0.281 in 2004 to a concentration index of 0.00 in 2006, signifying no inequity [24].

In Niger a study done post nationwide campaigns to distribute long lasting insecticide-treated nets (LLINs) to children below 5 years of age found that ITN ownership in all households was 6.3% prior to the campaign, increasing to 65% after the campaign. ITN utilization fluctuated with season, during dry season 15% of children less than five years slept under an ITN, increasing to 56% during rainy season [25].

Some studies have documented lower utilisation of free distributed ITNs. In southern Tanzania, one year after free net distribution, households were found with new ITNs that had not been utilized [16]. Similarly, in Kenya 30% of freely distributed ITNs were found unutilized[15]. However contrary to these findings, a recent study from Tanzania showed that years after acquiring bed nets for free, 90% were intact and brought for re-treatment [20].

It is argued that targeting groups such as under five children with free ITNs reduces mortality in children, but lacks community wide effect on reducing malaria related mortality [26]. A cross sectional study in Rufiji district, Southern Tanzania revealed that combination of three delivery strategies, the sale of nets at full market price, voucher-subsidized and freely distributed nets, enabled a poor rural community to achieve net coverage high enough to yield both personal and community level protection for the entire population [27]. But ITNs supply at full market price was not affordable to the poorest, with a significant pro-rich inequality and a concentration index of (0.254), as compared with free distributed bed nets with concentration index of (0.015).

2.3 ITNs ownership and use

A meta analysis of data from household surveys in 43 Sub-Saharan Africa countries between 1999 and 2006 on net and ITN coverage revealed that possession of ITNs was 6.7% and 23.8% for any net [28]. This is below 80% coverage targeted by MDG and Roll Back Malaria Strategy. That corresponds with a survey done in Nigeria which revealed that, household ownership of any net was 24% and 10% for ITNs, with ITNs use at only 2% [29].

A study conducted 38-months post mass campaign of distributing free ITNs through measles campaign in Ghana, showed increased possession of ITN (74%) among households with at least one child less than 5 years of age, but not all available nets were used as only (60%) of children slept under an ITN [30].

Another study in Lawra District Ghana, post free insecticide-treated bed net distribution by the Ghana Red Cross and UNICEF to children less than five years old indicates that 94% of households were observed to have an insecticide-treated bed net. However, only 68% were observed to have a net hung over a bed [31].

A review of data from household surveys including demographic and health surveys in sub-Saharan African countries revealed ITN use to be lower than possession. In all households owning ITNs, only 55% of children slept under it [32].

The most successful story of ITNs coverage in country wide survey is in Eritrea, where distribution of free pre-treated mosquito bed nets to all households in malaria endemic

areas in 2002-2003 resulted in a gross increase in household ITN coverage to 82%, with 68% of children under five sleeping under ITNs [33]. The coverage in Eritrea was above the 60% target of Roll Back Malaria; however, the gap between ITN ownership and use is substantial and may represent lost opportunities to prevent malaria [34].

2.4 Equity impact of different ITNs distribution strategies

The widening gap in inequity for coverage and utilization of proven cost-effective interventions like ITNs may jeopardize the achievement of the Millennium Development Goals and the Roll Back Malaria Targets [35]. MDG aims at achieving 80% coverage and utilisation of ITNs and reversing the number of malaria cases and incidences, currently the data released by MDG progress report (2006) indicates that it is far from being achieved.

Studies have showed that there is inequity in ITN use among various socio-economic groups, with the poorest being the least to benefit from ITNs even where they are highly subsidized [36]. Without equity in accessing ITNs, this prevailing public health tool will have a limited impact on the intended outcome [21]. Margaret whitehead defined equity in health is as minimizing avoidable and unfair inequalities in health and its determinants. This is often interpreted as equal access for equal needs, irrespective of income and other socio-demographic characteristics [37]. For malaria control to be a success, socioeconomic differences in coverage and use should also be considered. While Poverty militates against ownership of net, lack of education curtail its use [29].

According to the recent Malaria and HIV/AIDS survey in Tanzania, there is a significant difference in ITN ownership and use among population of different socioeconomic

quintiles. While the least poor quintile ITN ownership is 67%, poorest quintile possession is 22%; with a pro rich concentration index of 0.217. For any net the least poor owns 84% of nets and poorest 36%, with a concentration index of 0.165. Similarly for utilisation: while 55% of the least poor population sleep under ITNs, only 13% of the poorest group sleep under ITNs. This gives a high concentration index of 0.272.The trend for any net is similar with 69% of the least poor population sleeping under any net compared to only 20% of poorest population, with a concentration index of 0.230 [11].

A study in Kilombero, Tanzania suggests that community wide protection for both net users and non-users can be achieved if long lasting insecticide nets are accessed and utilized [38]. It has been argued that 80% ITN use by only 20% of the population will provide limited protection and impact on equity, compared to moderate ITN use of 35% - 65% more evenly distributed among the entire population which may provide community-wide protection [39]. So for proper utilization and community protection against malaria to be achieved there is a need for sustainable and equitable supply of ITNs.

ITNs offer the same public health advantages as vaccines; perhaps they should receive the same approach to public financing [40]. As children cannot share a vaccine but young African children typically share beds and bed nets, therefore, fewer ITNs than vaccinations are needed [30].

CHAPTER THREE

3.0 METHODOLOGY

3.1 Study area

The study was carried out in two districts purposively chosen to provide information on coverage and utilisation of ITNs. The study districts represent a range of ITN delivery mechanism that is present in Tanzania. Mpanda was selected as a proxy representative of a district endemic with malaria. Data were collected six months after all household with under five children received free ITNs from a national wide "Catch Up" campaign. Mpanda has few established social marketing and private outlets. Kisarawe District represents a district endemic with malaria without free ITNs, but with a well established social marketing system from national campaigns and some local NGOs (such as Plan International) providing heavily subsidized ITNs. There are also commercial outlets for ITNs as a result of a reliable supply due to its proximal location to Tanzania's commercial capital Dar es Salaam.

Available information on coverage and utilisation provided by the most recent survey HIV/AIDS Malaria indicator survey of 2007/08 [11] shows that mosquito net coverage in Kisarawe (Coast Region) is higher (63%) for any type of nets and about 48% for ITNs compared to 45% for any type of nets and 29% for ITNs in Rukwa Region where Mpanda District is located.

Mosquito bed net utilisation in Kisarawe (Coast Region) is higher than Mpanda (Rukwa Region) by three times, while utilisation for any net is 55% and 40% for ITNs in Kisarawe (Coast Region). In Mpanda (Rukwa Region) is 17% for any net and 13% for ITNs.A

comparison of these two areas is anticipated to highlight whether distribution of free ITNs might increase coverage and utilization and minimize inequality.

Mpanda district is one of the three districts of Rukwa Region, It is bordered by Urambo District (Tabora) to the North Sikonge district (Tabora) to the East, Chunya District (Mbeya) to the East, Nkansi District (Rukwa), to the South, Sumbawanga District (Rukwa) to the South – East, Democratic Republic of Kongo DRC to the West (separated by lake Tanganyika) and Kigoma District (Kigoma) to the Northwest. According to Tanzania's National Census of 2002, the population of the Mpanda District was 412,683. Mpanda is comparatively a very large District covering above 50% of the Rukwa Region. It is divided into seven divisions, and further sub- divided into 29 wards and 118 villages. The district has an altitude ranging from 1000 to 2500 meters above sea level, the average temperature ranges between 26 and 30 degree centigrade annually. Mean annual rainfall ranges from 920 to 1,200 millimetres.

Kisarawe is one of the six districts of the Coast Region. It is bordered to the North by Kibaha District, east by Mkuranga District, to the south by the Rufiji District and to the west by Morogoro Region. The population of Kisarawe District is 95, 6149 (2002 Tanzania National Cencus). Administratively the district is divided into four division, the four divisions are further divided into fifteen wards. The district has an altitude ranging from 100 to 350 metres above sea level. The average annual temperature is 29 degree centigrade and the average annual rainfall is 800 -1000 millimetres.

3.2 Study design

A quantitative descriptive cross sectional household survey was carried out in Kisarawe and Mpanda Districts.

3.3 Study population

The study population were households with children under five years old at the time of the study.

3.4 Sample size estimation

Sample size was determined based on the following formula of a single proportion,

$$n = \frac{z^2 p (100-p)}{\varepsilon^2}$$

Where n = the required minimum sample size

p = estimated proportion of children under age five sleeping under an insecticide-treated net (ITN) 26% [11]

ε = margin of error on p (set at 5%)

z = standard normal deviate corresponding to 95% confidence level (=1.96)

$$n = \frac{(1.96)^2 26(100-26)}{(5)^2} \approx 296$$

Sample size was adjusted for non-response, using a formula:

$n' = (100/f)\ n$,

Where f = Expected percentage of the eligible study participants that will respond (assumed to be (90%), n' = adjusted sample size that will allow for non-response, n = is the sample size calculated before:

n'= (100/90)296 =328 ≈ 330,

Therefore sample size was increased to **330** households.

3.5 Sampling procedures

The study was carried out in March and April 2009 during rainy season, and hence peak malaria transmission period. A simple random sampling was employed in selecting study participants. Districts were selected purposively whereby Mpanda District represented an area with free distributed ITNs and Kisarawe District represented an area without free distributed ITNs.

By using simple random selection, a total of two villages were selected in each District, (Misunkumilo A and B) for Mpanda District and (Masaki and Mitwini) for Kisarawe District, in additional two streets were selected in each district to have represented both urban and rural areas (Mpanda Hotel and Makanyagio) for Mpanda and (Bomani and Sanze) for Kisarawe. For each village/street that was selected, all households with children under five year's old children were enumerated and randomly selected by spinning a bottle in front of a community leader's house and starting from that direction in which a bottle pointed to provide a total of 314 for both Districts. Every head of the selected household either female or male present at home was interviewed.

3.6 Data collection procedures

3.6.1 Research instrument

A structured pre-validated questionnaire (the WHO/ORC Macro malaria indicator survey household questionnaire (2005)) (appendix 3 and 4) was adopted and modified to suit the study context. The questionnaire was translated from English to Kiswahili and was used in Kiswahili form.

3.6.2 Pretesting of instruments and training of research assistants

Three research assistants were recruited, one from each of the study districts, with at least four years of secondary education able to read and write. Prior to the actual field work, the research assistants were trained for one day. During this training, the research assistants were introduced to the study, its objectives and the methodology. They were also familiarized with the questionnaire and the procedure for obtaining informed consent from the study participants. Pre testing of the research instrument were conducted in Ilala Municipality and results from pre testing were used to finalize the questionnaire.

3.6.3 Data collection

Interviews were conducted mainly by the researcher with assistance of the research assistant in each of the study district. All interviews were in Kiswahili language using the adopted questionnaire. The household head was interviewed for all information about socio demographic characteristics, household information, indicators of socioeconomic status, indicators of ITN ownership and use. A total of 158 household were interviewed in Mpanda district and 156 Households in Kisarawe district.

3.7 Ethical issues

Ethical clearance was sought and acquired from the Muhimbili University of Health and Allied Sciences (MUHAS) research and publication committee. Permission to conduct research was sought from Regional Administrative Secretaries of both Rukwa and Coast regions, whom wrote a letter of introduction to Kisarawe and Mpanda district administrative secretaries. The district administrative secretaries of Kisarawe wrote letters of introduction to both division secretaries and Ward executive officers who further introduced the team to Village and Street executive officers who facilitated introduction to community leaders popular known as "balozi" (leaders of a specified number of houses within the local area) whom made introduction to head of household.

Each selected participant before responding to a questionnaire were informed verbally about intention of the study and requested for their participation, they were told that participation in the study is voluntary and they are free to participate in the study and they are free to withdraw from the study and it will have no consequences. To ensure confidentiality questionnaires did not bear participant's name, therefore assuring that information provided were anonymous. Those agreeing to participate signed a written informed consent.

All approached head of household agreed to voluntarily participate in the study, all signed the consent form after reading it (for those who could read) and being read loud for those who could not read.

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3.8 Data management

Data collected on each day were counterchecked for accuracy and completeness of each questionnaire, all completed questionnaires were entered using EpiData version 3.1. All data entered were checked for consistency each day; any inconsistencies were resolved by referring to the original questionnaire.

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3.9 Data analysis

All data were cleaned and analysed using STATA Version 10.0 (Stata Corporation, 2007). This software was used in computing frequencies, calculating confidence intervals, doing chi-square tests and regression analysis to compare differences in proportions of ITN ownership and use among different socioeconomic status and study areas. The programme was also used in principal component analysis of household assets to generate socioeconomic score. A p-value of 0.05 was set for statistical significance.

3.9.1 Principal component analysis

Principal component analysis (PCA) [41-43] was used to develop wealth indices for the study households based on household characteristics, ownership of assets; source of drinking water, education level and occupation of head of household. Household characteristics included ownership of the house, number of sleeping rooms, material of the floor and type of toilet facility. Household assets included iron, radio, television, telephone, land and bicycle. Variables that featured in only a few households were not included in principal component analysis for example car, motorcycle and refrigerator. To allow for a well capture of each district wealth differences a PCA score were generated separately for each district. The first principal component accounted for 28.7% variation in

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Mpanda district, with the first eigenvalue of 3.4. In Kisarawe the first principal component described 26.7% variation with first eigenvalue of 3.2 (a detailed report on each socioeconomic quintile asset score is on appendix 1 and 2 for Mpanda and Kisarawe respectively). Households were ranked into five socio economic quintiles; most poor, poorer, poor, less poor and least poor.

3.9.2 Equity analysis

Concentration curve and concentration index as described in O'Donnell, O. et al [43] and logistic regression [44] were used to determine extent of socio-economic inequality in ownership and use of mosquito net among different socioeconomic status of study population in Mpanda and Kisarawe districts.

The concentration curve is generated by plotting the cumulative proportion of the population ranked from poorest to richest along the X-axis, and the cumulative proportion of the health variable along the Y-axis. A 45-degree line, running from the bottom left-hand corner to the top right-hand corner represents perfect equality and is known as the line of equality. If the concentration curve lies above the line of equality, this indicates that the health variable is concentrated among the poorest and if the concentration curve lies below the line of equality it indicates that the health variable is concentrated among the richest group. The more the curve is beyond the line of equality the more concentrated the health variable is among the poor or vice versa.

The concentration curve illustrates whether socioeconomic inequality in the health variable exists and whether it is more prominent in poor or relatively rich socioeconomic quintiles.

The concentration index on the other hand quantifies the extent of the health inequality, hence enabling measurement and comparison of the degree of socioeconomic-related inequality [45]. The concentration index ranges from -1 to +1 with a value of 0 indicating perfect equality. The index takes a negative value if a desired variable (such as intervention coverage) is concentrating among the poorest and positive index demonstrates that the variable is concentrated among the richest group. Masanja et al [46], describes a health variable as "Goods" such as intervention coverage e.g. ITN or "Bads" such as malnutrition or mortality. In this study because net use is a good health variable a positive value of the index show that net use is concentrated among the richest group [24].

CHAPTER FOUR

4.0 RESULTS

4.1 Background characteristic

A total of 314 households were visited; 158 in Mpanda and 156 in Kisarawe districts. In all, (890) Mpanda and (798) Kisarawe) persons lived within visited households. Under five children were 32.6 % (290) of all household occupants in Mpanda and 26.4 % (211) in Kisarawe district **(See Table 1).**

A majority of interviewed head of households in both districts were female Mpanda 68% and Kisarawe 72%. Education level of most interviewee were primary schooling i.e. had completed seven years of primary education Mpanda (67%) and Kisarawe (78%). Majority of respondent were engaged in agricultural activities Mpanda (80%) and Kisarawe (81%).

4.2 Ownership of mosquito bed net

Mosquito bed net ownership varied significantly between the two districts. A household in Mpanda was more likely to possess a mosquito net (98%) than a household in Kisarawe (76%) (OR 11.97, $p < 0.001$). A similar pattern was seen for ITN ownership; households in Mpanda (90%) were more likely to own at least one ITN than households in Kisarawe (53%) (OR 4.93, $p<0.001$) **(Table 2 and 3).**

In Mpanda district ownership of ITNs were significantly firm as per number of nets. Sixty seven percent of household owned two ITNs in Mpanda, only twenty two percent of households owned more than two ITNs in Kisarawe district. Ownership of three or more

ITNs were lower in Kisarawe District with only eight percent of household owning more than three ITNs compared to forty seven percent in Mpanda **(Table 2).**

4.3 Mosquito bed net ownership by wealth index

Ownership of at least one net varied significantly among different socioeconomic quintile ranked by wealth index in Kisarawe. Households in the poorest socioeconomic quintile were less likely to own any net compared with households of least poor socioeconomic quintile 63.3% (OR 0.056, p=0.008) vs. 93.8% (OR 0.927, p=0.03); with a pro-rich inequality, concentration index of 0.068. In Mpanda district there was no significant difference in net ownership along socioeconomic quintiles with a hundred percent for both poorest quintile and least poor quintile that is also revealed by almost perfect equality with a concentration index (0.003) **(Table 3 and 4).**

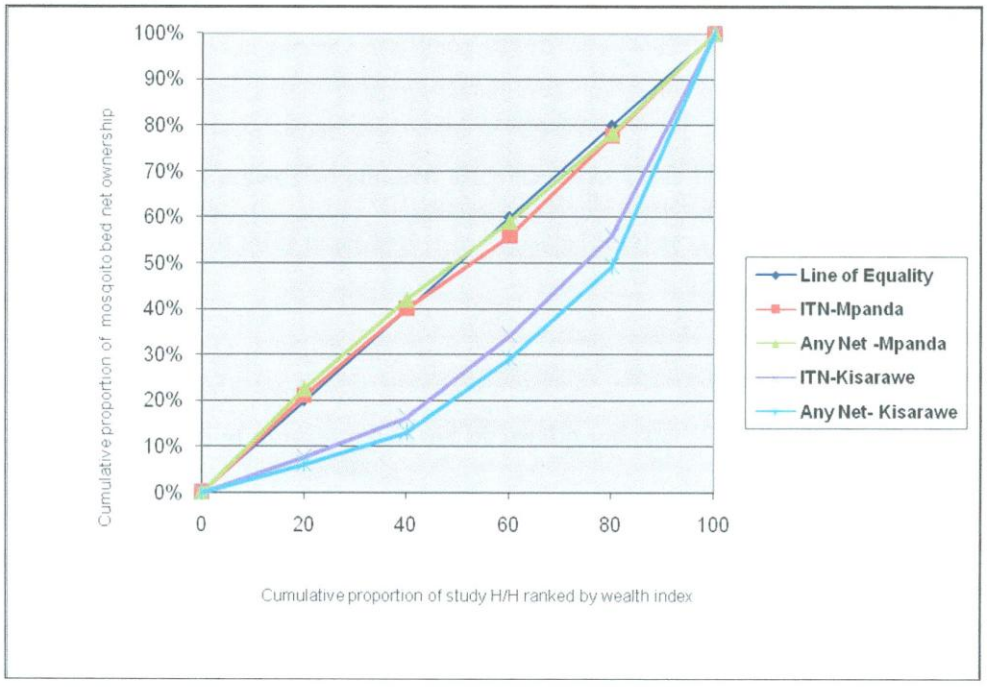
There was no significant difference in ownership of at least one ITN in Kisarawe district among households of poorest socioeconomic quintile and least poor socioeconomic quintile 50% (Poorest quintile) vs. 50.1(least poor quintile) (p=0.06). Similarly in Mpanda district (87.1%) (Poorest quintile) vs. 93.8% (least poor quintile) (p=0.184) and with a concentration index of 0.004 and 0.018 for Kisarawe and Mpanda respectively (**Table 3 and 4**).

However, distribution of ownership of mosquito bed nets in Kisarawe became disproportionate among households of different socioeconomic quintile with increased number of nets. Households of the poorest quintile ownership of any net decreased

compared to household of least poor quintile with a marked pro-rich inequality, concentration index (0.20). In Mpanda district inequality is minimized, with a low concentration index (0.009). The same holds for ITN ownership, with a pro-rich inequality in Kisarawe, with a concentration index of 0.132 compared to 0.01 in Mpanda **(Table 5).**

The disproportionate distribution of mosquito bed nets is clearly portrayed by the concentration curve below (Figure 1).

Figure 1 Degree of inequality for mosquito bed nets in household of different socioeconomic status in Mpanda and Kisarawe district



In figure 1 the curve below line of equality represents ownership of mosquito bed nets (ITNs and any net) in Kisarawe District, and from that it is evident that mosquito bed nets are more concentrated in households of least poor socioeconomic quintile, hence pro least

poor inequality. The curve for ITNs and any net in Mpanda lies almost on the line of equality. This indicates equality in mosquito net ownership in that district.

4.4 Mosquito net utilisation

Under five children in Mpanda were more likely to sleep under an ITN than children in Kisarawe district, about (77%) of all under five children in Mpanda slept under ITN compared to only 42% in Kisarawe (CI 35.0-48.7). Utilisation of any net by under five children in Mpanda was higher (84%) compared to (56%) in Kisarawe (OR 6.25, $p<0.001$) **(Table 2 and 3)**.

The proportion of under five children sleeping under ITNs in households with more than one ITN was almost three times higher in Mpanda (28%) as compared to (9%) in Kisarawe **(Table 2).**

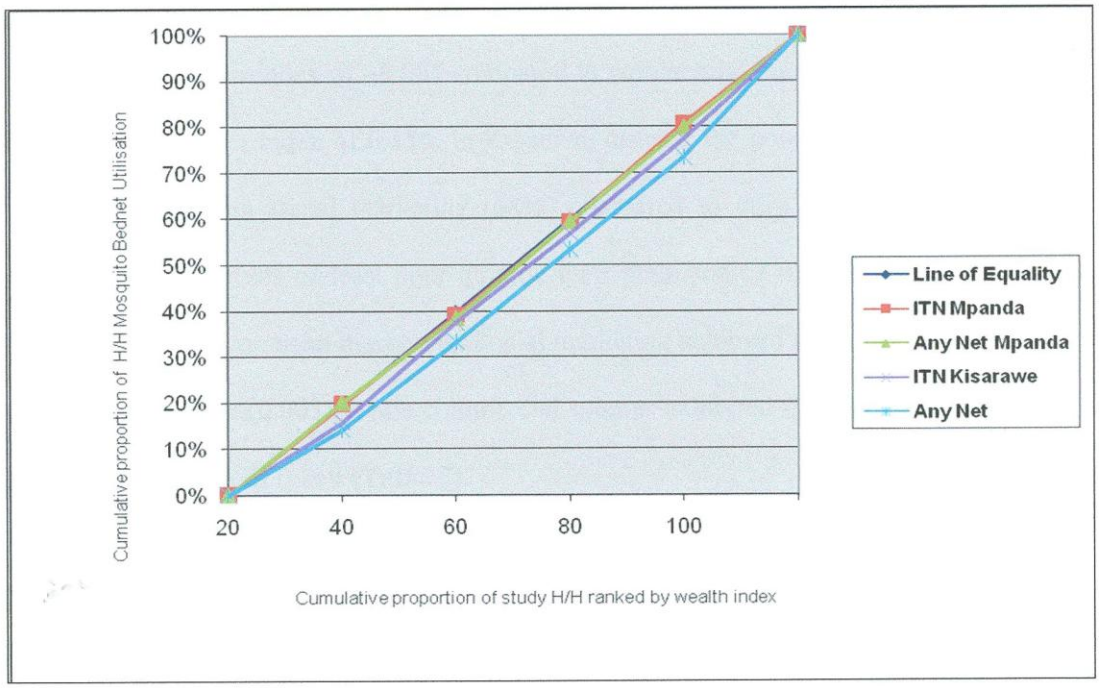
4.5 Utilisation of mosquito bed net by wealth index

Utilisation of mosquito bed net significantly varied in Kisarawe district, under five children in households of poorest socioeconomic quintile (35%) were less likely to sleep under an ITN than households of least poor quintile (49%) (OR 0.28, $p=0.024$). For any net the difference was almost twice with only (43%) of under five from poorest socioeconomic quintile in Kisarawe sleeping under an ITN compared to 78% of least poor quintile. In Mpanda district ITN utilisation did not vary among different socioeconomic groups ($p=0.468$).

Nets in households of the poorest quintile were torn in 48% of the cases, compared to 15% those in the least poor quintile. In Kisarawe district more torn nets belonged to household of least poor quintile (54.3%), compared to only 36% in poorest quintile households (even though that is masked by the percentage difference in net possession with least poor having three times more nets 71 compared to 25 in poorest household).

There was some pro-rich inequality in under five children ITN use among different socioeconomic quintile in Kisarawe with concentration index of 0.027 compared to nearly perfect equality in Mpanda concentration index 0.009 **(Table 6)**

Figure 2 Degree of Inequality for Mosquito bed net use in H/H of different Socioeconomic Status in Mpanda and Kisarawe District



The concentration curve in figure 2 above depicts the variation of mosquito bed net utilisation among different socioeconomic quintiles. Lines of utilisation of ITNs and any net for Kisarawe district lies below the line of equality indicating that mosquito bed net utilisation is pro rich in that district. While for Mpanda district the line for ITN and any net lies on or above the line of equality indicating almost perfect equality in utilisation of ITNs and any net.

4.6 Source of nets

The major source of bed net in household of poorest socioeconomic quintile in Mpanda district was free nets (66%), with only 27% from commercial outlets. In households of least poor socioeconomic quintile main source of nets (51%) were commercial and 47% obtained them from the free distribution system. Free distribution in Mpanda was pro-poor with a concentration index of –0.064 compared to commercial market which was pro-rich with a concentration index of 0.156. In Kisarawe district; the poorest quintile households mainly depended on social marketing (68%) compared to only 16% from commercial outlets. For households of least poor quintile their main source of nets were commercial (51%) and 37% from social marketing. Social marketing achieved a nearly perfect equality concentration index (0.003), while commercial sources exhibited marked inequality with a concentration index of 0.269 **(Table 7).**

CHAPTER FIVE

5.0 DISCUSSION

This study examined whether free net distribution improves equity of access and utilisation in relation to socioeconomic status. Findings shows that poorest households are less likely to own and use a mosquito bed net (ITNs and untreated nets). It has also shown that free distribution of ITNs is more likely to reduce pro-rich inequality in ownership and use of ITNs currently experienced by poorest socioeconomic quintile. Studies conducted recently in Tanzania also revealed existence of inequality in ownership and utilisation of ITNs [47-49].

5.1 Mosquito bed net ownership and use post free distribution

Free distribution of ITNs in Mpanda District is also associated with higher ownership and utilisation of ITNs in the poorest households. The national survey in 2007/08 [11] indicated ownership of ITNs in Mpanda to be 29%, after free distribution by the end of 2008 it increased to 90%. Utilisation of ITNs increased from 13% during a national survey to 77% post free distribution of ITNs. That is beyond a target of 60% coverage by Roll Back Malaria African Summit held in Abuja in 2000 [5], only 3% less than the improved Roll Back Malaria target of 80% coverage by the year 2010 [7] and 2015 by MDG [3]. In Kisarawe District (an area without free ITN distribution); ITN ownership was (53%) almost similar to that of a 2007/08 national survey (48%) far below the MDG and Roll Back Malaria targets.

Ownership and utilisation of ITNs in Mpanda District post free distribution are higher than what other studies have found from other settings post implementation of free of charge ITN distribution in Kenya, Ghana and Eritrea [24]. In Kenya ownership increased from 7.1% in 2004 to 67% in 2006; Ghana possession was at 74% and utilisation was at 60% and Eritrea possession rose to 82% and use at 76%.

5.2 Mosquito bed net ownership and use by wealth index

The results of this study have indicated that distributing free ITNs enabled households of poorest socioeconomic quintile to access this important public health intervention. Through increased ownership and utilisation of ITNs, inequalities among relatively rich and poorest quintiles have been minimized. During a National survey done in 2007/08 concentration index on ownership of ITNs in Tanzania were at 0.217, findings from this study indicates that post free ITN distribution inequality in ownership declined in Mpanda district with a concentration index of 0.010. For utilisation, the concentration index was 0.272 (National data), while this study found a concentration index of 0.009 post free ITN distribution in Mpanda. We cannot from this preliminary study conclude that there is causality between free bed net distribution and increased ownership and use of ITNs, but the results shed some light on the significance of free ITNs provision. However, a study in Kenya revealed similar findings, where post distribution of free ITNs, socioeconomic inequity of ownership decreased from concentration index of 0.281 to perfect equality with a concentration index of 0.000 [24].

5.3 Social marketing versus free distribution

In this study, households of the poorest socioeconomic quintile mainly depended on free or heavily subsidized supply of bed nets as their source of mosquito bed nets (free nets for Mpanda 66% and social marketing for Kisarawe 68%. This subsequently reduced inequality to nearly perfect equality with concentration index of -0.064 for Mpanda and 0.003 for Kisarawe.

The social marketing strategy has recorded some achievement. However, five years after it was launched in 2004, with the aim of providing vouchers to all pregnant women attending ante-natal clinics, the strategy has yet not expanded ownership and utilisation of ITNs to the required target of 80%. The free distribution approach launched in the last ten months in Mpanda has been able to reach the national and international target of 80%, although it is too early to evaluate long term effects. In Kisarawe were social marketing is the main supply of ITNs, among households of poorest quintile coverage is only 50% compared to 87% in the poorest quintile of Mpanda district were main supply is from free nets distribution.

It has been argued that social marketing is an important strategy in distribution of ITNs, but the fact that, in most areas, it relies on commercial market channels to operate and tends to concentrate more in urban areas or relative wealth part of rural areas [27]. That may be a contributing factor in inability of social marketing to serve the poor. It is evident that poorest households are the most affected by malaria and less served with ITNs. This calls for concerted efforts in reaching the poor. Distributing free of ITNs seems to be a better strategy all things considered. Social marketing may remain an important

complementary strategy after distribution of free bed net to all households. However, if equity achieved by free nets is to be sustained, vouchers should be cheaper and affordable, and with a specific and deliberate strategy of targeting the poorest of the poor. A voucher should take into consideration geographical location instead of having a uniform voucher for the whole country. It is well documented that majority of poor people reside in rural areas. Geographical targeting with higher subsidies in rural areas could therefore be considered.

5.4 Equity and efficiency of free bed net distribution

Health service distribution decisions in countries like Tanzania concerns how to make sure that interventions achieve equity and efficiency at the same time. In the case of ITNs, the intervention is cost effective with costs per Disability Adjusted Life Years (DALY) averted between US$ 19 and $ 85 [8]. ITNs have been associated with a recent reduction in child mortality [50] and it can achieve equity by reducing malaria morbidity and mortality in the poorest quintile households. That highlights the need of increased efforts in distribution of ITNs with explicit pro poor strategies.

A study in rural Tanzania revealed that the poorest households are most affected by malaria [17]. Distribution of free ITNs will ensure that poor populations' health is protected and may decrease inequality in health outcomes. The disease is very costly: resources spent on controlling mosquito bite and preventing malaria by both state and households have been estimated to be US$ 119 million (3.4%) of GDP in Tanzania [4]. This has also been estimated by Tanzania National Malaria Control Programme (NMCP). A major share of that expenditure is spent by poor households. The saving may be spent

elsewhere to combat poverty and decrease inequality between relatively rich households and poorest households.

The Tanzania Government is currently scaling up free ITNs to all under five children in Tanzania. This activity started in September 2008 and is expected to last until early 2010. This may raise questions of who should be considered while providing free ITNs. Should it be only vulnerable groups (pregnant women and under five children) who are at high risk of malaria or should the strategy further cover households of poorest socioeconomic quintile who can hardly afford mosquito bed nets.

A study examining level of coverage that can achieve protection and equity revealed that, ITN use of 35% - 65% by the majority of entire populations can achieve community wide protection compared to protecting only under five children [39]. In this study it was found that 48% of nets in poorest quintile in Mpanda district were torn compared to 15% in least poor quintile who had a additional nets from commercial source, just six months after free net distribution. This suggests that under five children are more likely to share bed nets with their older siblings and parents, which results into early bed nets worn out hence reducing ability of protection against mosquito bites which predispose these poor families to malaria.

An interesting question is whether distribution of free nets should aim at covering all sleeping spaces rather than only malaria vulnerable groups as it is evident that many of the poorest households cannot afford bed nets to all.

ITNs offer the same public health advantages as vaccines: they are effective, cost-effective and address a large disease burden. It is high time that they receive the same approach to public financing [40]. Given the fact that people in African communities share beds and are expected to share ITNs if freely distributed and reaching all households, it may prove to be an effective option in combating malaria [30].

5.5 Study limitations

However findings from this study should be interpreted carefully, ranking of households into different socioeconomic status posses a major challenge. The choice of assets to be included in construction of wealth index is difficult as there is no agreed amount or type of assets to be used [43]. Some assets (for example a telephone) may have varied prices and may place people together in the same quintile while their phones are not of the same value, a bicycle, despite being an asset in households in rural areas, it is associated with poverty in urban areas [42, 47]. However according to Filmer and Pritchett [41] a household classified in poorest group by wealth index will not be classified as rich by reduction of the number of assets used for classifications of socioeconomic group.

To enhance reliability of the results multiple analyses were performed, concentration index analysis was supplemented with regression analysis which also revealed inequality in ownership and utilisation of ITNs among different socioeconomic quintiles in an area without free ITN provision.

Recall bias of respondents on last time a bed net was treated may have resulted into under or over reporting on ITN ownership and use. Given that a bed net treated within one year

was considered as an ITN, failure to remember the accurate time a bed net was treated might have led to wrong categorization. In households with at least one bed net 45 households were not able to recall last time a bed net was treated. In Mpanda that was only 12/155 (8%) as compared to Kisarawe 33/119 (27%). Better recall in Mpanda may be pointed to the fact that during free net provision also existing nets were being treated. But the fact that 86/119 (72%) of households with at least one bed net in Kisarawe were able to remember last time a net was treated it was assumed that those who did not recall, either they had not treated a net or it was longer than one year. Due to logistical reasons both financial and time period a sample size used may have not been large enough to portray firm conclusions.

However, respondents were selected at random, and the distinction of the study areas, Mpanda district being more than two thousand kilometres from the main city Dar es Salaam, and with one of the poorest infrastructure in the country hence less served with mosquito bed nets from both subsidized and market outlets. A comparison district Kisarawe with close proximity to Dar es Salaam and a better infrastructure with a well established social marketing and easy access to other market outlets for mosquito bed net. That to some extent reduced bias and augment strength of the study results. A much larger sample size in case of enough financial resources and time period may yield more conclusive results

Furthermore the result from this study reveals short term results, which render it difficult to draw firm conclusions that there is a real change in ITN ownership and utilisation after free net distribution. But there is a notable difference which calls for further studies.

CHAPTER SIX

6.0 CONCLUSION AND RECOMMENDATIONS

6.1 Conclusion

The findings of this study indicate that in the areas studied, where source of ITNs are commercial or socially marketed, there is low level of ITN ownership and use. In Kisarawe district ownership was 53% and utilization 42%. Households of the poorest socioeconomic quintile are the most deprived, with a pro-rich inequality. The study also indicates that free distribution of ITNs is associated with higher ownership and utilization rates, and less inequality. That calls for concerted efforts by the state in distributing free ITNs to all under-privileged group.

6.2 Recommendations for further research

This study provides some information of the possibility of attaining the national and international target of 80% coverage and use of ITNs, as well as reducing inequality through free distribution of ITNs. Further research could clarify the possible impact of changing distribution policies from cost-sharing schemes to free distribution. The optimal study design would be a controlled randomized trial with sufficient number of households and adequate time to follow up.

CHAPTER SEVEN

7.0 TABLE OF RESULTS

Table 1: Background characteristics of study households

Characteristics	Mpanda		Kisarawe		Total	
	n	%	n	%	n	%
Number of Household	158	50.3	156	49.7	314	100
Number of People in Household	890	52.7	798	47.3	1688	100
Average number of People per H/H	5.6		5.1		5.4	
Number of Under five Children	290	58	211	42	501	100
Average number of >5 Children per H/H	1.8		1.4			1.6
Age of respondent						
15-34 Years	95	60	84	54	179	57
35-54 Years	49	31	58	37	107	34
Above 55 Years	14	9	14	9	28	9
Total	158	100	156	100	314	100
Sex of interviewed head of household						
Male	51	32	44	28	95	30
Female	107	68	112	72	219	70
Total	158	100	156	100	314	100
				2		
Education level of interviewed head of H/H						
Primary Education	106	67	121	78	227	72
Secondary Education and above	25	16	8	5	33	11
No Education	27	17	27	17	54	17
Total	158	100	156	100	314	100
Occupation of interviewed head of H/H						
Peasant	12	80	126	81	252	81
Employed	5	3	11	7	16	5
Businessman/woman n (%)	26	17	19	12	45	14
Total	158	100	156	100	314	100
Number (%) of households						
Poorest	175	19.6	139	19.3	314	18.6
Very poor	166	20.3	128	19.8	294	16.9
Poor	206	19.6	172	20.5	378	22.4
Less poor	177	20.3	175	19.9	352	20.9
Least poor	166	20.3	184	20.5	350	20.7

Table 2 Distribution characteristics of ownership and utilisation of mosquito bed nets by number of net in Mpanda and Kisarawe district.

	Districts					
	Mpanda			Kisarawe		
2.1 Ownership of ITN and untreated net	**n**	**%**	**95% CI**	**n**	**%**	**95% CI**
Total number of nets	369	100		207	100	
ITNs	322	87.3	(83.4-90.5)	127	61.4	(54.4-68.2
Untreated net	47	12.7	(9.5-16.6)	80	38.6	(32.0-45.6)
Average number of nets per HH	2.3			1.4		
Average number of ITNs	2			0.8		
Average number of untreated net	0.3			0.5		
Total number of HH	158	100		156	100	
HH with any net	155	98.1	(94.6-99.6)	119	76.3	(68.8-82.7)
HH with ITN	142	89.9	(84.1-94.1)	82	52.6	(44.4-60.1)
HH with untreated net	13	8.2	(4.5-13.7)	37	23.7	(17.3-31.2)
HH without net	3	1.9	(0.4-5.4)	37	23.7	(17.3-31.2)
2.2 HH utilisation of ITN and untreated net						
Total Number of under fives	290	100		211	100	
Slept under ITN	222	76.6	(71.2-81.3)	88	41.7	(35.0-48.7)
Slept under untreated net	22	7.6	(4.8-11.3)	30	14.2	(9.8-19.7)
Slept under any net (ITN+ untreated)	244	84.1	(79.4-88.1)	118	55.9	(48.9-62.7)
2.3 Ownership of mosquito bed net by number of net	***(n = 158)***			***(n=156)***		
One net						
ITN	142	89.9	(84.1-94.1)	82	52.6	(44.4-60.6)
Untreated net	13	8.2	(4.5-13.7)	37	23.7	(17.3-31.2)
Two nets						
ITN	106	67.1	(59.2-74.3)	33	21.2	(15.0-28.4)
Untreated net	16	10.1	(5.9-15.9)	22	14.1	(9.1-20.6)
Three nets and above						
ITN	74	46.8	(38.9-54.9)	12	7.7	(4.0-13.1)
Untreated net	18	11.4	(6.9-17.4)	21	13.5	(8.5-19.8)
2.4 Under five who slept under mosquito bed net night before survey	***n=290***			***n=211***		
One net						
ITN	141	48.6	(42.7-54.5)	69	32.7	(26.4-39.5)
Untreated net	13	4.5	(2.4-7.5)	22	10.4	(6.7-15.4)
Two nets						
ITN	57	19.7	(15.2-24.7)	17	8.1	(4.7-12.6)
Untreated net	4	1.4	(0.4-3.5)	4	1.9	(0.5-4.8)
Three nets and above						
ITN	24	8.3	(5.4-12.1)	2	0.9	(0.1-3.4)
Untreated net	5	1.7	(0.6-4.0)	4	1.9	(0.5-4.8)

Table 3. Logistic regression model for probability of ownership and utilisation of ITN by wealth index

	Kisarawe			Mpanda		
	OR	**P**	**CI**	**OR**	**P**	**CI**
Ownership of at least one net	Own a Net=1			Do not have a Net =0		
Least poor	1	1				
Less poor	0.927	0.03	(0.01-0.79)	**	**	**
Poor	0.097	0.033	(0.01-0.83)	0.074	0.027	0.07-0.74
Very poor	0.079	0.02	(0.009-0.67)	0.756	0.811	0.76-7.5
Poorest	0.056	0.008	(0.006-0.47)	**	**	**
Ownership of ITN						
Least poor	1	1				
Less poor	2.65	0.101	(0.83-8.53)	1	1	(0.061-6.71)
Poor	2.28	0.15	(0.74-7.03)	0.1548	0.098	(0.02-1.41)
Very poor	3.2	0.065	(0.94-10.8)	0.4677	0.55	(0.04-5.44)
Poorest	3.5	0.06	(0.95-13.01)	0.2177	0.18	(0.023-2.07)
Utilisation of ITNs	Slept under net=1 Not slept under net=0					
Least poor	1					
Less poor	0.8	0.714	(0.25-2.57)	0.4838	0.562	(0.04-5.62)
Poor	0.36	0.066	0.12-1.07	0.1677	0.113	(0.02-1.53)
Very poor	0.44	0.15	(0.15-1.34)	0.3118	0.325	(0.03-3.17)
Poorest	0.28	0.024	(0.09-0.84)	0.4677	0.544	(0.04-5.44)

0wnership and utilisation of ITN in study H/H

	District						
Characteristic	**Mpanda**			**Kisarawe**	**OR**	**P**	**CI**
	n	%	N	%			
HH with any net	155	98.1	119	76.3	11.97	<0.001	(4.2;34.5)
HH with ITN	142	89.9	82	52.6	4.93	<0.001	(2.5;9.8)
Slept under any net	244	84.1	118	55.9	6.25	<0.001	(3.2;12.0)

** The socioeconomic groups presented no difference since ownership was 100% each hence logistic regression was perfect predicted of outcome.

Table 4 Household ownership of at least one mosquito bed nets in various study households in Mpanda and Kisarawe District by Household wealth index

	Wealth index					Conc.
1. Mpanda	Poorest	Very poor	Poor	Less Poor	Least Poor	Index
N(158) overall	31	32	31	32	32	
Proportion ownership(%(95% CI)						
No net**	0.00	3.1(0.07-16.2)	6.5(0.7-21.4)	0.00	0.00	-0.1183
ITN	87.1(70.2-94.4)	90.6(75.0-98.0)	77.4(58.9-90.4)	96.9(83.899.9)	93.8(79.2;99.20)	0.0178
Untreated Net	12.9(3.6-29.8)	6.3(0.8-20.8)	16.1(5.5-33.7)	3.1(0.07;16.2)	6.2(0.8;20.8)	0.017
Anynet	100.00	96.9(83.8-99.9)	93.5(78.6-99.2)	100	100	0.0026
2.Kisarawe						
N(156) overall	30	31	32	31	32	
No Net	36.7(19.9-56.)	29(14.2-48.0)	25.0(11.5-43.4)	25.8(11.9-44.6)	3.1(0.07-16.2)	-0.2146
ITN	50.0(31.3-68.)	54.8(36.0-72.7)	53.1(31.3-68.7)	58.1(39.1-75.4)	50.1(31.9-68.1)	0.0042
Untreated net	13.3(3.8-30.7)	16.1(5.4-33.7)	15.6(52.8-32.8)	16.1(5.5-33.7)	46.9(29.1-65.3)	0.2415
Any net	63.3(43.9-80.1)	71.0(52.0-85.8)	75.0(56.6-88.5)	74.2(55.4-88.1)	93.8(79.2-99.2)	0.0681

Table 5: Proportion ownership of mosquito bed nets in various study households in Mpanda and Kisarawe district by household wealth index

	Wealth index					
	Poorest	Very poor	Poor	Less Poor	Least Poor	Conc. Index
1. Mpanda						
N(369) overall						
Proportion ownership(%(95% CI))						
ITN	17.9(14.1-22.2)	17.1(13.4-21.3)	15.4(11.9-19.5)	18.7(14.9-23.10)	18.2(14.4-22.5)	0.0102
Untreated net	3.0 (1.5-5.3)	2.2 (0.9-4.2)	2.7(1.3-4.9)	1.6(0.6-3.5)	3.2 (1.7-5.6)	0.0075
Any net	20.9(16.8-25.4)	19.2(15.3-23.6)	18.2(14.4-22.5)	20.3(16.3-24.8)	21.4(17.3-26.0)	0.0087
2.Kisarawe						
N(207)overall						
Proportion ownership(%(95% CI))						
ITN	8.7(5.2-13.4)	9.2(5.6-14.0)	12.6(8.4-17.9)	13.5(9.2-19.0)	17.4(12.5-23.4)	0.1318
Untreated Net	3.4(1.4-6.8)	3.4(1.4-6.8)	6.8(3.7-11.1)	8.2 (4.9-12.8)	17.0(12.1-22.7)	0.303
Any net	12.1(8.0-17.3)	12.6(8.4-17.9)	19.3(14.2-25.4)	21.7(16.3-28.0)	34.3(27.9-41.2)	0.2033

Table 6: Under five children utilisation of untreated mosquito bed net and insecticide treated nets(ITN) by Wealth index in Mpanda and Kisarawe districts

1.Mpanda	Wealth index					
No. Of net	**Poorest**	**Very poor**	**Poor**	**Less Poor**	**Least poor**	**Conc. index**
N=(290)						
Overall	60	53	63	59	55	
Proportion use	(%(95%CI)					
ITN	73.3(60.3-83.9	81.1(68-090.6)	71.4(58.6-82.1)	79.7(67.2-89.0)	78.2(65.0-88.2)	0.009
Untreated Net	8.3(2.8-18.4)	3.7(0.5-13.0)	9.5(3.6-19.6)	5.1(1.1-14.1)	11.0(4.1-22.2)	0.064
Any Net	81.7(69.6-90.5)	84.9(72.4-93.3)	81.0(69.1-89.8)	84.8(73.0-92.8)	89.1(77.8-95.9)	0.014
Torn Nets***	48.1(36.5-59.7)	34.4(23.0-47.3)	37.7(25.6-51.0)	21.2(12.1-33.0)	15.1(8.1-25.0)	-0.199*
2.Kisarawe						
n=(211)						
Overall	40	37	46	47	41	
ITN	35(20.6-51.7)	51.4(34.4-68.1)	37.0(23.2-52.5)	38.3(24.5-53.6)	48.8(32.9-64.7)	0.027
Untreated Net	7.5(1.6-20.4)	10.8(3.0-25.4)	15.2(6.3-28.9)	12.8(4.8-25.7)	29.3(16.1-45.5)	0.232
Any Net	42.5(27.0-59.1)	62.2(44.8-77.5)	52.2(36.9-67.1)	51.1(36.1-65.9)	78.0(62.4-89.4)	0.082
Torn Nets	36.0(18.0-57.5)	50(30.0-70.1)	47.5(31.5-63.7)	37.8(23.8-53.5)	54.3(41.9-66.3)	0.040**

* Indicates that inequality is pro rich as many torn nets are concentrated in poor household

** Indicates that inequality is pro poor as more torn nets are in richer households

*** Torn nets are nets that had holes hence less protective

Table 7: Source of mosquito bed nets owned in various study households in Mpanda and Kisarawe district by household wealth index

1. Mpanda	***Wealth Index***					
Source of Net	Poorest	Very poor	Poor	Less Poor	Least Poor	Conc. Index
N(369) overall	77	71	67	75	79	
Proportion (%(95% CI))						
Free Nets	66.2(54.6-76.6)	78.9(67.6-87.7)	61.2(48.5-72.9)	61.3(49.4-72.9)	46.8(35.5-58.4)	-0.064
Commercial	27.3(17.7-38.6	19.7(11.2-30.9)	31.3 (20.6-43.8)	25.3(16.0-36.7)	50.6(39.1-62.1)	0.156
Social Market	2.6(0.3-9.1)	0.00	4.5 (0.9-12.5)	2.7(0.3-9.3)	2.5(0.3-8.8)	0.172
Other Source	3.9(0.8-11.0)	1.4 (0.04-7.6)	2.9 (0.4-10.4)	10.7(4.7-19.9)	0.00	0.04
2.Kisarawe						
N(207))overall	25	26	40	45	71	
Free Nets	N/A	N/A	N/A	N/A	N/A	N/A
Commercial	16.0 (4.5-36.1)	42.3(23.4-63.1)	50.0(33.8-66.2)	51.1(35.8-66.3)	50.7(38.6-62.8)	0.269
Social Market	68.0(46.5-85.1)	46.2(26.6-66.6)	45.0(29.0-61.5)	28.9(16.4-44.3)	36.6(25.5-49.9)	0.003
Other Source	16 (4.5-36.1)	11.5(2.4-30.2	12.5(4.2-26.8)	17.8(8.0-32.1)	12.7(6.0-22.7)	0.179

Table 8: Asset ownership in each social economic quintile households of surveyed in Mpanda district ranked by wealth index (n=158)

Household asset (*Loading on first Principal Component*)	Number of households per quintile (%)				
	Poorest	Very Poor	Poor	Less Poor	Least Poor
	175(19.6)	166(20.3)	206(19.6)	177(20.3)	166(20.3)
Source of water (0.65)					
Water piped into house	0	0	0	3.1	0
Piped water stand point	3.2	25.0	35.5	65.6	96.9
Well water	96.8	75	64.5	31.3	3.1
Toilet facilities (0.80)					
Water closet	0	0	6.45	18.8	59.4
Pit latrine with cement	3.2	12.5	19.4	56.3	40.6
Pit latrine with earth	96.8	87.5	74.2	25	0
Iron (0.64)	0	9.4	38.7	46.9	81.3
Radio (0.35)	38.7	56.3	83.9	71.9	90.6
TV (0.67)	0	0	0	3.1	62.5
Telephone (0.69)	0	15.6	38.7	8.3	93.8
Own house (-0.20)	64.5	56.3	58.1	50	37.5
Land use (0.24)					
Land cultivated	22.6	46.9	51.6	43.8	65.6
Land not cultivated	77.4	53.1	48.4	56.3	34.4
Education level (0.15)					
No education	38.7	25	12.9	9.4	0
Primary school	56.8	75	74.2	68.8	59.4
Secondary school	3.2	0	12.9	21.9	40.6
Occupation (-0.52)					
Peasant	100	90.6	93.6	78.1	40.6
Business	0	9.4	6.5	18.8	46.9
Employed	0	0	0	3.1	12.5
Floor material (-0.72)					
Earth/Sand	100	87.5	56.1	25	3.1
Cement	0	12.5	41.9	75	96.8
Rooms for sleeping					
1room	48.4	50.0	32.3	37.5	31.3
2rooms and above	51.6	50.0	67.7	62.5	68.8

Table 9 Asset ownership in each social economic quintile of households surveyed in Kisarawe district ranked by wealth index (n=156)

	Number of households per quintile (%)				
Household asset (Loading on first Principal Component)	Poorest	Very Poor	Poor	Less Poor	Least Poor
	175(19.6)	166(20.3)	206(19.6)	177(20.3)	166(20.3)
Source of water (0.65)					
Water piped into house	0.00	0.00	0.00	9.7	28.1
Piped water stand point	0.0	9.7	18.8	29.0	46.9
Well water	100	90.3	81.3	61.3	25
Toilet facilities (0.71)					
Water closet	0.00	0.00	0.00	9.7	31.3
Pit latrine with cement	0.0	0.0	6.3	29.0	43.8
Pit latrine with earth	93.3	100	93.8	61.3	25
No toilet	6.8	0.00	0.00	0.00	0.00
Iron (0.68)	3.3	0	18.8	38.7	90.6
Radio (0.70)	66.7	80.7	78.1	74.2	81.3
Television (0.65)	0	0	0	19.4	56.25
Telephone (0.54)	6.7	45.2	68.8	74.2	96.9
Bicycle (0.20)	10	32.3	40.6	41.9	50
Land use (-0.05)					
Land cultivated	66.7	64.5	56.3	67.7	68.8
Land not cultivated	33.3	43.75	32.26	31.25	34.4
Education level (0.35)					
No education	56.67	19.4	9.4	3.2	0
Primary school	40	80.7	87.5	93.6	84.4
Secondary school	3.3	0	3.1	3.2	15.6
Occupation (-0.46)					
Peasant	100	96.8	81.3	77.4	50
Business	0	0	6.3	9.7	18.8
Employed	0	3.2	12.5	12.9	31.3
Floor material (-0.78)					
Earth/Sand	100	96.8	71.9	29	3.1
Cement	0	3.2	28.1	71	96.9
Rooms for sleeping					
1room	63.3	45.2	18.8	16.3	18.8
2rooms and above	36.8	54.8	81.3	83.9	81.3

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APPENDICES

Appendix 1: **Informed consent form (English version)**

MUHIMBILI UNIVERSITY OF HEALTH AND ALLIED SCIENCES

DIRECTORATE OF RESEARCH AND PUBLICATIONS, MUHAS

INFORMED CONSENT FORM

ID-NO. ☐☐☐

Consent to Participate in a Study

Greetings! My name is ……., I am working on this research with the objective of **exploring the inequality in ownership and utilization of Insecticide treated nets and among household with under five children in two districts namely Kisarawe in Coast region and Mpanda in Rukwa region.**

Purpose of the study
The study is conducted in partial fulfillment of the requirements for the degree of Master of Arts Health Policy and Management of MUHAS. Examine coverage and utilization of ITNs and the equity implications and generate information that may be used to develop evidence based targeted interventions that will achieve high ITNs coverage and increase their utilization. The study will also contribute to the debate on proper methods of distributing ITNs.

What Participation Involves
If you agree to join the study, you will be interviewed in order to answer a series of questions in the questionnaire prepared for the study.

Confidentiality
All information collected on forms will be entered into computers with only the study identification number. Confidentiality will be observed and unauthorized persons will have no access to the data collected.

Risks
We do not expect that any harm will happen to you because of participating in this study.

Right to Withdraw and Alternatives
Taking part in this study is completely voluntary. You can stop participating in this study at any time, even if you have already given your consent. Refusal to participate or withdrawal from the study will not involve penalty.

Benefits
If you agree to take part in this study, the information you provide will enable us to explore the elements embedded in ownership and utilization of ITNs. The results from this study may be used to improve guidelines on distribution of ITNs, hence improve ownership and use of ITNs while minimizing inequality. This will be beneficial to you and other people in this district as beyond the district.
A small group of scientific experts who are not involved in implementing this study will monitor the results of this study and how we conduct this research.

Who to Contact
If you ever have questions about this study, you should contact the Principal Investigator, **George Ruhago** of Muhimbili University of Health and Allied Sciences, P. O. Box 65001, Dar es Salaam.
If you ever have questions about your rights as a participant, you may call Prof. E. F. Lyamuya, Chairperson of the Senate Research and Publications Committee, P. O. Box 65001, Telephone : 255 22 2152489 Dar es Salaam.

Signature:

Do you agree?

Participant agrees …….. Participant does NOT agree ……..

I …….. have read the contents in this form. My questions have been answered. I agree to participate in this study.

Signature of participant ……

Signature of Research Assistant ……..

Date of signed consent ……..

Appendix 2: **Informed consent form (Swahili version)**

CHUO KIKUU CHA SAYANSI ZA AFYA MUHIMBILI

KURUGENZI YA TAFITI NA UCHAPISHAJI

FOMU YA RIDHAA

Namba ya utambulisho ☐☐☐

Ridhaa ya kushiriki kwenye utafiti

Hujambo! Ninaitwa ....., nashughulika kwenye utafiti huu wenye lengo la **kuangalia ulinganifu wa umiliki na matumizi ya vyandarua vyenye viuatilifu vinavyotolewa bure katika kaya zenye watoto walio na umri chini ya miaka mitano katika wilaya za Kisarawe mkoani Pwani na Kyela mkoani Mbeya.**

Madhumuni ya Utafiti
Utafiti huu unafanyika katika kutimiza sehemu ya matakwa ya shahada ya uzamili ya Sera na Usimamizi katika sekta ya Afya ya Chuo Kikuu cha Afya na Sayansi ya Tiba Muhimbili. Utafiti unalenga kutoa taarifa ambazo zitaweza kutumika kuboresha miongozo ya usambazaji, umiliki na matumizi ya vyandarua vyenye viuatilifu kwa kutambua mambo muhimu yanayohitaji kufikiliwa katika kuboresha usambazaji na matumizi ya vyandarua vyenye viuatilifu kama kinga muhimu dhidi ya ugonjwa wa malaria kwa watoto wenye umri chini ya miaka mitano.

Nini kinahitajika ili kushiriki
Ukikubali kushiriki katika utafiti huu, utasailiwa ili kuweza kujibu maswali toka kwenye dodoso lililoandaliwa kwa ajili ya utafiti huu.

Usiri
Taarifa zote zitakazokusanywa kupitia dodoso zitaingizwa kwenye ngamizi kwa kutumia namba za utambulisho.Kutakuwa na usiri na hakuna mtu yeyote asiyehusika atakayepata taarifa zilizokusanywa.

Hatari
Hatutegemei madhara yoyote kukutokea kwa kushiriki kwako kwenye kwenye utafiti huu.

Haki ya kujitoa au vinginevyo
Ushiriki katika utafiti huu ni wa hiari. Unaweza kuacha kushiriki katika utafiti huu muda wowote hata kama ulikwishatoa idhini yako. Kukataa kushiriki au kujitoa kutoka kwenye utafiti hakutahusisha adhabu yoyote.

Faida
Kama utakubali kushiriki kwenye utafiti huu taarifa utakazotoa zitatuwezesha kuangalia usambazaji, umiliki na matumizi ya vyandarua kwa watoto walio chini ya miaka mitano. Matokeo ya utafiti huu yanaweza kutumika kuboresha miongozo ya usimamizi wa usambazaji na kuboresha usawa katika matumizi ya vyandarua vyenye viuatilifu miongoni mwa kaya zenye watoto na jamii kwa ujumla. Hii italeta faida kwako na kwa wakazi wengine wa wilaya hii na kwa wilaya nyingine.
Kundi dogo la wataalam wa kisayansi ambalo halihusiki na utekelezaji wa utafiti huu litafanya ufuatiliaji wa matokeo na jinsi tulivyoendesha utafiti huu.

Endapo utapata madhara
Hutegemewi kupata madhara yoyote kutokana na ushiriki wako katika utafiti huu.

Nani wa kuwasiliana naye
Kama una maswali kuhusiana na utafiti huu, wasiliana na Mtafiti mkuu wa utafiti huu, **George Ruhago** wa Chuo Kikuu cha Afya na Sayansi ya Tiba Muhimbili, S. L. P. 65001, Dar es Salaam.
Kama una swali kuhusu stahili zako kama mshiriki unaweza kumpigia simu Prof. E.F. Lyamuya, Mwenyekiti wa kamati ya Utafiti na Uchapishaji, S.L.P 65001, Simu: 255 22 2152489 Dar es Salaam.

Sahihi:
Je umekubali?
Mshiriki amekubali ..... Mshiriki hajakubali .....

Mimi ..... nimesoma maelezo ya fomu hii.
Maswali yangu yamejibiwa.Nakubali kushiriki katika utafiti huu.

Sahihi ya mshiriki.....

Sahihi ya mtafiti msaidizi.....

Tarehe ya kutia sahihi ya idhini ya kushiriki.....

Appendix 3: **Questionnaire (English version)**

1. DEMOGRAPHIC CHARACTERISTIC

Date of Interview _ _ / _ _ / 2009

Name of Street / Hamlet.....

Code Number.....

Name of Interviewer.....

1. Age (years) of head of household interviewed ☐

2. Sex

   1. Male ☐
   2. Female ☐

3. What is your marital status?

   1. Single ☐
   2. Married ☐
   3. Widowed/widower ☐
   4. Divorced / Separated ☐

4. What is the level of your education?

   1. Primary school education ☐
   2. Secondary school education ☐
   3. College ☐
   4. No formal education ☐

5. What is your Occupation?

   1. Peasant ☐
   2. Civil servant ☐
   3. Businessman/Woman ☐
   4. Others Specify..... ☐

6. How many people are living in this household?
7. How many people slept in this house household previous night? ☐ ☐

8. How many under five children in your household?
9. Do their parents live in this household? ☐
10. If no, who do they live with? ☐
11. Do Children under five sleep with their Parents? ☐

2. INDICATORS OF SOCIOECONOMIC STATUS

12. What is the main source of drinking water for members of your household?
    1. Piped water into house ☐
    2. Piped water into the compound ☐
    3. Piped water standpoint ☐
    4. Protected well ☐
    5. Unprotected well ☐
    6. Bottled water ☐
    7. Others (Specify).....

13. What kind of toilet facilities does your household use?
    1. Water Closet (W.C) ☐
    2. Ventilated improved (VIP) ☐
    3. Pit latrine with slab ☐
    4. Pit latrine without slab/ open pit ☐
    5. No Facility ☐
    6. Others (Specify) .....

14. Do your household/any member of your household have?

	Yes	No
1. Iron?	☐	☐
2. A radio?	☐	☐
3. A television?	☐	☐
4. A telephone?	☐	☐
5. A refrigerator?	☐	☐
6. Bicycle?	☐	☐
7. Motorcycle or motor scooter?	☐	☐
8. Car or truck?	☐	☐

15. How many rooms does your house have? ☐

16. How many rooms does your household use for sleeping? ☐

17. Main material of the floor. (Record observation) ☐

1. Earth or Sand ☐
2. Dung ☐
3. Wood Planks/Bamboo/reed ☐
4. Polished wood/ Parquet ☐
5. Cement ☐
6. Ceramic tiles ☐
7. Others (Specify) ..... ☐

3. INDICATORS OF OWNERSHIP AND USE OF MOSQUITO NET

18. Does your household have any mosquito nets that can be used while sleeping?

1. Yes ☐
2. No ☐

19. How many mosquito nets does your household have? ☐

20.	Ask respondent to show you the net(s) in the household.	NET #1 Intac ☐ Torn ☐ Not observed ☐	NET #2 Intact ☐ Torn ☐ Not observed ☐	NET #3 Intact ☐ Torn ☐ Not observed ☐
21.	How long ago did your household obtain the mosquito net?	Mos ☐ Ago More than 2 years ago……..	Mos ☐ Ago More than 3 years ago……..	Mos ☐ Ago More than 3 years ago……..
22.	Where did you get your mosquito net?	NET #1 Shop ☐ Street Hawkers ☐ Health facility ☐ Market ☐ Gift ☐ Not Sure ☐ Others(Specify)	NET #2 Shop ☐ Street Hawkers ☐ Health facility ☐ Market ☐ Gift ☐ Not Sure ☐ Others(Specify)	NET #3 Shop ☐ Street Hawkers ☐ Health facility ☐ Market ☐ Gift ☐ Not Sure ☐ Others(Specify)
23.	Are mosquito nets available in the nearby shops in your community?	Yes ☐ No ☐ Not sure ☐	Yes ☐ No ☐ Not sure ☐	Yes ☐ No ☐ Not sure ☐

24.	If you purchased it what was the cost of a mosquito net?	☐☐ Tsh	☐☐ Tsh	☐☐ Tsh
25.	Have you ever received a mosquito net from a National Campaign	Yes ☐ No ☐ Not sure ☐	Yes ☐ No ☐ Not sure ☐	Yes ☐ No ☐ Not sure ☐
26.	When you got the net, was it already factory-treated with an insecticide to kill or repel mosquitoes?	Yes ☐ No ☐ Not sure ☐	Yes ☐ No ☐ Not sure ☐	Yes ☐ No ☐ Not sure ☐
27.	What is the brand of your mosquito net?	Permanent net ☐ Pre-treated net ☐ Untreated net ☐ Don't know ☐ Brand Other (Specify)	Permanent net ☐ Pre-treated net ☐ Untreated net ☐ Don't know ☐ Brand Other (Specify)	Permanent net ☐ Pre-treated net ☐ Untreated net ☐ Don't know ☐ Brand Other (Specify) .....

28.	Since you got the mosquito net, was it ever soaked or dipped in a liquid to repel mosquitoes or bugs?	NET #1 1. Yes ☐ 2. No ☐ 3. Not sure ☐	NET #2 1. Yes ☐ 2. No ☐ 3. Not sure ☐	NET #3 1. Yes ☐ 2. No ☐ 3. Not sure ☐
29.	If (19 above) is yes, how long ago was the net last soaked or dipped?	1. Less than 6 months ago ☐ 2. One yr ago ☐ 3. Two yrs ago ☐ 4. Above two yrs ☐	Less than 6 months ago ☐ 2. One yr ago ☐ 3. Two yrs ago ☐ 4. Above two yrs ☐	Less than 6 months ago ☐ 2. One yr ago ☐ 3. Two yrs ago ☐ 4. Above two yrs ☐
30.	Did anyone sleep under this mosquito net last night?	1.Yes ☐ 2. No ☐ 3. Not sure ☐ (If 2 or 3 END here)	1.Yes ☐ 2. No ☐ 3. Not sure ☐ (If 2 or 3 END here)	1.Yes ☐ 2. No ☐ 3. Not sure ☐ (If 2 or 3 END here)
31.	Who slept under this mosquito net last night? (Record age in the respective line number).	☐ ☐ ☐ ☐	☐ ☐ ☐ ☐	☐ ☐ ☐ ☐

32. Do you own a land?

1. Yes ☐

2. No

33. If 32 above is yes.

1. How many acres are cultivated?

2. How many acres are not cultivated?

Appendix 4: **Questionnaire (Swahili version)**

1. TAARIFA ZA KAYA

Tarehe ya Usahili _ _ / _ _ / 2009
Jina la Mtaa/Kata.....
Namba ya dodoso.....
Jina la Msaili.....

1. Umri (Miaka) wa mkuu wa Kaya aliyesailiwa ☐
2. Jinsia ☐
   1. Mume
   2. Mke ☐
3. Je una Ndoa? ☐
   1. Nimeoa/Nimeolewa ☐
   2. Sijaoa/Kuolewa ☐
   3. Tumetengana/Tumeachana
   4. Mjane ☐
4. Je una kiwango gani cha elimu? ☐
   1. Elimu ya Msingi ☐
   2. Elimu ya Sekondari (1-6)
   3. Elimu ya Juu(Chuo n.k) ☐
   4. Sijasoma ☐
5. Je unafanya kazi gani? ☐
   1. Mkulima ☐
   2. Mtumishi wa Kuajiliwa
   3. Mfanyabiashara ☐
   4. Nyinginezo(Taja)..... ☐

6. Ni watu wangapi wanaishi katika kaya hii? ☐
7. Watu wangapi walilala hapa usiku wa kuamkia leo? ☐
8. Je kuna watoto wangapi wenye umri chini ya miaka mitano katika kaya hii? ☐
9. Je watoto hawa wanaishi na wazazi wao? ☐
10. Kama Hapana nini uhusiano na wanayeishi naye sasa? ☐
11. Je watoto umri chini ya miaka mitano hulala na wazazi/Ndugu? ☐

2. VIASHILIA VYA KIWANGO CHA HALI YA MAISHA

12. Nini Chanzo cha maji ya kunywa kwenye kaya yako?

    1. Maji ya bomba ndani ya nyumba ☐
    2. Maji ya bomba uani ☐
    2. Maji ya bomba kibandani ☐
    3. Kisima kirefu ☐
    4. Kisima kifupi ☐
    5. Maji ya chupa ☐
    6. Nyingine (Taja).....

13. Je mnatumia choo cha aina gani ☐

    1. Choo cha Maji (W.C) ☐
    2. Choo cha VIP ☐
    3. Choo cha shimo chenye sakafu
    4. Choo cha shimo bila sakafu ☐
    5. Hakuna choo ☐
    6. Nyingine (Taja) .....

14. Je katika kaya yako mnamiliki chochote kati ya hivi?	Ndiyo	Hapana
1. Pasi?	☐	☐
2. Radio?	☐	☐
3. Televisioni?	☐	☐
4. Simu?	☐	☐
5. Jokofu?	☐	☐
6. Baisikeli?	☐	☐
7. Gari?	☐	☐
8. Pikipiki?	☐	☐

15. Je unamiliki nyumba?
    1. Ndiyo ☐
    2. Hapana ☐

16. Ni vyumba vingapi vinatumika kwa kulala? ☐

17. Nyumba imesakafiwa wa kutumia nini. (Andika ulichoona)
    1. Udongo ☐
    2. Samadi ☐
    3. Mbao/Magogo/Miti ☐
    4. Mbao iliyogalishwa ☐
    5. Simenti ☐
    6. Vigae ☐
    7. Nyingine (Taja)..... ☐

3. VIASHILIA VYA UMILIKI NA UTUMIAJI CHANDARUA CHA MBU

18. Je kaya yako ina Chandarua/Vyandarua

1. Ndiyo ☐

2. Hapana ☐

19. Kama Ndiyo, je idadi yake ni vingapi? ☐

20	Muulize mhojiwa akuonyeshe vyandarua **(Kama ni zaidi ya Vitatu tumia Dodoso la Ziada)**	**Chandarua #1** Kizima ☐ Kimetoboka ☐ Sikuona ☐	**Chandarua #2** Kizima ☐ Kimetoboka ☐ Sikuona ☐	**Chandarua #3** Kizima ☐ Kimetoboka ☐ Sikuona ☐
21	Ni miezi mingapi imepita tangu kaya yako ilipopata chandarua?Kama ni chini ya mwezi mmoja weka 00	☐☐ Miezi iliyopita Zaidi ya miaka miwili iliyopita ☐	☐☐ Miezi iliyopita Zaidi ya miaka miwili iliyopita ☐	☐☐ Miezi iliyopita Zaidi ya miaka miwili iliyopita ☐

22	Ulipata wapi Chandarua?	Dukani ☐ Machinga ☐ Kituo cha Afya ☐ Sokoni ☐ Zawadi ☐ Sijui ☐ Njia nyingine(Eleza)	Dukani ☐ Machinga ☐ Kituo cha Afya ☐ Sokoni ☐ Zawadi ☐ Sijui ☐ Njia nyingine(Eleza)	Dukani ☐ Machinga ☐ Kituo cha Afya ☐ Sokoni ☐ Zawadi ☐ Sijui ☐ Njia nyingine(Eleza) .....
23	Je vyandarua vinauzwa katika maeneo haya	Ndiyo ☐ Hapana ☐ Sijui ☐	Ndiyo ☐ Hapana ☐ Sijui ☐	Ndiyo ☐ Hapana ☐ Sijui ☐
24	Je katika maeneo haya Chandarua kinauzwa bei gani?	**Chandarua #1** ☐☐ Tsh.	**Chandarua #2** ☐☐ Tsh.	**Chandarua #3** ☐☐ Tsh.
25	Je, ulipata chandarua katika mpango wa taifa wa kugawa vyandarua bure kwa watoto wa chini ya miaka mitano?	Ndiyo ☐ Hapana ☐ Sijui ☐	Ndiyo ☐ Hapana ☐ Sijui ☐	Ndiyo ☐ Hapana ☐ Sijui ☐

26	Je ulipopata Chandarua kilikuwa kimewekwa? kuulia au kufukuza mbu?	Ndiyo ☐ Hapana ☐ Sijui ☐	Ndiyo ☐ Hapana ☐ Sijui ☐	Ndiyo ☐ Hapana ☐ Sijui ☐
27	Je Chandarua ni aina gani?	1. Kudumu ☐ 2. Kurudiwa Daw ☐ 3. Hakina Dawa ☐ 4. Sijui ☐ 5. Nyingine (Eleza) ……..	1. Kudumu ☐ 2. Kurudiwa Daw ☐ 3. Hakina Dawa ☐ 4. Sijui ☐ 5. Nyingine (Eleza) ……..	1. Kudumu ☐ 2. Kurudiwa Daw ☐ 3. Hakina Dawa ☐ 4. Sijui ☐ 5. Nyingine (Eleza) ……..
28	Toka umepata chandarua kimewahi kuwekwa/kulo wekwa ktk dawa ya kuulia mbu au wadudu?	1. Ndiyo ☐ 2. Hapana ☐ 3. Sina uhakika	1. Ndiyo ☐ 2. Hapana ☐ 3. Sina uhakika	1. Ndiyo ☐ 2. Hapana ☐ 3. Sina uhakika

29	Kama (28) ni ndiyo lini mara ya mwisho uliweka dawa?	1. Chini ya miezi sita ☐ 2. Mwaka mmoja uliopita ☐ 3. Miaka miwili iliyopita ☐ 4. Zaidi ya Miaka miwili ☐	1. Chini ya miezi sita ☐ 2. Mwaka mmoja uliopita ☐ 3. Miaka miwili iliyopita ☐ 4. Zaidi ya Miaka Miwili ☐	1. Chini ya miezi sita ☐ 2. Mwaka mmoja uliopita ☐ 3. Miaka miwili iliyopita ☐ 4. Zaidi ya Miaka Miwili ☐
30	Kuna yeyote aliyelala kwenye Chandarua hiki usiku wa kuamkia leo?	1.Ndiyo ☐ 2. Hapana ☐ 3. Sina uhakika ☐ (Kama 2 au 3 uliza chandarua cha pili)	1.Ndiyo ☐ 2. Hapana ☐ 3. Sina uhakika ☐ (Kama 2 au 3 uliza chandarua cha tatu)	1.Ndiyo ☐ 2. Hapana ☐ 3. Sina uhakika ☐ (Kama 2 au 3 uliza chandarua cha nne)
31	Kama (21) ni **Ndiyo**, nani alilala kwenye chandarua usiku wa kuamkia leo? (Andika miaka ya aliyelala kwenye chandarua).	**Chandarua #1** ☐ ☐ ☐ ☐	**Chandarua #2** ☐ ☐ ☐ ☐	**Chandarua #3** ☐ ☐ ☐ ☐

32. Je unamiliki Shamba?

1. Ndiyo
2. Hapana

33. Kama (32) ni Ndiyo je

1. Hekali ngapi zimelimwa? .....
2. Hekali ngapi hazijalimwa? .....