

People's Perception on Mosquito Net Performance
A Cross-Sectional Study in North-Western Part of Lake Zone in
Tanzania, Muleba District

By

Eliud Andrea Lukole

A Dissertation Submitted to the School of Public Administration and Management in
Partial Fulfilment of the Requirements for Award of the Degree of Master of Health
Systems and Management (MHSM) of Mzumbe University.

2015

CERTIFICATION

We, the undersigned, certify that we have read and hereby recommend for acceptance by the Mzumbe University, a dissertation entitled : *Population’s Perception on Mosquito Net Performance in North-Western Part of Lake Zone in Tanzania, Muleba District: A Cross-Sectional Study*, in partial of the requirements for award of the degree of Master of Health System Management of Mzumbe University.

Dr. Bunini Manyilizu

Signature

Major supervisor

Signature

Internal Examiner

Signature

External Examiner

Accepted for the Board of School of Public Administration and Management

Signature

DEAN/CHAIRPERSON

DECLARATION AND COPYRIGHT

I, Eliud Andrea Lukole, declare that this dissertation is my own original work and that it has not been presented and will not be presented to any other university for a similar or any other degree award.

Signature _____

Date _____

© 2015

This dissertation is a copyright material protected under the Berne Convention, the Copyright Act 1999 and other international and national enactments, in that behalf, on intellectual property. It may not be reproduced by any means in full or in part, except for short extracts in fair dealings, for research or private study, critical scholarly review or discourse with an acknowledgement, without the written permission of Mzumbe University, on behalf of the author.

ACKNOWLEDGEMENT

With sincere gratitude and grateful heartfelt thanks, I would like to thank my Almighty God the Lord for allowing me pass triumph over this stage of study.

I would like to thank my supervisor Dr Wilbert Manyilizu for his kindness, really has prayed multi-roles across all phases of report development to mention parenting, teaching, counseling and guidance roles. I appreciate your support Dr. Also I thank my class supervisor Mr. Deogratias Mpenzi who has persuaded me to climb this high mountain and install the flag of success.

Furthermore; I would like to thank my project manager Dr Natacha Protopopoff for allowing me work with PAMVERC Project in all project activities, and other fellow Dr Derek JacqueCharlwood, and Miss Stacie Gobin for their constructive assistance through this study. I much extend appreciation to PAMVERC staff, specifically, field workers who were involved in data collection, really your work is tangible.

Last but not in importance, I thank my family, my lovely father Mr Andrea Lukole, who highly introduced this idea to me and ready to support any financial obligation related to my study. More so, my step mother Gilida Andrea, my sisters Jonatha, Elida, Jivina, Venia, and Alinda; my brothers Victor and Evad. Their love, support and tolerance are of great value to me. I also thank Mr&Mrs Johansen Kakiziba for hosting me every time I went for my studies before getting to college and during short recesses, I felt home away from home. My Almighty God bless you abundantly.

DEDICATION

I dedicate this work to my three little siblings Evad, Venia and Alinda who are still in school to work hard and reach this stage and advance more and more.

ABBREVIATIONS AND ACRONYMS

ANC	Antenatal Care
BCC	Behavior Change Communication
CI	Confidence Interval
COSTECH	Tanzania Commission for Science and Technology
CRERC	Kilimanjaro Christian Medical College Research and Ethics Review Committee
DMO	District Medical Officer
EC	Ethics Committee
FGD	Focus Group Discussion
GPS	Global Positioning System
HH	House Hold
HI	Hole Index
IEC	Information Education Communication
IQR	Inter-quartile Range
IRS	Indoor Residual Spraying
ITN	Insecticide Treated Net
KCMUCo	Kilimanjaro Christian Medical College
LLIN	Long-Lasting Insecticidal Net
LSHTM	London School of Hygiene and Tropical Medicine
MANOVA	Multivariate Analysis of Variance
MoH	Ministry of Health and Social Welfare
MRCC	Medical Research Coordinating Committee
NIMR	National Institute for Medical Research
NMCP	National Malaria Control Programme
PAMVERC	Pan-African Malaria Vector Research Consortium
PDA	Personal Digital Assistant
PMI	President's Malaria Initiative
SES	Socio Economical Status
SOP	Standard Operating Procedure
UCC	Universal Coverage Campaign
WHO	World Health Organisation

ABSTRACT

The main aim of this study was to assess People's Perception of Mosquito Net Performance in Muleba District in the North-Western Part of the Lake Zone of Tanzania. A cross-sectional survey and KAP survey were conducted a month apart. It was found that the sole reasons for not using bed nets in the study area were having not enough nets and bed nets being too old or poor condition. Half of the respondents continued to sleep under bed nets with poor conditions since they had no other alternatives. The attrition, survivorship and fabric integrity (LLIN with holes) rates were 36.85%, 57.76% and 60.15% respectively. Moreover, over 3 years more than 3 nets for every 10 nets distributed were lost because of wearing and tear, 5 nets survived out of 10 nets after 3 years and 4 nets sustained field condition for every net used. A proportionate hole index (pHI) was developed so that the integrity of net structure could be categorized. The pHI, IQR(Inter-quartile Range), median and standard deviation for HI were 3382.74, 2594.47, 3310.58 and 2551.50 respectively. There is wider dispersion of data on holes, and this is due to cluster geographical differences and differences in household composition between and within clusters. Based on study findings, mosquito nets are the main preventive measure against malaria used in Muleba. The population highly associate nets with malaria prevention. Nets with too many holes and more than three years old were perceived to be poorly performing in malaria prevention. Moreover, net attrition and survivorship and fabric integrity as elements of net durability showed significance difference between clusters because of geographical difference and the within cluster variation was due SES led by household composition. It is recommended that intensive and robust community-specific communication programmes should be devised by the government and/or other private institutions. Nets accessibility ought to be increased 3 years after free universal distribution through supply of subsidized nets in private shops so that families can at any time have access to them at lower costs. Pro-poor exemption policies can help the poorer group on equity bases.

TABLE OF CONTENTS

CERTIFICATION	ii
DECLARATION AND COPYRIGHT	iii
ACKNOWLEDGEMENT	iv
DEDICATION	v
ABBREVIATIONS AND ACRONYMS	vi
TABLE OF CONTENTS	vii
LIST OF TABLE	xi
LIST OF FIGURES	xi
ABSTRACT	vii
CHAPTER ONE	1
1.1 Introduction	1
1.2 Background of the problem	2
1.3 Statement of the problem	3
1.3.1 Necessary and sufficient prerequisites for net	3
1.4 Research objectives	5
1.4.1 General objective	5
1.4.2 Specific objectives	5
1.5 Research Questions	6
1.6 Significance of the study	6
1.7 Scope of the study	6
1.8 Limitation of the study	7
CHAPTER TWO	8
LITERATURE REVIEW	8
2.1 Introduction	8
2.2 Theoretical Literature Review	8
2.2.1 Definition of important terms	8
2.2.2 Actual and expected use of ITNs	9
2.2.3 Social and behavioural aspects on ITNs use	10

2.2.4 Determinant of net use.....	11
2.3 Empirical Literature Review	12
2.3.1 Longevity of nets in local communities’ context	12
2.3.2 Effectiveness of LLIN over other nets when used every night	13
2.4 Research Gap	13
2.5 Conceptual framework	14
2.5.1 Dependent variables and independent variable	14
CHAPTER THREE	16
METHODOLOGY OF THE STUDY.....	16
3.1 Introduction.....	16
3.2 Study Design	16
3.3 Study Area	17
3.4 Study population	20
3.5 Study Outcomes	20
3.5.1 Primary outcomes	20
3.5.2 Secondary Outcomes	21
3.6 Sampling and Sample Size Estimations	21
3.6.1 Sampling Techniques	21
3.6.2 Sample Size	22
3.7 Data Types and collection Methods	22
3.7.1 Data Types.....	22
3.7.2 Data Collection Methods.....	22
3.8 Data analysis	23
3.9 Data Validation	24
3.10 Ethical considerations	24
3.11 RESEARCH ACTIVITIES.....	25
3.11.1 Sensitization	25
CHAPTER 4.....	26
DATA PRESENTATION	26
4.1 Introduction.....	26
4.2 Demographic Characteristics	27
4.3 Study Findings	28

4.3.1 People’s perception of mosquito nets on malaria prevention.....	28
4.3.2: Appropriate indicators for perceived failing of nets	29
4.3.3: Approximate useful lifespan of nets	30
4.3.4: Net status is associated with perceived negative health effects among community members	31
CHAPTER FIVE	32
DISCUSSION OF THE FINDINGS.....	32
5.1 Introduction.....	32
5.2 Study Findings	32
5.2.1 People’s perception of mosquito nets on malaria prevention.....	32
5.2.2 Appropriate indicators for perceived failing of nets	33
5.2.3 Approximate useful lifespan of nets	33
5.2.4 Net status is association with perceived negative health effects among community members	34
CHAPTER SIX	36
SUMMARY, CONCLUSIONS AND POLICY IMPLICATIONS.....	36
6.1 Introduction.....	36
6.2 Summary	36
6.3 Conclusion	36
6.4 Policy implication	37
6.5 Recommendations	37
6.6 Area for further research.....	37
REFERENCES	38
APPENDIXES.....	40
Appendix 1: Questionnaire	40
Appendix: 2	52
Consent Forms	52

LIST OF TABLE

Table 3.1 Insecticide Treated Net (ITN) used between June 2011 and October 2014....	18
Table 3.2 Criteria for cluster selection.....	20
Table 4.1 Characteristics of study population.....	27
Table 4.2 Population's attitude on malaria preventive practices.....	27
Table 4.3 Population attitudes on when they decide that a bed net is failing or has failed and different measures upon failed nets.....	28
Table 4.4 Association between age of net and whether a net has hole, is hung or frequency of wash.....	30
Table 4.5 Proportion of the elements of net durability and status they indicate	31

LIST OF FIGURES

Figure 2.1 Conceptual Framework	15
Figure 3.1 Kagera Regional map with administrative boundaries	17
Figure 3.2: Bed net use and malaria prevalence in the study area.	19

CHAPTER ONE

1.1 Introduction

Malaria is the leading cause of mortality in children and pregnant mothers in Tanzania (WHO, 2014). Two predominant measures to control malaria, Insecticide Treated Nets (ITNs) and Indoor Residual Spraying (IRS) have now been in place for many years. ITNs, originally required periodic re-treatment to maintain effectiveness, this was not only difficult to achieve but added to the cost of control and led to the development of the Long-lasting Insecticidal Net (LLIN). According to the manufacturers and the WHO such nets can be washed at least 20 times and can last for at least 3 years (Baume, et al., 2009). LLINs were expected to provide an extended protection to people sleeping under them and by 2010 the number of nets distributed in Sub-Saharan Africa increased from 6 million to 145 million. Thus LLINs are designed to have a long life span with an indirect function of reducing costs in malaria control, hence nets can be used for longer periods of time and users need to ensure that the net remains in good condition for at least three years because after 2010 donor funding for nets stagnated and the number of nets which were procured decreased compared to other past years (Baume, et al., 2009; Loll, et al., 2013). In contrast to IRS, LLINs have proven to be highly effective in preventing mosquito bites and in providing protection when a person sleeps under the net. Thus, consistent use of LLINs can reduce malaria transmission by up to more than 90% and avert as much as 44% of deaths among children <5years of age (Loll, et al., 2013). Despite considerable efforts to achieve mass coverage of mosquito nets in most parts of Africa, net use is still incomplete. There are still little information on the determinants of owners using nets or not using nets despite several studies conducted following mass net distribution campaigns post 2005 (Loll, et al., 2013).

There is still no standard measure used to determine durability of mosquito nets or when a net is no longer helping in mostly places where nets are commonly used (Loll, et al., 2013; WHO, 2014). Rate of accumulation of holes and loss of insecticide are useful yard sticks to define when a net is too old to be used or is no longer useful, irrespective of net

age. The World Health Organization (WHO) indicates that the decision on when a net is no longer protecting should be up to the home owner or, to be more specific, the bed net user him or herself. However, while people might think that nets with many holes and with little or no remaining insecticide are no longer protective, there may still be some degree of protection against malaria vectors and other biting insects compared to sleeping without net at all (WHO, 2014). The question of whether nets should be replaced or redistributed, based on individual decisions, has yet to be answered. The average time a net is expected to last, if used as required, in traditional housing has also yet to be answered. Bad behaviour in net use has played a major role on net wearing. Knowing people's perceptions, which entails knowledge, attitude and practices, can help reverse the trend through strong and intensive Behavioural Change Communication (BCC).

1.2 Background of the problem

The last universal net coverage in Muleba district was conducted three years ago in 2011. It was thought that this would increase net use but this did not occur. It was anticipated that the LLINs distributed in 2011 would last for 3 to 5 years and sustain more than 20 washes. The trend of net usage has been falling since 2011. In June 2011, about fifty six percent of nets were in use, it went down to 36.1% in October 2012 and results of a cross-sectional study from randomly selected clusters conducted in October 2014 Muleba revealed 27% of net usage ranging from 9% to 65.4% (PAMVERC, 2014) (*unreported*). There are two kinds of bed nets that are normally used in Muleba. They are either conventional ITN's or LLIN's. The former net requires annual retreatment with insecticide (if it is washed three times or less) otherwise they should be retreated several times a year (WHO, 2014). Though this is like a pipe dream when considering the economic status of communities in Muleba most of whom cannot afford the required insecticides for re-treatment purposes. As described LLIN's are designed to retain their biological efficacy, without re-treatment, for more than twenty WHO standard washes under laboratory conditions and not less than three years of recommended use under

field conditions. Durability of the nets is, however, not simple to anticipate, especially in varied field situations, as is the case in Muleba. Poor housing largely contributes to reducing net life times. Nets are commonly made of polyester and rarely last longer than 2-3 years under field conditions. Unless we embark on new technologies that ensure manufacturing of stronger and longer lasting nets, the recommended life span for nets will always be divergent to actual field situations, leaving populations unprotected for a number of years before a subsequent net distribution (WHO, 2014).

1.3 Statement of the problem

1.3.1 Necessary and sufficient prerequisites for net use

Net ownership is the first prerequisite for net use (Graves, et al., 2011). Net ownership in African countries increased sharply following large donations of free nets from 2000 onwards. This initially increased net use but there has been a downhill trend with time (Graves, et al., 2011; Baume, et al., 2009). There might be a number of reasons why individuals do not use nets even if they own them.

A number of reasons are associated with low net usage among populations; nets being too old, nets being dirty, nets having many holes or being in poor condition, nets being washed were some of reasons for not using nets in the night before or the week before the study of West et al., (2012).

Communities should be encouraged to regularly repair and wash their LLINs when they become damaged and dirty (WHO, 2014). Furthermore, the community should have clear strategies on how to manage nets for long life and in case it fails have good management of failed nets than using them in other alternative uses which could be hazardous to the environment. As recommended by WHO that poorly disposing LLINs may contaminate water bodies, and the environment at large since the residual insecticide used in nets is thought to be toxic when used against intended purposes (WHO, 2014).

Population's non-use of nets prevails among communities following earlier perceptions on IRS that was only be effective within six months, people therefore think that nets too behave the same unless another intervention should come in being the same intervention or different but targeting on malaria. In their report, Baume et al., (2009) found that ITNs of less than six months old were more likely to be used than those over a year old, logically according to community perceptions newer ITNs are likely to be in better condition when you consider composition of households and believed to have more visible mosquito-repelling power than older ITNs. Is this similar to what LLINs were expected to be perceived? Actually not, there should be strong behavioural communication strategies to just change community's misconception on life span of LLINs.

Recent studies have identified several reasons as to why there are less use of LLINs in most parts of Africa and found that nets are ineffective regardless of less time spent in use (Baume, et al., 2009). Even though ambiguity still exists in singling out what might be strong reason of not using nets among the population, the diminishing mosquito knock-down effect with time is the greatest perceived sign of ineffectiveness, or lack of prior messages about the importance of consistent use of nets and assuring every household member is covered during night by a net unless nets are not enough in given household (Baume, et al., 2009). Adjusting the frequency of LLINs distribution is of vital importance. This should respect the differences in village or community settings (rural/urban) since the plan in rural areas should greatly be different form urban setting. In the former setting, nets are expected to wear out earlier than their predetermined time, while in the latter setting nets can even stay longer than anticipated years (Baume, et al., 2009). 'Catch-up' strategies offer opportunities to rapidly increase ITN coverage in all targeted communities whereas 'keep-up' strategies allow for the continuous distribution of ITNs through routine antenatal or immunization services in a bid to maintain coverage.

Despite the fact that the number of nets available in Muleba District is scarcer with time since the last mass distribution in 2011, even the available nets in households are less commonly used, sometimes without any valid reason, or not used at all. Here the reason can no longer be lack of nets in the community. What makes people not use their nets should be clearly examined. A net being too dirty has been the reason given for non-use, but is the community aware of the rewashing procedures of nets, or are there misperceptions that when nets are washed they lose their efficacy? Is it better to let them become extremely dirty and then dump them completely? Net having many holes are another reason for non-use. Having many holes means there are possibilities of allowing mosquitoes pass through and bite people sleeping under the net. However, the problem holes can be addressed by mending habits. If mended or sewed, the protective capability of a net is increased compared to leaving it unrepaired. As the Swahili proverb says ‘Something is better than nothing, wearing torn clothes is not the same as staying naked’, the same applies to sleeping under worn out nets (having many holes) since such nets still provides some protection to people sleeping under them (WHO, 2014).

1.4 Research objectives

1.4.1 General objective

The main objective of the study was to assess peoples’ perception and indicators on failing nets in Muleba

1.4.2 Specific objectives

- i. To establish the people’s perception of mosquito nets on malaria prevention
- ii. To explore appropriate indicators for perceived failing of nets
- iii. To determine the approximate useful lifespan of nets
- iv. To assess whether net status is associated with perceived negative health effects among community members

1.5 Research Questions

- i. What effect do people perceive mosquito nets have on malaria prevention?
- ii. What are appropriate indicators for perceived failing nets?
- iii. What is the approximate useful lifespan of nets?
- iv. Is net status (worn out/with many holes) associated with perceived negative effects?

1.6 Significance of the study

Since this study was conducted in local communities of Muleba district which are similar to most places in Tanzania and Africa at large, the following are likely to be its milestones:

- i. It would help policy makers and strategic planners in the health sector to specifically devise robust strategies of controlling malaria in local communities similar to the study area in Tanzania.
- ii. It will help on social marketing especially on behaviour change towards wrong perceptions on malaria preventive measures like mosquito nets.
- iii. Implementing the researcher's recommendations communities will be drawn from risks of malaria, loss of their incomes for seeking treatment on malaria, standard of living and life expectancy is likely to increase.
- iv. This study will be helpful to the researcher for academic purposes to fulfil school requirements to attain master degree at Mzumbe University.

1.7 Scope of the study

The study was conducted in Muleba district, Kagera region, North West Zone of the Lake. Sixteen villages found in high risk areas of malaria were surveyed. Thirteen wards out of 43 wards in the district were included. Therefore, the study finding would be inferred and generalized to the whole district and customized in anticipating future trend

of malaria in the Muleba district and other districts in Tanzania or other parts of the world have same community setting like Muleba.

1.8 Limitation of the study

However minor it would be, but still will be considered a barrier unto attaining research goals to this study. Since it was for academic purposes, time frame for this work was pre-planned in advance and the research and not to his discretion, so had to comply with university schedule which in fact does not respect the type of study and methodologies adopted by the researcher. This limited the length of data collection and choice of study methodologies at large.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

Combining what health policies, procedures and protocols say is of vital importance in any academic research. This part will provide the reader an extended view of the problem in both policy and theory as well as what other recent studies write about the problem; hence theoretical and empirical part of reviews.

2. 2 Theoretical Literature Review

2.2.1 Definition of important terms

- i. **An insecticide-treated net (ITN)** is a mosquito net that repels, disables and/or kills mosquitoes coming into contact with insecticide on the netting material. There are two categories of ITNs: conventionally treated nets and long-lasting insecticidal nets:
 - **A conventionally treated net (CTN)** is a mosquito net that has been treated by dipping in a WHO-recommended insecticide. To ensure its continued insecticidal effect, the net should be re-treated after three washes, or at least once a year (WHO, 2014).
 - **A long-lasting insecticidal net (LLIN)** is a factory-treated mosquito net made with netting material that has insecticide incorporated within or bound around the fibers. The net must retain its effective biological activity without re-treatment for at least 20 WHO standard washes under laboratory conditions and three years of recommended use under field conditions (WHO, 2014).
- ii. **Survivorship** is the proportion of distributed nets still available for use as intended in the households to which they were given after a defined period, e.g. 1, 2, 3 or more years (WHO, 2014).

- iii. **Attrition** (opposite of survivorship) is the proportion of nets no longer in use as intended after a defined period after their distribution to the households. Attrition can be categorized by the main reasons why a net is no longer used, namely decay (e.g. destroyed, so torn and worn out that it is considered useless for protection against mosquitoes), absence (e.g. stolen, given away, moved) or used for other purposes (WHO, 2014).

- iv. **Physical or fabric integrity** reflects the number, location and size of holes in each net. When possible, the assessment can also be categorized by type of hole (burn, tear, seam failure, nibbled or chewed by animals) (WHO, 2014).

- v. **Insecticidal activity (bio-efficacy)** is the degree of knock-down, mortality or inhibition of blood-feeding induced in susceptible mosquitoes, as determined by standard WHO test procedures and criteria (i.e. cone bioassay, tunnel test) Insecticidal activity is associated with the type and content or availability of insecticide. The insecticide content is expressed as g/kg or mg/m² of the LN and is determined by the method outlined in WHO specifications for LLINs (WHO, 2011).

2.2.2 Actual and expected use of ITNs

As usual, it is difficult to find a match between anticipated results and actual outcomes in the expected life of nets. Appropriate uses of ITNs do not actually go hand in hand with the possession of nets. This is a result of insufficient attention upon designing and implementation locally appropriate communication strategies to accompany ITN distribution. The community should be informed in advance of the importance of ITNs, proper ways of hanging and how to use and maintain them properly. Communities are rarely given this information. As a result many people who receive ITNs do not sleep under them; re-sell them to other people; use them for alternative purposes (e.g. as a fish net); reduce their efficacy through inappropriate washing practices (excessive or

aggressive washing, use of harsh detergents-mostly traditional soaps) or dispose them incorrectly when they become damaged or torn (WHO, 2014). Unless these problems are resolved, “catch-up” and “keep-up” strategies will never be a solution in these places.

2.2.3 Social and behavioural aspects on ITNs use

Net ownership, retention and use are highly determined by socio-cultural factors in a particular community. Disparities in community settings draw attention to which strategies to use in addressing ownership, retention and use of ITNs. Specific and targeted local communities’ perceptions of malaria, ITNs/LLINs as well as washing practices, need keen assessment to foster proper choices of communication media where behavioural change messages and advocacy strategies can be promoted. Type of housing (including composition of household), sleeping places per household, and the economic status of the household are chief determinants of sustainability of ITNs in specific communities. In Muleba, houses are roofed with grass, papyrus, banana leaves or, more commonly iron sheets. Most have mud walls. Furthermore, most households are thirty minutes up to two hours away from the nearest water source. This explains why nets are not regularly washed, which in turn makes them too dirty and of poor condition to continue using them; the type of households was in fact facilitate easy worn out/tearing of nets in these household as witnessed during a recent conducted cross-sectional survey when greatest number of nets with many holes where of age less two years.

Apart from not having enough nets or possessing worn out nets, which actually inhibits net use, there is great need of understanding additional determinants of net use and the relationships between them. Moreover, net use among those who own nets is commonly interrupted by temporary, periodic or infrequent conditions, which can inhibit net use even among regular net users. These conditions include travelling, night work, sleeping in the fields during planting or harvest seasons or while tending livestock, attending late night social events, disruption of usual sleeping arrangements, net unavailability due to

washing or dirtiness, extreme fatigue, labour pains, illness or forgetfulness among others.

2.2.4 Determinant of net use

There are several determinants of net use including perception of malaria risk, the proportion of nets hanging in the households, ability to hang nets by household members, net conditions (as distinguished from presence of holes) for instance cleanliness, smell and perceived effectiveness of insecticide, all of which greatly affect peoples' choice to sleep under nets (Graves, et al., 2011). When nets are worn, a large percentage the population is likely to stop using them because of socio-economic hindrances, falling of risk perception and so forth. What specifically inhibits net use despite their presence in households was one reason for doing the study. Even if firm answers are not available clues would help picture potential and strong drives to this case. According to Graves et al., (2011) seasonality in malaria transmission, climatic factors (presence of dry and rainy seasons) may affect net use. This sound like an old version of determinants to net use, for if the risk perception level is high, weather will have no significant effect over the use of nets or other preventive practices. The question remains, 'Why is there less use despite increased net availability?' Net use might be improved through improving net conditions seen to be a barrier for use, otherwise there should be more robust measures to intensively focus on education and promotions of net use in school age children, young adults, men (who are potential influencing factor in the family). Consequently malaria transmission would probably be reduced (Graves, et al., 2011).

2.3 Empirical Literature Review

2.3.1 Longevity of nets in local communities' context

Controversy still persists in determining the issues associated with what is believed to be an expired net no longer suitable for use. More qualitative research to investigate when the household/population consider nets unfit for use and triangulating expectations of the investigations with similar quantitative work is required (Graves, et al., 2011). This therefore provides a wider view into this important community protecting strategy by knowing why damaged and unused nets are kept (being curious in knowing whether there are other important alternative uses of nets outpacing protecting against mosquitoes) which was in turn generate realistic assessment of actual usable net life in line with the household composition thereby improving replacement and distribution plans opposed to predetermined intervals of blanket mass distribution (Graves, et al., 2011; WHO, 2011). Net durability is determined by several interacting factors including socioeconomic status, the house environment and behaviour related to net use, handling and washing factors. Retrospective cross-sectional surveys which are powerful tools used to identify the age of previously distributed nets have been used to study net durability in areas where nets are already distributed; however, prospective study designs can also be applied where follow up is required (WHO, 2011). When measuring elements of net durability, households should be visited and the physical presence of nets recorded, including all nets lost but which were once used, nets no longer useful and nets still in use but excluding nets that have never been used (WHO, 2011). Ignoring holes of less than 0.5 cm, the number of holes should be counted by their location on the net and their size. Size can be classified as smaller than a thumb (0.5–2 cm), larger than a thumb but smaller than a fist (2–10 cm), larger than a fist but smaller than a head (10–25 cm) and larger than a head (> 25 cm) (WHO, 2011; WHO, 2014). A proportionate hole index (pHI) was developed so that the integrity of net structure could be categorized. The rationale behind this index is to have proportionality to the average surface of the hole. Holes were counted during the survey for each net in four categories of size named and smaller than a thumb, larger than a thumb but smaller than a fist,

larger than a fist but smaller than a head, larger than a head corresponding to (0.5-2cm), (2–10cm) (10–25 cm) and (> 25 cm) diameter and weights were 1, 23, 196 and 578 cm² respectively. The holes were are weighted according to the average area of each hole category (WHO, 2011) which corresponded to the areas estimated on the assumption that the hole sizes in each category are equal to the mid-points.

2.3.2 Effectiveness of LLIN over other nets when used every night

A sustained high coverage of LLINs results in the reduction of mosquito densities and thus in the reduction of overall malaria transmission (Pioneer_Project, 2014). Activities increasing coverage and usage of prevention measures are, therefore, guaranteed to have a rapid impact on the malaria burden. The systematic distribution of LLINs along with information on how to hang, use and maintain them properly (care and repair) has been at the core of the WHO guidelines since 2007 (Pioneer_Project, 2014; WHO, 2014). Different from other ITNs, LLINs have a double effect. On one hand, they are working as a physical barrier preventing the mosquitoes from reaching their prey, on the other hand they act as a chemical barrier through the insecticide within that repels the mosquitoes or kills them when they enter into contact with the net (Pioneer_Project, 2014). Moreover, LLINs are significantly distinguished from other insecticide treated nets in that they are made with netting material that has insecticide incorporated within, and bound strongly around, the fibres (Lorenz, 2014; WHO, 2011; WHO, 2014; Pioneer_Project, 2014).

2.4 Research Gap

Based on above reviews, it can be seen that there still a gap to be looked into about when people perceive a net to have failed. In simple way, nets are there though in less proportion that what ought to be, but with that proportion net usage rate has been going down with time. This has not been widely covered in recent research, the only research that tried to answer this combined determinant for net use but did not actually answer what perception people have when they use or not use nets and how do they decide that a net is no longer protecting.

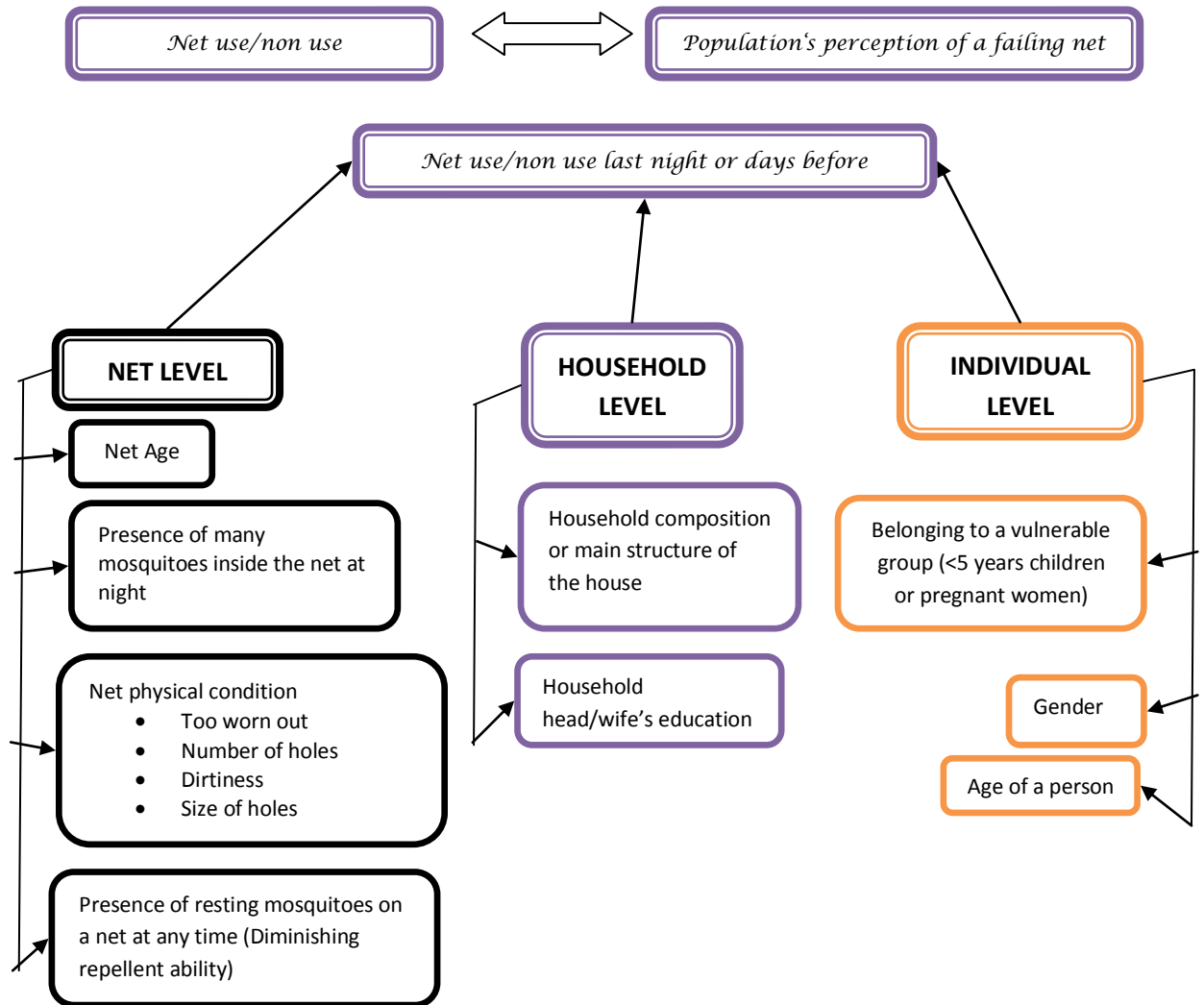
2.5 Conceptual framework

Net failure, before due time, is a function of a couple of interrelating factors. There are net based, household and individual factors that affect user determined end life of nets in most African communities. Most communities in Muleba are rural and only small part is town based (partial town). The study area is completely based in the rural areas where housing condition is poor. At the household level, factors like the composition of the household, call it the main structure of the household, and level of education of the household or if the wife was educated influence net life's perception. Whereas at individual level, factors like age, gender, belonging to a vulnerable group (children <5years or pregnant women) greatly influence failure perception in the population (Graves, et al., 2011; Loll, et al., 2013).

2.5.1 Dependent variables and independent variable

A couple of factors associated with net use, net condition which were identified which in one way or another influence population's perception on use of nets. Factors were operationalized and categorized into three major variables: independent, dependent and confounding variables. The dependent variable was perception of user determined end life of nets while independent variables were: Presence of mosquitoes inside the net at night, Net too old, Net having many holes, Presence of resting mosquitoes on the net (Extent of repellent ability), Household composition/main structure of the house, Age, gender, education, Vulnerability (Pregnant women and <5years). However, net use is directly associated with the population's perception on nets, and risk of malaria. Therefore, people's attitude to malaria risk was assessed and associated with net use.

Figure 2.1 Conceptual Framework



Source: Customized from different sources (Lukole, 2015)

CHAPTER THREE

METHODOLOGY OF THE STUDY

3.1 Introduction

This chapter details the exact path of arriving at specified goal for this work. It gives the reader an understanding of whole methodology the researcher adopted in this study aiming at answering the major aim of the study “**People’s Perception on Mosquito Net Performance**” which further were broken down into four specific objectives.

3.2 Study Design

The study was conducted over 6 months with 1 month of preparation, 2 months of cross-sectional study, a 1 month interval between KAP and cross-sectional study 1 month of KAP study and 1 month of month of report writing. People’s knowledge on malaria, attitude on use of preventive measures and practice on malaria control measures was assessed within a month after the cross-sectional survey to eliminate or reduce possibilities of time bias from when same community is surveyed.

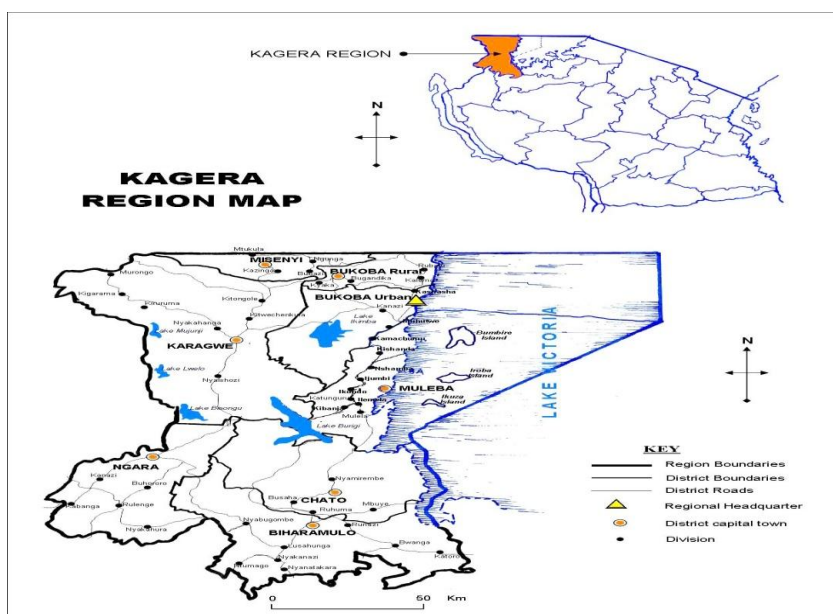
During cluster selection, malaria prevalence (above 10%) and mosquito density was used as a yard stick for assuming whether a cluster may have high net usage or otherwise. The design of the cross-sectional and KAP surveys for this study was based on a recent study in the same area, which obtained information about malaria prevalence and net usage. Twelve clusters were randomly selected, according to information from the local District Health Office 4 were assumed to have high malaria prevalence, 4 with moderate/relative prevalence and 4 with low prevalence. Information on house environment, net condition and net usage was collected. A month later, the same clusters were studied to compare if knowledge, attitude and practice differed significantly between clusters. Swapping of clusters was anticipated to occur during the KAP study depending on the baseline cross-sectional survey. Questions using different scenarios for

the use of preventive measures against malaria were also assessed. Questions used differential semantic scales.

3.3 Study Area

The study was carried out in the district of Muleba (1° 70'S, 31° 60'E), Kagera Region, on the western border of Lake Victoria, Tanzania. Muleba covers an area of 3,550 km². The annual rainfall ranges from 850 mm to 1500 mm (Igabiwo weather station 2006 to 2012) (Canty&Associates, 2014). Muleba has two rainy seasons interrupted by a distinct long dry season (June to August/September) and an unpredictable second dry season in December or January. Altitude in the study area ranges from 1100 to 1600 meters. Housing structure in Muleba is mainly dominated by mud walls, grass roofs, papyrus beds, grass mattresses or reed mats. The type of housing is favourable for rodents and other small animals to live in. There are no private shops selling LLINs in Muleba. Nets are only available in health centres where only pregnant women have access on them. Administratively the district has 43 wards, 161 villages and a population of 540,310 people (2012 population and housing census) with 85,035 (20%) children <5 years old. The district has 45 health facilities comprising 3 hospitals (Rubya, Kagondo and Ndolage).

Figure 3.1 Kagera Regional map with administrative boundaries



The district has been subjected to free LLINs issued through universal coverage, Antenatal Care (ANC) to pregnant women with vouchers from 2005 to 2011 for universal coverage and up to mid 2014 for ANC to pregnant women with vouchers under PMI and Global Fund programs. Catch up campaigns, via school going children, has not been done in Muleba.

As part of the National Malaria Control strategy, net coverage has increased since 2005 through net distribution campaigns initially targeting pregnant women and children under five in 2009 (63% of households provided with nets) and then targeting the entire population in 2011. After the universal coverage campaign distribution ownership increase to 91% and ITN/LLIN usage in all residents had risen to 56%.

Net usage has been decreasing drastically since the past surveys from 55.8% just after the 2011 net distribution campaign to 27.7% now.

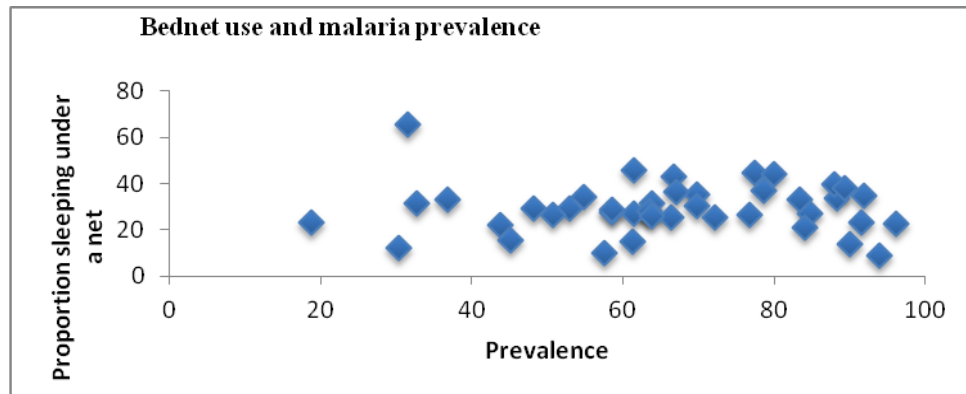
Table 3.1 Insecticide Treated Net (ITN) used between June 2011 and October 2014

Time period	ITN use
Jun-11	55.80%
Feb-12	49.80%
Jun-12	42.40%
Oct-12	36.10%
Oct-14	27.70%

Source: PAMVERC (2014)

Presently, there is no apparent relationship between the proportion of people sleeping under a bed net and malaria prevalence. This is probably because bed net use, with the exception of the one village of Kyamyorwa (an area known for the high density of mosquitoes) is universally low.

Figure 3.2: Bed net use and malaria prevalence in the study area.



Source: PAMVERC (2014)

Although not yet well established, decrease in net use is highly associated with net durability (Graves, Ngondi, Hwang, Getachew, & Gebre, 2011; Baume, Reithinger, & Woldehanna, 2009; WHO, Guidelines for monitoring the durability of long-lasting insecticidal mosquito nets under operational conditions, 2011) which is assessed through net survivorship, fabric integrity and insecticidal activity (bio efficacy) which determine whether people perceive a net to have failed or not. The above components of durability are determined partly by material composition, knitting or weaving pattern, quality of finishing, insecticide type and content, additives, and other factors that cause wear and tear. Sustainability of current nets used in households to which they are given after a defined period of above 3 years is questionable with available housing structures.

Table 3.2: Criteria for cluster selection

Cross-sectional survey		KAP Study	
<i>Criteria: Malaria prevalence</i>	Number of clusters	<i>Criteria: Bed Net Usage</i>	Number of clusters
High malaria Prevalence	4 Clusters	High Bed Net Usage	4 Clusters
Average Malaria Prevalence	4 Clusters	Average Bed Net Usage	4 Clusters
Low Malaria Prevalence	4 Clusters	Low Bed Net Usage	4 Clusters

3.4 Study population

The study population were people above 16 years old who were eligible to be consented and then interviewed. The researcher targeted heads of households or their wives. If in the household visited and only children were available at that time, questionnaire could not be administered. Data were only collected from 16 villages (clusters) from 13 wards in Muleba district.

3.5 Study Outcomes

3.5.1 Primary outcomes

3.5.1.1 Survivorship: Numerator: Total number of each LN product present in surveyed households (and available for sleeping under) x 100 and Denominator: Total number of each LLIN product distributed to surveyed households

3.5.1.2 Attrition: Attrition rate-1 for nets that have been destroyed or disposed of: Numerator: Total number of each LN product reported as lost due to wear and tear (poor condition) in surveyed households x 100. Denominator: Total number of each LN product distributed to surveyed households

3.5.1.3 Fabric integrity: Proportion of LLIN with any holes (with 95% confidence interval): Numerator: Total number of each LLIN with at least one hole of size 1–4. Denominator: Total number of each LLIN found and assessed in surveyed households

Hole index = (A x no. of size-1 holes) + (B x no. of size-2 holes) + (C x no. of size-3 holes) + (D x no. size-4 holes).

3.5.2 Secondary Outcomes

Secondary outcomes to this study were proportions of peoples' Knowledge, Attitude and Practices to different questions subjected to them

3.6 Sampling and Sample Size Estimations

3.6.1 Sampling Techniques

3.6.1.1 Cluster selection and randomization

3.6.1.1 .1 Mapping/Census of study area

During initial visits geo-located 100 hamlets were identified within the district that are accessible and within a travelling time from PAMVERC office in Muleba town of less than 2 hours. Each cluster was comprised of 3 to 4 hamlets (average household in a hamlet in Muleba district is 130) for a total number of houses of 600.

Every building of each hamlet was mapped using a Global Positioning System handled units (GPS) (Garmin Legend e-trex) and ExpertGPS v3.8 (TopoGrafix) software. Boundary of each hamlet, health facilities and other landmark are also geo-located. A short questionnaire including name of the head of the houses, number of people leaving in the house etc were administered during data collection. The census was used to estimate the number of LLIN required to be distributed in each house.

3.6.1.1 .2 Cluster identification

With the maps it becomes possible to identify clusters to use in the cross-sectional prevalence survey. Each cluster comprised of at least one hamlet, because the hamlet is the smallest administrative unit.

Cross sectional surveys and KAP study were conducted in all clusters but the KAP study were based on the outcome of data during the cross-sectional survey only, which is

likely to be less affected by time gap from when the last study on prevalence and net usage was done.

3.6.1.1.3 Cluster selection and randomization

The selection of the clusters for the main study was based on the following criteria determined from the cross-sectional survey:

1. Hamlet leader and population acceptance
2. Within 2 hours drive from Muleba Office
3. Clusters with estimated malaria prevalence over 10% (from baseline cross sectional survey)

Restricted randomization was used to allocate the 12 clusters in 3 criteria (high, medium and low) for both cross-sectional and KAP study. Important variables were balanced between the three criteria (prevalence during baseline, mosquito density, housing density, elevation, net use and ownership). The randomisation method allowed the researcher to limit the difference of these selected variables between the clusters.

3.6.2 Sample Size

The sample size is based on the principles of cluster randomized trials using survivorship rate in the study area the primary outcome. Based on recent surveys in the study area, it was assumed that survivorship rate had a mean of 27% with a coefficient of variation between clusters of 0.3; and that 80% power and 5% significance would be required. Thus, using these parameters for sample size estimation the resulting $n = 676$ households

3.7 Data Types and collection Methods

3.7.1 Data Types

This study employed two types of data, qualitative and quantitative part of data.

3.7.2 Data Collection Methods

Quantitative data were gathered through well administered questionnaires by well trained fieldworkers who using the GPS waypoints were able to reach the house randomly selected from the list of all mapped houses. Qualitative data were gathered through In-depth Interviews with key informants (IDIs), Focus Group Discussions (FGDs) by the aid of Tape Recorder which were transcribed and analysed.

3.8 Data analysis

Since compliance with survivorship, attrition, and fabric integrity calculation may not be fully adhered to, because of the lack of a net distribution database at the district by villages, the study assumed nets available in the studied households (whether still in use or not) to be the denominator instead of the total number of LLIN distributed. The mean (and standard deviation) as well as the median (and inter-quartile range) hole index was determined. Data analysis was done using Stata 11 (Stata-Corporation, USA).

Data analysis was based on methods that made allowance for between-cluster or village variation (intra-cluster correlation) of responses. Data analysis was carried out using measures of associations both at cluster level and individual level. Survivorship, attrition and fabric integrity in studied clusters, relative to other clusters was assumed to have been in the first instance based on cluster summaries not on malaria prevalence. A non-parametric test (Chi-square) was applied to test the strength of variables within and between clusters. Qualitative data was not completely squeezed out, but some of common statements were matched with what were collected in KAP study to make strong evidence on the posed question.

Rate of accumulation of holes, as one of the measure of failure of nets, was calculated in each cluster, and compared between clusters relative to the housing structure/composition from every cluster using negative binomial regression in estimating clustering effect. Logistic regression was used to compare durability rates (survivorship, attrition and fabric integrity) between the study clusters.

3.9 Data Validation

Data validation in qualitative analysis does not have a “gold standard”, when compared to quantitative analysis. The conventional ways to conduct validation are through anecdotalism. This term means the form that qualitative researchers “*convince themselves (and their audience) that their ‘findings’ are genuinely based on critical investigation of all their data and do not depend on a few well-chosen examples*” (Silverman, 2000).

The most common forms of anecdotalism are triangulation and respondent validation. Triangulation compares the results from different methods (e.g. interviews and observations, interviews with members of different groups) and is seen as a way of ensuring comprehensiveness and compensation between methods (assuming that any weakness in one method was compensated by the strengths in another) (Mays and Pope, 2000). In a respondent validation, the investigator’s account is compared with those of the research subjects to establish the level of correspondence between the two sets. Study participants’ reactions to the analyses are then incorporated into the study findings.

3.10 Ethical considerations

Under PAMVERC authority, this study was conducted according to the Declaration of Helsinki and the International Guidelines for Ethical Review of Epidemiological Studies. All procedures for data collection, management, storage and manipulation followed SOPs. Ethical clearance was sought from the Medical Research Coordinating Committee (MRCC) of the National Institute for Medical Research (NIMR), LSHTM and KCMUCo. Final report was also provided to PAMVERC and to Mzumbe University at the end of the study.

Written informed consent (Appendix 2) was sought from the selected communities and households. None of the information registered were sensitive and participant confidentiality were maintained. When data is analysed I ensured complete anonymity

by using a number coding system to create a unique Identification Number for each person. This is an 8-digit determined by a geographical cluster number (2 digits) in combination with a household number (4 digits) and an individual number (2 digits) given to each participant in the household (i.e.78-1114-02).

Prior to any project activities, village and hamlet leaders were invited to sensitisation sessions conducted by PAMVREC and district health officers. The hamlet leaders were involved in all subsequent activities.

3.11 RESEARCH ACTIVITIES

3.11.1 Sensitization

An introductory meeting of the research project and activities at district (District Medical Officer, District Executive Director, District commissioner etc) and regional level was taken place at the beginning of the project.

A presentation of the project to all district counsellors is plan during their regular meeting with the District Commissioner. During this meeting we presented the objective of the research, each research activities (Mapping, Cross sectional surveys, and entomology survey) and intervention activities including information on each of the vector control measure.

To ensure support, lower level meetings also took place at hamlet level with community representatives. Hamlet leaders were involved in each activity (Mapping/census, surveys, entomology monitoring, net distribution, indoor residual spraying etc.) with the project team to ensure adherence of all the population.

CHAPTER 4

DATA PRESENTATION

4.1 Introduction

This chapter presents the findings collected as described in chapter 3 above following specific objectives accordingly. Tables were used to make presentation easier for the reader to figure out the meaning and measures of associations were used to make strong statistical relationships between the variables. All the data in this chapter that are presented in tables were collected via questionnaires with aid of small pocket computers called Personal Data Assistant (PDA) where the questionnaires were installed and field workers navigated through their pages and interviewed people. They are all quantitative scale, ordinal, nominal and ordinal levelled.

4.2 Demographic Characteristics

Table 4.1: Characteristics of study population

	Cross-sectional survey data	KAP Survey data
	n(%)	n(%)
Gender		n=594
Male		195(32.66)
Female		399(67.17)
Age distribution		n=594
≤24		106(17.85)
≥25		488(82.15)
Education of respondent	n=750	n=594
Primary (complete & incomplete)	514(68.5)	384(59.9)
No formal education	208(27.7)	146(20.2)
Secondary (complete & incomplete)	27(3.6)	35(1.5)
Post secondary (diploma, certificate)	1(3.6)	29(0.5)
Household source of income	n=750	n= 594
Craft/Agriculture/Livestock/Forestry/Fisheries	714(94.7)	561(94.4)
Formal employment	13(1.7)	8(1.3)
Trading/Business/Shop	23(3.1)	25(4.2)
Household composition		
Wall structure n=750		
Mud	585(78.0)	
Brick	79(10.5)	
Brick &Mud	63(8.4)	
Cement	8(1.1)	
Grass/banana leaves/thatch	6(0.8)	
Brick & Cement	9(1.2)	
Roof structure n=750		
Metal sheets	559(74.5)	
Grass/banana leaves/papyrus	171(22.8)	
Metal sheets & Grass/Banana leaves/papyrus	20(2.7)	
Floor structure n=750		
Earth/Sand	686(91.5)	
Cement & Earth/Sand	33(4.4)	
Cement	31(4.1)	

Source: Study findings (2015)

Information presented in Table 4.1 was corrected in two different surveys, cross-sectional and KAP survey having an interval of one month. They all represent important demographic information relevant to the study area.

4.3 Study Findings

4.3.1 People's perception of mosquito nets on malaria prevention

Table 4.2: People's attitude on malaria preventive practices

Population's attitude on preventive practices against malaria						
	Agree	Strongly agree	Disagree	Strongly disagree	Neither	Don't know
Variable	n(%)	n(%)	n(%)	n(%)	n(%)	n(%)
The best way to prevent malaria by avoiding mosquito bite n=590	151(25.59)	419(71.02)	10(1.69)	4(0.68)	1(0.17)	5(0.85)
We mainly use bed net to avoid malaria n=593	168(28.33)	404(68.13)	6(1.01)	7(1.18)	6(1.01)	2(0.34)
We mainly use bed nets to avoid other pests n=592	162(27.36)	258(43.58)	111(18.75)	34(5.74)	23(3.89)	4(0.68)
We get good night sleep under a bed net n= 593	134(22.60)	438(73.86)	9(1.52)	8(1.35)	2(0.34)	2(0.34)
Sleeping under a torn net is similar with sleeping without net at all n=587	71(12.10)	123(20.95)	187(31.86)	199(33.90)	3(0.51)	4(0.68)

Source: Study findings (2015)

Table 4.2 above shows respondents' attitude on preventive practices commonly used in Muleba against malaria. It was observed that there was high understanding of mosquito bed nets as one of the protective means, and actually people like bed nets for getting comfortable night sleep, avoiding nuisance pests, avoid malaria and will always use nets regardless of their physical condition unless they are not available.

4.3.2: Appropriate indicators for perceived failing of nets

Table 4.3: People's attitudes on when they decide that a bed net is failing or has failed and different measures upon failed nets

Population's attitude on when do they decide that a net has failed				
When do you decide that a net has failed	Decisions on a failed net			
	Discard	Mend/Sew	Reuse for alternative purposes	
	n(%)	n(%)	n(%)	
	155(41.7)	119(32)	78(21)	
When has too many holes (n= 420)	<i>Number of holes before a net is discard</i>			
	10+Hole	5-9Holes	2-3Holes	1Holes
	170(60.5)	59(21)	42(15)	2(0.7)
When is too old (n =85)	<i>Number of years before a net is discard</i>			
	4Years	3Years	2Years	1Years
	41(54.7)	15(20)	6(8)	4(5.3)
When there are many mosquitoes inside at night (n=44)	15(39.4)	12(31.6)	11(28.9)	
Is too dirty (n=13)	5(62.5)	1(12.5)	2(25)	

Source: Study findings (2015)

A Chi-square test for independence indicated that there is strong association between the number of holes, age of a net and the decision of when it's no longer performing and when to discard the net; $p=0.001$, $p= <0.000$ respectively.

There was no significant difference between when the population discarded a net or perceived a net to be no longer helpful and the net being too dirty and having many mosquitoes inside the bed net an night, $p=0.083$ and $p=0.221$ respectively.

4.3.3: Approximate useful lifespan of nets

Table 4.4: Association between age of net and whether a net has hole, is hung or frequency of wash

Variable	Net hang (n=658)		Net holes (n=745)		Frequency of wash (n=681)		
	Yes	No	Yes	No	Once	2-3 times	≥4 times
Net age	n(%)	n(%)	n(%)	n(%)	n(%)	n(%)	n(%)
1 year	39(79.6)	10(20.4)	30(60.0)	17(34.0)	14(13)	16(6.1)	10(3.4)
2 years	85(66.9)	42(33.1)	87(58.0)	41(27.3)	33(30.6)	44(16.7)	38(13)
3 years	139(64.9)	75(35.1)	161(65.5)	40(16.3)	28(26)	82(31.1)	101(34.6)
4 years	102(48.6)	108(51.4)	170(74.2)	25(10.9)	23(21.3)	97(36.7)	82(28.1)
≥5 years	29(50.0)	29(50.0)	46(65.7)	3(4.3)	10(9.2)	25(9.4)	61(20.9)

Association between net hole and net months, P-value=0.000

Association between net months and frequency of net wash, P-value=0.293

Association between net hole and frequency of wash, P-value=0.000

Source: Study findings (2015)

A decision on whether a net should be hung up or not depends on different aspects, but as per study findings net age, number of holes in it and the extent of dirtiness influenced net to be hung. Number of holes in an individual net increased with net age, making old nets less desirable for use. This reveals that people will decline washing nets as they get old in fear of easy wearing and hence letting them become extremely dirty which in turn hinders comfortable use.

4.3.4: Net status is associated with perceived negative health effects among community members

Therefore, hole index was calculated as follows:

$$\begin{aligned} \text{Hole index} = & (A \times \text{no. of size} - 1 \text{ holes}) + (B \times \text{no. of size} - 2 \text{ holes}) \\ & + (C \times \text{no. of size} - 3 \text{ holes}) + (D \times \text{no. size} - 4 \text{ holes}) \end{aligned}$$

Table 4.5: Proportion of the elements of net durability and status they indicate

Elements of net durability				
Elements	Numerator	Denominator	%	
1: Survivorship	558	966	57.76	
2: Attrition : Rate1	356	966	36.85	
3: Fabric Integrity	LLIN with Holes	329	547	60.15
	Hole Index (HI)		LLIN	Not LLIN
		Sample size	n= 544	15
		Hole Index (HI)	3382.74	4325.73
		Std. Dev of HI	3310.58	3653.15
		Median HI	2551.5	3596
		IQR of HI	2594.47	3615.56
Net status based on HI	HI Interval	n(%)	Effectiveness	
Good condition	≤24	39(7.2)	Effective	
Fair Condition	25-174	38(7.0)		
Mediocre condition	175-299	17(3.1)	Ineffective	
Poor condition	≥300	450(82.7)		

Source: Study findings (2015)

Chi-Square test for independence showed there was no significant difference between two different nets (LLIN and Not LLIN), $p=0.861$ but indicated a significant difference between elements of net durability, thus the function of age in nets is highly significant, $p < 0.004$, $p < 0.000$ and $p < 0.000$ for survivorship, attrition and fabric integrity (LLIN with holes) respectively.

When comparing the Hole Index (HI) to only LLINs with age of net, there were strong association between the two variables, $p < 0.001$. However, there was marginal evidence between the HI and structure of households surveyed, $p < 0.005$.

CHAPTER FIVE

DISCUSSION OF THE FINDINGS

5.1 Introduction

“LLINs are not something you can throw off the back of a lorry like food or blankets and expect people to use properly” (Graves, Ngondi, Hwang, Getachew, & Gebre, 2011). However simple the technology is, LLIN needs intensive knowledge among communities which have not used nets before or highly persuasive mode of communication to keep communities using them. Prior to use of bed nets, communities need to know about mosquitoes and much more malaria aspects, understand other benefits besides malaria protection; hanging, care and repair habits and many others depending on community setting are corner stone to net use. Community success regarding malaria and its prevention largely depends on the knowledge and practice regarding malaria control measures (Ahmadi, et al., 2012). This study investigated in particular knowledge, attitude and practice of net use in an endeavour to understand their perception on when do they think a net is not protective any more.

5.2 Study Findings

5.2.1 People’s perception of mosquito nets on malaria prevention

The people’s understanding on how malaria is transmitted, avoided and risks associated with it was high. However, this experience was limited as in such a way that few people couldn’t perceive mosquito nets with many holes to have some protection against malaria. According to study findings, a net is a most common means of avoiding measure mosquito bites and therefore protecting against malaria. In terms of performance, a failure net was determined using age it has been used, number and size of holes, and number of times it was washed. This shows inadequate care and repair habits among net owners.

5.2.2 Appropriate indicators for perceived failing of nets

Apparently, there is no universally accepted definition of the end of neither life of a net nor guidelines for determining the appropriate end of net life based on net age. However, net users should have this in mind so that to allow them make own anticipation of how long their nets would be useful through devising suitable net care and repair Loll, et al., (2013) which might prolong net life before next net replacement if would be. As for this study, it is vivid that net life can be determined or anticipated and communicated to users but with these reservations: community setting (urban or rural), housing composition and so forth. The standard LLIN is designed to tolerate different field conditions to last more than 3 years and can be subjected to more than 20 standard washes (WHO, 2011; WHO, 2014). Finding in Table 4.4 and Table 4.5 show that majority of effective nets are of 3 years age or less and of 3 or less wash frequencies. This might in one hand concur with Loll, et al., (2013) who suggested among practices to extend net life is to lessen washing frequency, believing that the more a net is washed the faster it expires. In the other hand it might contradict with Loll, et al., (2013) as the more you reduce washing times the more the net becomes dirty in traditional housing. Table 4.4 shows nets are considered to failed when are too dirty, thus when left unwashed in a fair of expire will be subjected to early.

5.2.3 Approximate useful lifespan of nets

Basically, the above paragraph clearly describes how long a net is expected to last. As WHO (2014) recommends that even if a bed net has many holes it will still have some protection against mosquitoes compared to sleeping without net at all. This also concurs to what majority of respondents said that they will use their nrtts regardless of what physical condition it has. However, a conflicting notion chips in as a major reason that deprived people to sleep under bed nets was that nets had many holes. This is a contravening idea. Compromising between these two strong ideas, one might come with this fact that the population which still slept in nets of poor conditions were in high malaria prevalence area because they had no alternative means of avoiding mosquitoes.

There are standard washing procedures (WHO, 2014). These are washing without hard detergent, and not exposing the net to direct Ultra-Violet Rays (UVR) since these rays affect their insecticidal efficacy. Whereas, Loll, et al., (2013) found that among the reasons that will make a net quickly expire is washing times. This doesn't pinpoint which washing behaviours will exhaust the net. It is true that a net with insecticide provides greater protection against mosquitoes, but even a net without holes also will. The WHO and Loll concentrated on insecticidal ability and partly or not on durability. In these local communities, durability is of great significance to talk about.

5.2.4 Net status is association with perceived negative health effects among community members

In Tanzania, net replacement interval is yet to be determined as always changes according to funders preferences, or intensity of malaria cases. While communities are varied in different aspects including SES, their behaviors on net use will similarly vary. Nets may last longer in one community, may not in other community. The average time a net suppose to last when used as recommended is between 3-5 years. This is the life of net. A good net to use has to have at most 174 mean HI (Table 4.5), which in fact should have few holes of size one and size two only. However, most nets investigated to measure hole size (Table 4.4) were less or equal to 3 years old and has holes, that is these nets irrespective that many of them were still used but were relatively ineffective to protect a person inside against malaria. The average time nets should last in these communities should at most be 3 years, and another net campaign must occur or other replacement strategies need to be put into consideration so that the community should not be left unprotected. No doubt should be put on this major protective measure against mosquitoes transmitting malaria, because the majority of respondents perceived nets to be the main way of preventing against mosquitoes and malaria (Table 4.2).

Linking results in Table 4.2 through Table 4.5 it is clear that people are willing to use bed nets in whichever condition since the survivorship rate as previously defined is

above 50% Table 4.5) but not all will abide on this situation as attrition rate is above 30% (Table 4.5). This implies that, intensive education programmes need to be implemented especially on net care and repair because the majority of respondents said will always discard their nets when they become too old or have many holes (Table 4.3). Since some of respondents would mend/sew their nets when they become worn out, this behaviour should be promoted and persuaded even to the whole population and transition will be easier if we have peers on this particular habit.

CHAPTER SIX

SUMMARY, CONCLUSIONS AND POLICY IMPLICATIONS

6.1 Introduction

No single bullet policy on malaria control strategies especially on mosquito nets will combat this deadly disease in local communities where SES is varied and low. Together with the already stipulated policies and strategies to fight against malaria in Tanzania, more robust and community-setting specific strategies should be devised and keenly communicated and implemented to net users according to their differences.

6.2 Summary

A net is the only preventive measure against malaria in Muleba that lasts longer than a few months, but if, and only if, cared for accordingly. This study identified that the net being old, having many holes, being dirty (lets assume it might be because of fear to wash it frequently so that its insecticide cannot expire and not because of lack of soap and water). People understand malaria and know it as a killing disease. People preferred mosquito nets to other preventive measures. People need education on behaviour change so as to built net repair and care habits in them, taught the standard ways of washing a net, standard ways of hanging and tucking in the bed net.

6.3 Conclusion

Studies on nets are common but varied and diverse in procedures and strategies used to study their characteirstics and status. No study will explore every feature related to nets. The integration of different writings will in the end make a complete sense specific for nets. Since this study tested KAP with other elements on net durability, it did not capture every feature of net durability in their broadness because it did not have follow up phase and considered nets were distributed at one time since getting specific and reliable dates nets were distributed in the district was not possible.

6.4 Policy implication

There are several angles where nets could be made available and be promoted and from them a step might be made to combine whole community have access on insecticide impregnated nets. Introducing private shops or using existing ones and supply nets at a subsidized price to enable availabilities at any time than waiting for free national campaigns which always come when it is too late. Pro-poor exemption policies should also be put in places and identify both vulnerable groups and unable to pay for a net even at the subsidized prices, and let all abled groups purchase nets. This will first reduce the burden to the governments and donors and ensure equity in net accessibility.

6.5 Recommendations

The researcher recommendation are based on the following grounds: the protocols and guidelines suggest at least 3 years of net life but field situations do not. Suggest 20 WHO standard washes. Suggest daily use of nets will strengthen protection. However, the communities mostly affected with malaria are characterized with poor housing which will easily tear the net before recommended time. These communities should always be treated differently.

6.6 Area for further research

There still a lot to study in order to have complete idea on people's perception on net performance. Net durability elements need to be assessed closely since the net distribution campaign starting till the wearing out of nets. More so, need qualitative part of data, although the research collected but did not analyse them intensively to provide a wider picture on perception.

REFERENCES

- Ahmadi, S., Vatandoost H, S., Raeisi A, A., Eshraghian MR, A., Madani AH, S., & Jamshidi M, A. (2012). *Effects of educational intervention on long-lasting insecticidal nets use in a malarious area, southeast Iran*. Tehran University of Medical Sciences.
- Baume, C. A., Reithinger, R., & Woldehanna, S. (2009). *Factors associated with use and non-use of mosquito nets owned in Oromia and Amhara Regional States, Ethiopia*. Malaria Journal: BioMed Central.
- Canty&Associates. (2014). *Weatherbase: Bukoba, Tanzania [database]*. Retrieved 2014 йил 11-March from <http://www.weatherbase.com/weather/weather.php3?s=92736&cityname>
- Graves, P. M., Ngondi, J. M., Hwang, J., Getachew, A., & Gebre, T. (2011). *Factors associated with mosquito net use by individuals in households owning nets in Ethiopia*. Malaria Journal.
- Loll, D. K., Berthe, S., Faye, S. L., Wone, I., Koenker, H., Arnold, B., et al. (2013). *User-determined end of net life in Senegal: a qualitative assessment of decision-making related to the retirement of expired nets*. Malaria Journal: BioMed Central.
- Lorenz, L. M. (2014). *ABCDR (Attrition. Bioefficacy. Chemical Residue. Damage. Resistance Insecticide)Retrospective Results*. Bagamoyo, Tanzania: GLOBVAC Donor meeting.
- PAMVERC. (2014). *Evaluation of a novel long lasting insecticidal net and indoor residual spray product, separately and together, against malaria transmitted by pyrethroid resistant mosquitoes*. Tanzania.
- Pioneer_Project. (2014). *Long Lasting Insecticidal Nets*. Uganda: Pioneer.
- WHO. (2011). *Guidelines for monitoring the durability of long-lasting insecticidal mosquito nets under operational conditions*.

WHO. (2014). *WHO Global Malaria Programme: Position Statement on ITNs.*

WHO. (2014). *WHO recommendations on the sound management of old long-lasting insecticidal nets.*

APPENDIXES

Appendix 1: Questionnaire

BEHAVIORAL COMPONENT PROTOCOL		
MALARIA PREVENTION TRIAL MULEBA		
KNOWLEDGE, ATTITUDES AND PRACTICES SURVEY		
Interview Information		
Date (dd/mm/yy)		Interviewer Initials
Household Number (Address)		Hamlet Code
Ward Name		
Village Name		
Hamlet Name		
Cluster		
Total No. Of Visits		Result*
*Result Codes	1. Consent Given	2. Dwelling not found
4. Dwelling vacant for survey duration	5. Ineligible (no children under 15)	6. Refused
Comments		
Socio-Demographic Characteristics		
Question	Categories	
Name of Head of Household		
Participant Full Name		
Age	_ _ (Years)	
Sex	Male	1
	Female	2
Education	No formal schooling	1
	Incomplete primary school	2
	Complete primary school (P7)	3
	Incomplete secondary school	4
	Complete secondary school (F4)	5
	Post-secondary (i.e. certificate, diploma)	6
	Degree and above	7
Source of Household Income	Formal employment	1
	Casual or wage labor	2
	Support from friends/family	3
	Agriculture, livestock, forestry, fisheries	4
	Craft/creative worker	5
	Trading, commerce, selling	6
	Transportation industry	7
What is your relationship to the head of the household?	I am the head of the household	1
	Wife/husband/partner	2
	Son/daughter	3
	Grandchild	4
	Parent	5
	Brother/Sister	6
	Other relative	7
	Note related	8
	I don't know	9

Household Information			
No	Question	Categories	
	Does anyone in your household earn a salary/income?	Yes	1
		No	0
	If yes, what is their approximate monthly salary?	1,000-30,000 T sh	1
		31,000-50,000 T sh	2
		51,000-100,000 T sh	3
		Over 100,000 T sh	4
		Refuses to Answer	5
		I don't know	6
Knowledge of Malaria			
No	Question	Categories	
	Have you ever heard of Malaria?	Yes	1
		No	2
		I don't know	3
	Have you had malaria in the past six months?	Yes	1
		No	2
		I don't know	3
	Which vector can transmit malaria to humans? <i>Interviewer: Allow multiple answers</i> <i>through insects and other animals, what insect or animal transmits malaria to</i>	Dog	1
		Cockroach	2
		Mosquito	3
		Rat	4
		Fly	5
		I don't know	6
	Malaria can be transmitted to humans by? <i>Interviewer: Allow multiple answers</i> You can use the following prompt: "How can you contract malaria?"	with a malaria patient	1
		Eating contaminated food	2
		water	3
		with malaria	4
		I don't know	5
	What are the most common signs and symptoms of malaria? <i>Interviewer: Allow multiple answers</i>		1
		Chills	
		Loss of energy	2
		Fever/high temperature	3
		Vomiting	4
		Headache	5
		Sweating	6
		Dizziness	7
		Loss of appetite	8
		Body aches/pains	9
		Itching	10
		I don't know	11
		Other	12
	Specify:		
	What are the ways to prevent malaria? <i>Interviewer: Allow multiple answers</i>	Making fire/smoke	1
		clothes	2
		Sleeping in bed nets	3
		Spraying insecticide	4
		the house	5
		the house	6
		I don't know	7
	When do mosquitoes bite? <i>Interviewer: Allow multiple answers</i> You can use the following prompt: "What time of day?"	At night	1
		During the day	2
		At night and daytime	3
		I don't know	4

	What personal protection measures will protect you against malaria?	Repellants	1
	<i>Interviewer: Allow multiple answers</i>	Mosquito nets	2
		Gauze wire in windows	3
		Closing windows and doors	4
		Burn cow dung/leaves	5
		Mosquito coils	6
		I don't know	7
	Do you think malaria is a serious and life-threatening disease?	Yes	1
		No	2
		I don't know	3
	If not treated, can malaria lead to death?	Yes	1
		No	2
		I don't know	3
	Do you think malaria can be prevented?	Yes	1
		No	2
		I don't know	3
Sources of Information about Malaria			
No	Question	Categories	
	Have you ever heard or received information about Malaria?	Yes	1
		No	2
		I don't know	3
	If yes, from which source(s)?	Family member	1
	<i>Interviewer: Allow multiple answers</i>	Friend/neighbour	2
		School	3
		Church	4
		Village Health Team	5
		Health Facility	6
		Hamlet Leader	7
		Community Health Worker	8
		Drug Shop/Drug Salesperson	9
		Posters/pamphlets	10
		Television	11
		Radio	12
		Newspapers	13
		Other	14
		Specify:	

What source of information do you trust the most?	Family member	1
	Friend/neighbour	2
	School	3
	Church	4
	Village Health Team	5
	Health facility	6
	Hamlet Leader	7
	Community Health Worker	8
	Drug Shop/Drug Salesperson	9
	Posters/pamphlets	10
	Television	11
	Radio	12
	Newspapers	13
	Other	14
Specify:		
Do you think you have enough information about malaria?	Yes	1
	No	2
	I don't know	3
If no, what information would you like to get about malaria? <i>Interviewer: Allow multiple answers</i>	Information on prevention	1
	Information on treatment	2
	Information on control	3
	symptoms	4
	Any information	5
	I don't know	6
	Other	7
Specify:		
How would you like this information communicated? <i>Interviewer: Allow multiple answers</i>	Family member	1
	Friend/neighbour	2
	School	3
	Church	4
	Village Health Team	5
	Health Facility	6
	Hamlet Leader	7
	Community Health Worker	8
	Drug Shop/Drug Salesperson	9
	Posters/pamphlets	10
	Television	11
	Radio	12
	Newspapers	13
	Other	14
Specify:		

Attitudes			
No	Question	Categories	
	The best way to prevent malaria is by avoiding mosquito bites?	Strongly Disagree	1
		Disagree	2
		Neither	3
		Agree	4
		Strongly Agree	5
		I don't know	98
	I mainly use a bed net to avoid malaria	Strongly Disagree	1
		Disagree	2
		Neither	3
		Agree	4
		Strongly Agree	5
		I don't know	98
	I mainly use a bed net to avoid pests that can bite me while I sleep	Strongly Disagree	1
		Disagree	2
		Neither	3
		Agree	4
		Strongly Agree	5
		I don't know	98
	It is easier to get a good night's sleep when you sleep under a bed net	Strongly Disagree	1
		Disagree	2
		Neither	3
		Agree	4
		Strongly Agree	5
		I don't know	98
	net at all	Strongly Disagree	1
		Disagree	2
		Neither	3
		Agree	4
		Strongly Agree	5
		I don't know	98

Personal Agency (Self-Efficacy)			
No	Question	Categories	
	I can easily protect myself from getting malaria	Strongly Disagree	1
		Disagree	2
		Neither	3
		Agree	4
		Strongly Agree	5
		I don't know	98
	I can easily protect my children from getting malaria	Strongly Disagree	1
		Disagree	2
		Neither	3
		Agree	4
		Strongly Agree	5
		I don't know	98
	I have been able to obtain enough bet nets to cover all of the sleeping spaces in my household	Strongly Disagree	1
		Disagree	2
		Neither	3
		Agree	4
		Strongly Agree	5
		I don't know	98
	I sleep under a bet net for the entire night when there are a lot of mosquitoes	Strongly Disagree	1
		Disagree	2
		Neither	3
		Agree	4
		Strongly Agree	5
		I don't know	98
	I sleep under a bed net for the entire night when there are few mosquitoes	Strongly Disagree	1
		Disagree	2
		Neither	3
		Agree	4
		Strongly Agree	5
		I don't know	98
	I am able to properly hang a bed net	Strongly Disagree	1
		Disagree	2
		Neither	3
		Agree	4
		Strongly Agree	5
		I don't know	98

Perceived Norms			
No	Question	Categories	
	In the past year, how often have you discussed malaria with your friends?	Frequently	1
		Sometimes	2
		Don't know	3
		Not very often	4
		Never	5
	Which topics have you discussed with your friends in the past year? <i>Interviewer: Allow multiple answers</i> <i>Do not prompt answers</i>	Risk of malaria	1
		Bet nets	2
		Indoor spraying	3
		Treatment	4
		Other	5
		Specify:	
	In how many households in your community do people sleep under a bed net?	All households	1
		Most households	2
		Don't know	3
		Some households	4
		Hardly any households	5
Preventive Practices			
No	Question	Categories	
	How often do you sleep under a bed net? If Always: Skip next question	Always	1
		Sometimes	2
		Never	3
	Why do you <i>sometimes or never not</i> sleep under a bed net?	Not enough nets	1
		Net too dirty	2
		Afraid of fire	3
		Net not hung	4
		No mosquitoes now	5
		Too hot	6
		condition	7
		Too cold	8
		Net bad for my/child health	9
		Feel afraid	10
		House sprayed	11
		Children cries	12
		Other	13
		I don't know	14
	Specify:		

	How often do children in the household sleep under a bed net?	Always	1
	If Always: Skip next question	Sometimes	2
		Never	3
	Why do the children sometimes or <i>never</i> sleep under a bed net?	Not enough nets	1
		Net too dirty	2
		Afraid of fire	3
		Net not hung	4
		No mosquitoes now	5
		Too hot	6
		condition	7
		Too cold	8
		Net bad for my/child health	9
		Feel afraid	10
		House sprayed	11
		Children cries	12
		Other	13
		I don't know	14
		Specify:	
	How many bed nets do you currently have in your household?	[__][__] bed nets	
	If you don't know, write 98.		
	<i>Net #1:</i>	Yes	1
	Does the net properly fit the intended bed?	No	2
		I don't know	3
	<i>Net #2:</i>	Yes	1
	Does the net properly fit the intended bed?	No	2
		I don't know	3
	<i>Net #3:</i>	Yes	1
	Does the net properly fit the intended bed?	No	2
		I don't know	3
	<i>Net #1:</i>	[__][__] months	
	How many months ago was the net obtained?		
	<i>Enter 00 for months if less than one month</i>		
	<i>Net #2:</i>	[__][__] months	
	How many months ago was the net obtained?		
	<i>Enter 00 for months if less than one month</i>		
	<i>Net #3:</i>	[__][__] months	
	How many months ago was the net obtained?		
	<i>Enter 00 for months if less than one month</i>		

<i>Net #1:</i>	Yes	1
Is the net a LLIN?	No	2
	I don't know	3
<i>Net #2:</i>	Yes	1
Is the net a LLIN?	No	2
	I don't know	3
<i>Net #3:</i>	Yes	1
Is the net a LLIN?	No	2
	I don't know	3
<i>Net #1:</i>	Yes	1
kill or repel mosquitoes?	No	2
	I don't know	3
<i>Net #2:</i>	Yes	1
kill or repel mosquitoes?	No	2
	I don't know	3
<i>Net #3:</i>	Yes	1
kill or repel mosquitoes?	No	2
	I don't know	3
<i>Net #1:</i>	Yes	1
Since you got the net, was it ever soaked or dipped in a chemical to kill or repel mosquitoes?	No	2
	I don't know	3
<i>Net #2:</i>	Yes	1
Since you got the net, was it ever soaked or dipped in a chemical to kill or repel mosquitoes?	No	2
	I don't know	3
<i>Net #3:</i>	Yes	1
Since you got the net, was it ever soaked or dipped in a chemical to kill or repel mosquitoes?	No	2
	I don't know	3
<i>Net #1:</i>	than one year	
If yes, how long ago was it dipped or soaked?	More than one year	13
	I don't remember	14
<i>Net #2:</i>	than one year	
If yes, how long ago was it dipped or soaked?	More than one year	13
	I don't remember	14
<i>Net #3:</i>	than one year	
If yes, how long ago was it dipped or soaked?	More than one year	13
	I don't remember	14

<i>Net #1:</i>	Campaign in April 2011	1
Where was the net acquired?	2010	2
	with voucher when	3
	or NGO	4
	Purchased full priced	5
	friend/family	6
	Other	7
	Specify:	
<i>Net #2:</i>	Campaign in April 2011	1
Where was the net acquired?	2010	2
	with voucher when	3
	or NGO	4
	Purchased full priced	5
	friend/family	6
	Other	7
	Specify:	
<i>Net #3:</i>	Campaign in April 2011	1
Where was the net acquired?	2010	2
	with voucher when	3
	or NGO	4
	Purchased full priced	5
	friend/family	6
	Other	7
	Specify:	
<i>Net #1:</i>	Yes	1
Has the net ever been washed?	No	2
	I don't know	3
<i>If yes:</i> How frequently has the net been washed?	Once	1
	Two or three times	2
	More than three times	3
<i>Net #2:</i>	Yes	1
Has the net ever been washed?	No	2
	I don't know	3
<i>If yes:</i> How frequently has the net been washed?	Once	1
	Two or three times	2
	More than three times	3
<i>Net #3:</i>	Yes	1
Has the net ever been washed?	No	2
	I don't know	3
<i>If yes:</i> How frequently has the net been washed?	Once	1
	Two or three times	2
	More than three times	3

	<i>Net #1:</i>	Yes	1
	Does the net have any holes?	No	2
		Not applicable	3
	<i>Net #2:</i>	Yes	1
	Does the net have any holes?	No	2
		Not applicable	3
	<i>Net #3:</i>	Yes	1
	Does the net have any holes?	No	2
		Not applicable	3
	<i>Net #1:</i>	[__][__] holes	
	Number of holes size 1 (Not larger than a finger)		
	>> If too many to count (more than 19) enter 20		
	<i>Net #1:</i>	[__][__] holes	
	Number of holes size 2 (Larger than finger but not larger than hand width)		
	>> If too many to count (more than 19) enter 20		
	<i>Net #1:</i>	[__][__] holes	
	Number of holes size 3 (Larger than hand width but smaller than head)		
	>> If too many to count (more than 19) enter 20		
	<i>Net #1:</i>	[__][__] holes	
	Number of holes size 4 (Larger than head)		
	>> If too many to count (more than 19) enter 20		
	<i>Net #2:</i>	[__][__] holes	
	Number of holes size 1 (Not larger than a finger)		
	>> If too many to count (more than 19) enter 20		
	<i>Net #2:</i>	[__][__] holes	
	Number of holes size 2 (Larger than finger but not larger than hand width)		
	>> If too many to count (more than 19) enter 20		
	<i>Net #2:</i>	[__][__] holes	
	Number of holes size 3 (Larger than hand width but smaller than head)		
	>> If too many to count (more than 19) enter 20		
	<i>Net #2:</i>	[__][__] holes	
	Number of holes size 4 (Larger than head)		
	>> If too many to count (more than 19) enter 20		
	<i>Net #3:</i>	[__][__] holes	
	Number of holes size 1 (Not larger than a finger)		
	>> If too many to count (more than 19) enter 20		
	<i>Net #3:</i>	[__][__] holes	
	Number of holes size 2 (Larger than finger but not larger than hand width)		
	>> If too many to count (more than 19) enter 20		
	<i>Net #3:</i>	[__][__] holes	
	Number of holes size 3 (Larger than hand width but smaller than head)		
	>> If too many to count (more than 19) enter 20		
	<i>Net #3:</i>	[__][__] holes	
	Number of holes size 4 (Larger than head)		
	>> If too many to count (more than 19) enter 20		
	Has a community health worker or member of the Village Health Team ever helped hang a mosquito net in your household?	Yes	1
		No	2
		I don't know	3

	I rely on the government to provide, treat and retreat bed nets	Yes	1
		No	2
	How do you decide when a bed net is failing?	holes	1
		inside the bed net at night	2
		The bed net is dirty	3
		The bed net is too old	5
		I don't know	5
		Other	6
		Specify:	
	<i>If answer is: (1) the bed net has too many holes</i>	1 hole	1
	How many holes before you discard the bed net?	2-3 holes	2
		5-9 holes	3
		10+ holes	4
		I don't know	5
		Other	6
		Specify:	
	<i>If answer is: (3) The bed net is too old</i>	Less than one year	1
	How long before you discard the bed net?	1 year	2
		2 years	3
		3 years	4
		More than 3 years	5
		I don't know	6
		Other	7
		Specify:	
	What do you do when a bed net has failed?	Mend it (sew it) and reuse	1
		Discard the bed net	2
		alternative purpose	3
		Other	4
		Specify:	
	<i>If answer is: (3) Reuse the bed net for an alternative purpose</i>	Fishing	1
	What alternative purpose(s) do you use a failed bed net for?	Collecting flying ants	2
		Enclosing poultry	3
		Cover eves	4
		Curtains	5
		Cover holes in wall(s)	6
		bed	7
		Other	8
		Specify:	
	How many failed bed nets are there in the household?	0 failed bed nets	1
		1 failed bed net	2
		2 failed bed nets	3
		3 failed bed nets	4
		More than 3 failed bed nets	5

Appendix: 2

Consent Forms

MALARIA KNOWLEDGE, ATTITUDES, AND PRACTICES (KAP) SURVEY INFORMED CONSENT AGREEMENT

Introduction

Good morning. My name is _____. I work with PAMVERC Malaria Prevention Trial Muleba. We work together with the Muleba District Health office, the National Institute for Medical Research, the Kilimanjaro Christian Medical College, London School of Hygiene and Tropical Medicine. I am here to ask you some additional questions to learn about knowledge of malaria prevention and treatment in Muleba. To do this, we are gathering information by visiting a number of households in your community.

Purpose of the survey

To better understand malaria in your community, we would like to ask you some general questions about your household, bed-net possession and use, whether your house has been sprayed to control malaria, and the understanding of malaria illness, prevention, and when to seek treatment in your community. Also we want to find out risk factors for malaria infection in your community. Your responses to our questions and the results of our studies will help us learn how best to further improve malaria control in your community and in the country.

Procedures

If you agree to take part, we will ask you a number of questions about your household, bed-net possession and use, whether your house has been sprayed to control malaria, and the understanding of malaria illness, prevention, and when to seek treatment in your community. We will also ask specific questions about all of the bed-nets currently in your household, those in use and those not being used. We will look at the bed-nets and measure any holes that may be present.

Voluntariness and confidentiality

It is entirely your choice to take part in or not take part in this survey as I have just described it. If you do agree to take part, your individual answers to all questions will be kept private and not revealed to anyone. If you agree to take part, you can also decide not to answer any of the questions that you do not want to.

Thank you very much for your time. Would you like to take part in this survey?



PROJECT COPY – Household
Cluster Number: _____ Household Number: _____
MALARIA KNOWLEDGE, ATTITUDES AND PRACTICES (KAP) SURVEY
INFORMED CONSENT AGREEMENT FOR PARTICIPANT IN THE TRIAL

THE PURPOSE OF THIS RESEARCH

To better understand malaria in your community, we would like to ask you some general questions about your household, bed-net possession and use, whether your house has been sprayed to control malaria, and the understanding of malaria illness, prevention, and when to seek treatment in your community. Also we want to find out risk factors for malaria infection in your community. Your responses to our questions and the results of our studies will help us learn how best to further improve malaria control in your community and in the country.

CONSENT

The study has been explained to me, I have been given the opportunity to ask questions concerning this study. Any such questions have been answered to my full satisfaction. I understand participation is voluntary and I may revoke this consent at any time without penalty or loss of benefits, if any.

I agree to take part.

SIGNED/THUMBPRINT.....

NAME.....

RELATIONSHIP TO THE HEAD OF THE HOUSEHOLD.....

NAME OF THE PERSON WHO ADMINISTERED THE FORM.....

SIGNED (FIELDWORKER): **DATE**

If you have any questions or clarification pertaining to this survey please feel free to ask the field workers or you may contact Mr Eliud Lukole



HOUSEHOLD COPY – Household and child
MALARIA KNOWLEDGE, ATTITUDES AND PRACTICES (KAP) SURVEY
INFORMED CONSENT AGREEMENT FOR PARTICIPANT IN THE TRIAL

THE PURPOSE OF THIS RESEARCH

To better understand malaria in your community, we would like to ask you some general questions about your household, bed-net possession and use, whether your house has been sprayed to control malaria, and the understanding of malaria illness, prevention, and when to seek treatment in your community. Also we want to find out risk factors for malaria infection in your community. Your responses to our questions and the results of our studies will help us learn how best to further improve malaria control in your community and in the country.

CONSENT

The study has been explained to me, I have been given the opportunity to ask questions concerning this study. Any such questions have been answered to my full satisfaction. I understand participation is voluntary and I may revoke this consent at any time without penalty or loss of benefits, if any.

I agree to take part.

SIGNED/THUMB PRINT.....

NAME.....

RELATIONSHIP TO THE HEAD OF THE HOUSEHOLD.....

NAME OF THE PERSON WHO ADMINISTERED THE FORM.....

SIGNED (FIELDWORKER): DATE.....

If you have any questions or clarification pertaining to this survey please feel free to ask the field workers or you may contact Mr Eliud Lukole