



**FACTORS ASSOCIATED WITH UTILIZATION OF LONG-LASTING INSECTICIDAL
TREATED NETS AMONG PREGNANT WOMEN IN NYANDO SUB-COUNTY,
KISUMU COUNTY, 2022**

CHARLES CHEGE KARIUKI

H57/11306/2018

Contact: 0722138971

Email: charleschege30@gmail.com

A THESIS SUBMITTED TO THE SCHOOL OF PUBLIC AND GLOBAL HEALTH IN
PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE AWARD OF THE
DEGREE OF MASTERS OF PUBLIC AND GLOBAL HEALTH OF THE UNIVERSITY OF
NAIROBI

2023

DECLARATION OF ORIGINALITY FORM

I am aware of the university's policy regarding the conduct of research leading to the award of a master's degree and further note of the effect of plagiarism. I herewith declare as follows;

1. This proposal is my original work and has not been submitted elsewhere for examination leading to the award of a degree or publication. Where other people work or my own work has been used, this has been properly acknowledged and referenced in accordance with the university of Nairobi requirements;
2. I have not sought any service in this work from any professional agency in its production;
3. I have not allowed, and shall not allow anyone to copy my work with the intention of passing it off as his/her work;
4. I understand that any false claim in respect of this work shall result in disciplinary action, in accordance with university plagiarism policy.

Signature:  _____

Date: 31st August 2023

Dr. Charles Chege Kariuki (MBChB)

ACKNOWLEDGEMENTS

My special gratitude to my supervisor Dr. Pamela Godia (University of Nairobi - UON), Prof. Joyce M. Olenja and Dr. David Gathara (London School of Hygiene and Tropical Medicine – LSHTM) for her dedication and support from the inception of the concept and finally delivery of the final product. To the entire School of Public and Global Health for the strong foundation that ultimately led to the development of this product.

I would also like to thank the department of Health in the county government of Kisumu, the subcounty health management team in Nyando subcounty for providing me with necessary assistance and great support during my data collection. Special thanks to the pregnant women who unconditionally accepted to participate in this study.

Finally, my sincere gratitude to my family and friends who kept checking on my progress and the prayers they offered to see me through in the study period.

DEDICATION

To my late Dad, Mr. George Kariuki who wished to see me through till the end. I will carry with me the patience and values that you taught me to the generations to come in pursuing their dreams and through enforcing knowledge to better the world.

SUPERVISORS' PAGE

This thesis has been submitted for examination with my approval as university supervisor.

Signature:  _____

Date: 31st August 2023

Dr. Pamela Miloya Godia, BDS, MPH, PhD

Lecturer, Department of Public and Global Health, Faculty of Health Sciences,

University of Nairobi

DIRECTOR'S APPROVAL

Signature  _____

Date 31st August 2023

Prof. Joyce M. Olenja, B.Ed (UON), M. Phil, PhD (University of Cambridge)

Chair, Department of Public and Global Health

Faculty of Health Sciences, University of Nairobi

TABLE OF CONTENTS

DECLARATION OF ORIGINALITY FORM.....	ii
ACKNOWLEDGEMENTS	iii
DEDICATION	iv
SUPERVISORS' PAGE	v
TABLE OF CONTENTS.....	vi
LIST OF TABLES.....	ix
LIST OF FIGURES	x
Abstract.....	xi
LIST OF ABBREVIATIONS AND ACRONYMS	xii
DEFINITION OF OPERATIONAL TERMS	1
CHAPTER 1: INTRODUCTION	2
1.1 Background information.....	2
1.2 Problem Statement	3
1.3 Research question	4
1.4 Objectives	5
1.4.1 General Objective	5
1.4.2 Specific Objectives	5
1.5 Justification.....	5
CHAPTER TWO: LITERATURE REVIEW.....	7

2.2 Factors associated with utilization of LLITNs among pregnant women	7
2.3 Conceptual Framework.....	11
CHAPTER THREE: METHODOLOGY	12
3.1 Study design.....	12
3.1 Study Site	12
3.3 Study Population.....	15
3.4 Inclusion and exclusion criteria	15
3.5 Sample size	16
3.6 Sampling technique.....	17
3.7 Data collection	17
3.8 Study variables.....	17
3.9 Statistical analysis.....	18
3.10 Ethical clearance	18
CHAPTER FOUR: RESULTS	20
4.1 Description of sociodemographic characteristics of the study participants	20
4.2 Description of obstetric characteristics of the study participants	22
4.3 Utilization of ANC services.....	24
4.4 Details on LLITNs usage among the study respondents	24
4.5 Assessment of knowledge of malaria	26
4.6 Knowledge of malaria transmission.....	28

4.7 Knowledge and information regarding prevention and control measures	29
4.9 Association between sociodemographic characteristics and use of LLITNs.....	32
4.10 Obstetric factors associated with the use of LLITNs among pregnant women	33
4.11 Association between knowledge on malaria and the use of LLITNs	36
4.12 Factors associated with utilization of LLITNs; Logistic regression	37
CHAPTER FIVE: DISCUSSION.....	39
CHAPTER SIX: CONCLUSIONS AND RECOMMENDATIONS	43
6.1 Conclusions.....	43
6.2 Recommendations.....	43
REFERENCES	45
APPENDIX I: PARTICIPANT’S INFORMATION SHEET	53
APPENDIX II: QUESTIONNAIRE.....	56
APPENDIX III: INFORMED CONSENT FORM.....	60
APPENDIX IV: QUESTIONNAIRE-SWAHILI VERSION (DODOSO)	64
Appendix V: INFORMED CONSENT FORM-(SWAHILI VERSION).....	69
APPENDIX IV: NACOSTI – RESEARCH LICENSE.....	74
APPENDIX V: KNH – UON ERC APPROVAL.....	75

LIST OF TABLES

Table 3.1 Antenatal Care Clinic visits (DHIS2, 2022)	13
Table 3.2 Distribution of the sample among the health centres in Nyando sub-county	17
Table 4.1 Sociodemographic characteristics of the study participants	21
Table 4.2 Obstetric history of the study participants	23
Table 4.3 Details on Utilization of ANC services	24
Table 4.4 Acquisition and utilization of LLINs among the study participants.....	25
Table 4.5 Distribution of the overall knowledge of signs and symptoms of malaria	28
Table 4.6 Knowledge and perceptions of mosquitoes and malaria transmission	29
Table 4.7 Distribution of overall knowledge scores about malaria transmission	Error!
Bookmark not defined.	
Table 4.8 Knowledge and information regarding malaria prevention and control measures	30
Table 4.9 Knowledge and information regarding malaria prevention and control measures	31
Table 4.10 Distribution of malaria knowledge scores by assessment domains	31
Table 4. 11 Association between sociodemographic characteristics and use of LLITNs	33
Table 4. 12 Oobstetric factors associated with the utilization of LLITNs	35
Table 4.13 Association between knowledge and the use of LLITNs among pregnant women	Error! Bookmark not defined.
Table 4.14 Outputs of binary logistic regression analysis	Error! Bookmark not defined.

LIST OF FIGURES

Figure 3.1 Map of Nyando Sub-County	15
Figure 4.1 Distribution of study participants by study sites.....	22
Figure 4.2 Signs and symptoms of malaria.....	27

ABSTRACT

Introduction: In spite of the progress made in the past decades, malaria continues to be a pressing public health problem in sub-Saharan African countries. Pregnant women are particularly vulnerable to infections and adverse health outcomes for themselves and their children who are unborn. In western Kenya, utilization of long-lasting insecticide-treated bed nets (LLITNs) among pregnant women is 40%. The prevalence of malaria in this region under which Nyando Sub-County falls is 19% which exposes the pregnant women living within the vicinity at risk of malaria. The associated risks can be mitigated through the appropriate deployment of control measures such as the use of LLITNs. There is therefore a need to determine the factors associated with utilization of LLITNs and, ultimately, formulate strategies for optimizing uptake of LLITNs use in this vulnerable group.

Objectives: The present study sought to determine the factors associated with the utilization of LLITNs among pregnant women in Nyando sub-county, Kisumu County, Kenya.

Methodology: The study deployed a cross-sectional design. Pregnant women who were coming for the second antenatal clinics (ANC) visits or more were enrolled. Data was collected using an interviewer-administered questionnaire. Descriptive analyses were done with categorical data being described using frequencies, absolute numbers, and proportions. Continuous data were summarized using appropriate measures of central tendencies. Normally distributed continuous data were summarized using means and standard deviations while continuous data exhibiting deviation from normal distribution were summarized using medians and interquartile ranges. Bivariate analysis to assess the association between various independent variables and the dependent variable were conducted using chi-square (χ^2) tests. Binary logistic regression analysis was also done to control for confounders in the test for associations. The level of significance for hypothesis testing was set at $p \leq 0.05$.

Results: A total of 373 pregnant women were recruited. Their age ranged from 16 to 44 years with mean age of 30.1 ± 6.85 (SD) years. Majority of the respondents were married (51.2%), Christian (92.8%), unemployed (79.4%), initiated ANC in the third trimester (60.5%) and reported having had no previous obstetric complications (79.4%). Those who reportedly slept under a LLITN in the night preceding the current study were 86.3%, 95%CI (82.5% - 89.5%) while those who always slept under an LLIN were 34.6% (95%CI 29.9% - 39.5%). The proportion of those who had suffered from malaria in the current pregnancy were 72.7% (95%CI 67.9% - 76.9%). The sociodemographic factors associated with LLITNs utilization included: Marital status AOR 2.173, 95% CI (1.065 - 4.459), and education AOR 2.067, 95%CI (1.011-3.416); for primary education. The obstetric factors associated with LLITNs utilization included previous loss of a child below 5 years (AOR 3.051, 95%CI (2.01 - 4.24), having had previous obstetric complications AOR 1.041, 95%CI (1.006-3.245), gestational age AOR 4.389, 95%CI (1.097-17.56), and AOR 16.232, 95%CI (2.46 -106.92) for second and third trimesters respectively, and number of ANC contacts AOR 2.2, 95%CI (1.059-7.68), for at least four ANC contacts) and suffered from malaria in the current pregnancy AOR 3.33, 95% CI (2.13 - 4.81). Besides, knowledge on malaria prevention and control in pregnancy was a predictor of LLITNs utilization among pregnant women AOR 3.3, 95% CI (1.36-8.06).

Conclusion: A substantial proportion of the pregnant women who took part in the present survey, slept under a LLITN in the night preceding the current study. The study identified modifiable factors associated with LLITN use in the study population which if prioritized can accelerate the already high uptake found in this study. On the other hand, the high prevalence of those who, reportedly, suffered from malaria in the current pregnancy is alarming. There is a need for more research on the underlying factors associated with malaria infection during pregnancy.

LIST OF ABBREVIATIONS AND ACRONYMS

ANC	Antenatal care
AOR	Adjusted odds ratio
CI	Confidence Interval
DNMP	Division of National Malaria Programme
ERC	Ethics and Research Committee
GOK	Government of Kenya
ITN	Insecticide Treated Nets
KCG	Kisumu County Government
KDHS	Kenya Demographic and Health Survey
KHIS	Kenya Health Information System
KMIS	Kenya Malaria Indicator Survey
KNH/UoN	Kenyatta National Hospital/University of Nairobi
KNBS	Kenya National Bureau of Statistics
LLIN	Long lasting insecticide nets
LLITN	Long lasting insecticidal treated nets
MiP	Malaria in Pregnancy
OR	Odds ratio
UN	United Nations
WHO	World Health Organization

DEFINITION OF OPERATIONAL TERMS

Proper use of LLITNs: Utilization of LLITNs or ITNs at night through proper hanging and sleeping under the net.

Adherence: Consistent and proper use of LLITNs or ITNs the previous night of the survey or study.

Availability of LLITNs: This refers to having a viable (acquired within the last three years) long lasting insecticide net or ITN in a household

Overcrowding: This involves more than three persons sleeping under one room

Type of Net: A polyester or polyethylene net

Universal Net coverage: this means the ownership of at least one net for two people living in the same household in the endemic and epidemic prone counties.

Utilization of long-lasting insecticide treated net (LLITN): Having slept under a LLITN the night prior to the day the survey was done

CHAPTER 1: INTRODUCTION

1.1 Background information

According to the World Health Organization (WHO) estimates of 2020, almost 241 million cases of malaria were reported in the world. Additionally, in 2020, 0.6 million malarial deaths were reported globally [WHO, 2021]. The reports by WHO also indicates that 24% to 40% of the pregnant women in each of the malaria-prone regions were exposed to infection by malaria during pregnancy (WHO, 2021). Additionally, in the WHO African Region which has 33 moderate and high malaria transmission nations, there were an estimated 33.8 million pregnancies, of which 11.61 million (34%) were exposed to malaria infection during pregnancy in 2020.

In Kenya, there are 10,700 deaths from malaria, annually, where there are an estimated 3.5 million new clinical cases, with residents of western Kenya being particularly at the highest risk. (Division of National Malaria Programme (DNMP) and ICF, 2021). Pregnant women with malaria are considered to be in a medical emergency and should receive treatment in a hospital setting to avoid future negative effects, such as maternal fatalities [(Division of National Malaria Programme ((DNMP), 2020]. Noteworthy is that pregnant women have a threefold increased risk of contracting severe malaria when compared to their counterparts who are not pregnant. Furthermore, pregnant women possess double the risk of mortality from malarial infection when compared to non-pregnant women [Schantz-Dunn et al, 2019].

The prevalence of malaria amongst pregnant with access and ITN use is low both at peripheral (maternal) or placental parasitemia. This is at the time of delivery with a protective efficacy of 25% in western Kenya. (Ter Kuile et al. 2003). To prevent malaria transmission in pregnant women, there are four strategic tools deployed with high impact in burden reduction. These include; the Intermittent Presumptive Treatment in Pregnancy (IPTp), Indoor residual spraying

(IRS), Laval source management (LSM) and the use of LLITNs. These interventions are aimed at mitigating the spread of malaria from a public health point of view thus reducing the number of admissions resulting from malaria. The statistical level of significance for the various variables highlighted in the conceptual framework provides an insight on the magnitude of associations.

The prevalence of placental parasitaemia among pregnant women in the western Kenya region is the highest in Kenya with a recent study reporting prevalence of up to 25% (Okoyo et al, 2021)

The study sought to highlight the key factors determining the use of LLITNs despite the access provided for free during the ANC visits. The National government is mandated to provide policy directions under all aspects including program-based implementation like malaria.

1.2 Problem Statement

Adoption of LLITNs usage is particularly imperative for women who are pregnant. Pregnant women are more susceptible to malaria. They are also more vulnerable to severe outcomes. The reasons for these phenomenon vulnerabilities include enhanced attractiveness to the mosquitoes due to suppression of the immune system, increased skin temperature, increased respiratory volume, and the sequestration of the parasites of malaria in the placenta (Rogerson et al 2007). The unborn child is subsequently at elevated risk for stillbirth, low birth weight, spontaneous abortion, and prematurity (Ernest et al 2017). Despite the increased risks and the enhanced prioritization of pregnant women in LLITN campaigns, LLITN usage among pregnant women who are in malaria-transmission zones (countries along the tropics) has plateaued in recent-years with most countries hovering around 50% (WHO, 2021).

Studies have revealed the possible effects of key malaria preventive practices including LLITNs and use of Intermittent presumptive treatment of malaria in pregnancy (IPTp) in interrupting

localized malaria transmission and, also, decreasing the number of malaria cases which are newly confirmed (Tizifa et al, 2018.; Wangdi, et al., 2018). For instance, the utilization of LLITN is internationally recognized as a very efficient and effective malaria prevention tool. As a result, it is recommended internationally that the distribution of LLITNs should happen regularly in every malaria-endemic country. In Kenya, currently, the impregnation of conventional bed nets is no longer done. Instead, all malaria projects, including the government-led, conduct mass distribution of LLITNs only every three years as defined in the National Strategic Plan (DNMP, 2018). The topping-up replenishments covering malaria vulnerable groups, such as children and pregnant women, are done on a rolling basis until the next cycle of mass distribution (DNMP, 2018). Nonetheless, studies have shown that proper utilization of LLITNs among the community remains poor. The high prevalence of malaria in western Kenya jeopardizes the efforts to eliminate malaria and the limited information on the level of utilization in specific areas including the study site poses a risk deploying interventions anecdotally. Overall, as per the 2020 Malaria Indicator Survey, the LLITNs ownership in highland epidemic, Lake and coastal endemic was 42.5%, 41.9% and 32.8% respectively with the ownership among the rural population being 51.9%. LLIN ownership in lake endemic region is 78% and the reported utilization rates fluctuate by different population groups – 80.2% in the general population nationwide, 39.8% among pregnant women, and 42% in the population of children under five years of age (DNMP, 2020).

1.3 Research question

What are the factors associated with the use of Long-Lasting Insecticidal Treated Nets among pregnant women visiting health facilities in Nyando Sub-County, 2022?

1.4 Objectives

1.4.1 General Objective

To determine the level of utilization and factors associated with the use of LLITNs among pregnant women in Nyando sub-county, Kisumu County

1.4.2 Specific Objectives

- To determine the level of the utilization of LLITNs among pregnant women in Nyando sub-county, Kisumu County
- To determine the sociodemographic factors associated with utilization of LLITNs among pregnant women in Nyando sub-county, Kisumu County
- To determine the obstetric factors associated with the utilization of LLITNs among pregnant women in the Nyando sub-county, Kisumu County
- To determine the association between knowledge on malaria preventive measures and the utilization of LLITNs among pregnant women in Nyando sub-county, Kisumu County

1.5 Justification

In Kenya, a total of 56,460 malaria cases and 234 malaria-related deaths were reported in 2019, with 365 malarial cases involving pregnant women (WHO, 2021). Aligned to this the vulnerability of pregnant women to malaria would be a chief impediment to achieving the nationwide 2030 malaria elimination target (NMCP, 2018). The prevalence rate of malaria in western region under which Nyando Sub-County falls is 19% (KMIS 2020) which exposes the pregnant women living within the vicinity at risk of malaria. Consequently, pregnant women should constantly use recommended malaria preventive tools and practices including LLITNs. However, targeted interventions for preventing malaria in pregnant women remain limited in utilization. These include LLITNs which are a form of personal protection that has been well documented to prevent

malaria infections and reduce the risk of severe sickness, , and mortality due to malaria (Asumah et al, 2021). The study ought to highlight the key factors determining the use of LLITNs despite the access provided for free during the ANC visits. The National government is mandated to provide policy directions under all aspects including program-based implementation like malaria. The highlighted recommendations will provide the policy makers with a background of developing new strategies to increase and sustain the level of utilization and raising some implementation research questions to trigger development issues as they conduct operation research.

CHAPTER TWO: LITERATURE REVIEW

2.1 Utilization of LLITNs among pregnant women

Research done on the West Region of Cameroon by Sidiki et al (2020) demonstrated that pregnant women who used LLITNs effectively during pregnancy are at reduced risk of infection with malarial parasites. A study on the uptake of LLITN for the prevention of malaria by pregnant women in Ghana showed that among the bed net owners (229, 78%), 61% reported using an LLITN the previous night (Ernest et al, 2017). A cross sectional study done in the malaria-endemic Thai-Myanmar border by Pooseesod et al (2021) revealed that the usage rate of LLITNs among pregnant women in the previous night was high (95.3%).

Research on ownership and use of LLITNs by pregnant women presenting in facilities in Nigeria confirmed a great disparity between ownership and usage of LLITNs with only 7% of the pregnant women who owned LLITNs reporting that they slept under them every night. The low utilization could partly explain why 72% of the pregnant women who took part in the research self-reported at least one episode of clinical malaria (Oduwole & Oyekanmi, 2021).

2.2 Factors associated with utilization of LLITNs among pregnant women

In a study done in Pakistan by Kumar et al (2021), the use of mobile phones was the most significant ($p < 0.001$) predictor of usage of LLITNs among pregnant women followed by the death of a newborn ($p < 0.05$). In South East Nigeria, Eleazar et al (2022) reported dislike by spouses, hot weather discomfort and forgetfulness as factors that contributed to failure of LLITNs usage by the pregnant women.

A study conducted in Woreda, Ethiopia, revealed that the utilization of LLITNs among pregnant women was low with the proportion of participants who used an LLITN being 39.9% (95% CI:

34.9–44.2%). The study also indicated that pregnant women from rural areas (AOR = 2.05, 95% CI: 1.14, 3.38), employed women (AOR = 1.80, 95% CI: 1.13, 2.86), monthly income >1050 Ethiopian total birr (AOR = 2.02, 95% CI: 1.06, 3.84), third trimester pregnancy (AOR = 2.19, 95% CI: 1.09, 4.40), and having antenatal care for current pregnancy (AOR = 3.86, 95% CI: 1.63, 9.10) were factors significantly associated with insecticide-treated nets. Lastly, the obstetric factors associated with LLITNs use in Ethiopia was 2.9 times for those in third trimester as compared to those in the first trimester. (Tesfaye et al. 2022)

A recent study on regional and socio-economic disparity in use of insecticide-treated nets to prevent malaria among pregnant women in Kenya showed an overt inequality in the use of ITNs among pregnant women. Greater ITN use was observed among pregnant women with a higher level of education. Pregnant women from urban settings tended to use ITNs (slept under a net the night before the survey) more than their rural counterparts (Haileselassie et al, 2022).

Factors such as financial access and missed opportunities of free distribution denied some pregnant women the opportunity to own or use an ITN. Reasons for not using ITNs during pregnancy included discomfort resulting from heat, smell of the net, and difficulty in hanging the net (Manu et al, 2017).

Research by Anikwe et al (2020) revealed that the rate of utilization of LLITNs in Southeast Nigeria was 37.5%; however, consistent use was only reported by about a third of this proportion. The major reasons for not utilizing the nets included discomfort, heat and fear of the chemical content of the LLITN. Women with tertiary education were more likely to utilize mosquito nets during pregnancy compared with women with secondary or primary education. Women who resided in rural areas (OR = 0.393 95% CI 0.602–0.073) were less likely to use LLITNs during

pregnancy, while those who are aware of the aetiology of malaria (OR = 4.38 95% CI 0.983–19.591) were more likely to utilize LLITNs in pregnancy.

In Ghana, while 67% of women had some general knowledge about malaria prevention, only 19% knew the specific risks in pregnancy. Determinants of LLITN use included LLITN ownership (odds ratio (OR) 2.4 [95% confidence interval {CI} 1.3 to 4.4]), good maternal knowledge of the risks of malaria in pregnancy (OR 2.4 [95% CI 1.3 to 4.3]) and more antenatal care (ANC) contacts (OR 1.3 [95% CI 1.0 to 1.5]) (Dunn-Dery et al, 2022).

A study on the use of long-lasting insecticidal nets among women attending antenatal clinic at a tertiary hospital in Bayelsa State, Nigeria, showed that 84.2% of the study participants owned LLITNs, and 196 (78%) used LLITN the night prior to the interview. Almost half of the respondents purchased their LLITNs. Those who purchased LLITNs were 3 times more likely to have used it (OR: 3.13, 95% CI 1.62–6.04) compared to those that got it free. Those who were gainfully employed (OR: 3.16, 95% CI 1.59–6.29) and those who earned above the minimum wage (OR: 2.88, 95% CI 1.45–5.72) were three times more likely to have used LLITN in their index pregnancy (Ibegu et al, 2020).

Forty et al (2021) reported that 88% and 64% owned and utilized LLITNs, respectively, in a study done in Malawi (A multistage cross sectional study) . In the same study, the odds of utilization of LLITNs were significantly low among women with no education, (AOR = 0.40, CI = 0.26–0.63), primary education (AOR = 0.53, CI = 0.36–0.78) and poor women (AOR = 0.70, CI = 0.51–0.97). Furthermore, the odds of utilization of ITNs were significantly low among women living in households without a radio (AOR = 0.79, CI = 0.67–0.93) and those who have not seen or heard a malaria message in the last 6 months (AOR = 0.74, CI = 0.64–0.87) (Forty et al, 2021).

A quantitative health survey by Okafor et al (2020) evaluated the knowledge, accessibility, and utilization of LLITNs among pregnant women in a selected hospital in South-Eastern Nigeria. The study indicated that out of the 97 women that owned at least one LLITN, the majority (69.1%) claimed to have started using LLITN even before pregnancy with 70% claiming to sleep under the LLITN always.

Research by Wekere et al (2020) documented the predictors of ownership and utilization of LLITNs among pregnant mothers in Rivers State University Teaching Hospital, Nigeria, which included the participants' age ($P < 0.001$) and occupation ($P < 0.001$); other statistically significant factors found were parity, educational status, and religion ($p = 0.002$, $p = 0.015$, $p = 0.044$) and ($p = 0.007$, $p = 0.002$, $p = 0.024$) respectively.

An evaluation of individual socio-demographic and household factors influencing the use of insecticides treated bed nets among pregnant women in Ghana found that 49.2% of pregnant women used LLITN to prevent malaria. Pregnant women aged 35–49 years (AOR=3.403, CI: 1.191–9.725), those with no formal education (AOR=5.585, CI=1.315–23.716), and those who had secondary education (AOR=3.509, CI=1.076–11.440) had higher odds of using ITN. Similarly, higher odds of LLITN usage were found among those who belonged to the Akan ethnic group (AOR=7.234, CI=1.497–34.955), dwell in male-headed households (AOR=2.232, 95% CI=1.105–4.508) and those whose household heads are aged 60–69 years (AOR=4.303, CI=1.160–15.966). However, pregnant women who resided in urban areas (AOR=0.355, CI=0.216– 0.582), those whose household heads aged 40–49 years (AOR=0.175, 95% CI=0.066–0.467), and those who belonged to richer (AOR =0.184, CI=0.050–0.679) and richest (AOR=0.107, 95% CI=0.021–0.552) households had lower odds of using ITN for malaria prevention (Klu et al, 2022).

2.3 Conceptual Framework

The conceptual framework for the proposed study is illustrated in Figure 2.1. The independent variables identified in the study were categorized into three broad areas including social demographic factors, obstetric factors, and the knowledge on malaria. The social demographic factors included age, marital status, education, religion, and the family size which were subjected to the level of net use. Obstetric factors in consideration included; parity, gestational age, previous obstetric complications, sickness during the pregnancy and whether the pregnancy was planned or not. The knowledge of signs and symptoms, control and preventive measures of malaria were included in the study to determine their influence on utilization. There is no direct relationship between the obstetric status of the woman and social demographic parameters thus independently influencing the utilization.

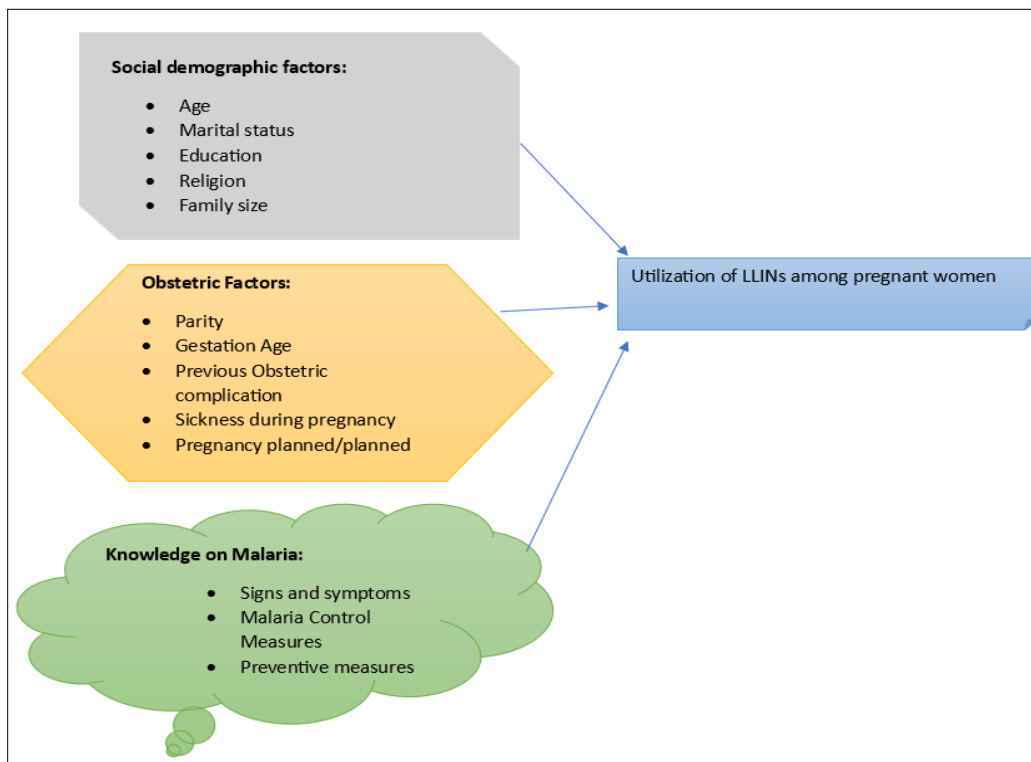


Figure 2.1 Conceptual framework (Guyatt & Ochola, 2003).

CHAPTER THREE: METHODOLOGY

3.1 Study design

The present survey was a health facility-based cross-sectional study. According to Mugenda and Mugenda (2003) cross-sectional study is a type of research design in which you collect data from many different individuals at a single point in time. In cross-sectional research, you observe variables without influencing them. Researchers in economics, psychology, medicine, epidemiology, and the other social sciences all make use of cross-sectional studies in their work. For example, epidemiologists who are interested in the current prevalence of a disease in a certain subset of the population might use a cross-sectional design to gather and analyze the relevant data.

3.1 Study Site

The study was undertaken in Nyando sub-county of Kisumu County. Nyando sub-county is situated between longitude 33° 20' 'and 35° 20 'East and latitude 0° 20" - 0° 50" South. Nyando Sub-County covers an area of approximately 163 km². The population of the area is estimated to be 73,227 persons (Kenya National Bureau of Statistics (KNBS), 2015). The area receives a mean rainfall of 1000 mm annually. The mean annual temperature of the area is 20°C (Kisumu County Government (KCG), 2018). The main drainage channels for Nyando Sub-County include river Nyando and R. Obuso. Black soils predominate in the area, and throughout the dry season, these soils develop large cracks that allow a lot of rainwater to seep through during the start of the rainy season. When the rainy season commences, the earth swells, cracks shut, and water cannot penetrate the soil any further, flooding the plains results. Additionally, the Sub-County is situated on low ridges where rivers occasionally overflow, resulting in floods that damage property and claim lives as well as contribution to the spread of mosquitoes which cause a surge in the

transmission and cases of malaria (KCG, 2018). The study was conducted in the antenatal care (ANC) clinics of health facilities in the study area between 10th December 2022 and 25th February 2023.

Malaria in Pregnancy in Nyando sub-county

The country’s malaria prevalence stands at six percent (6%) (Kenya Malaria Indicator Survey (KMIS) 2020) with the highest prevalence recorded in the lake endemic region at 19%. Kisumu lies in the lake endemic region where the environment favors the breeding of mosquitos throughout the year thus exhibiting the transmission of malaria across the resident population. The proportion of malaria among pregnant women in Nyando subcounty is 19% with an average of at least one ANC attendance of 96% (Kenya Health Information System (KHIS) 2022).

Table 3.1 Antenatal Care Clinic visits (DHIS2, 2022)

N O.	HEALTH CENTRE NAME	ANNUAL NEW ANC CLIENTS			AVERAGE MONTHLY NEW ANC CLIENTS		
		2020	2021	2022	2020	2021	2022
1	Hongo Ogoosa	182	220	102	15	18	9
2	Kochieng	99	91	47	8	8	4
4	Komwaga	95	81	25	8	7	2
5	Magina	68	57	27	6	5	2
6	Oren	84	81	22	7	7	2
7	Wanganga	73	72	33	6	6	3

Organization of health services in Nyando sub-county

Nyando Sub-County is one of the seven Sub-Counties of Kisumu County. Kisumu County has an estimated population of 1,224,531 persons. Nyando Sub-County had an estimated population of 178,246 residents and a projected population of 197,796 residents as of 2022. The population of other sub-counties are as follows; Seme (124,872 persons), Kisumu Central (213,450 persons), Nyando (178,246 persons), Muhoroni (178,246 persons), and Nyakach (168,140 persons). Nyando Sub- County has 6 wards namely; East Kano Wawidhi (has a population of 21,907

residents), Awasi Onjiko (has a population of 32,949 residents), Ahero (has a population of 45,884 residents), Kabonyo-Kanyagwal (has a population of 31,678 residents), Kobura (has a population of 45,828 residents), and East Kano Wawidhi (has a population of 21,907 residents) (KCG, 2018).

The health organization structure in Kisumu County is designed as a department of health services which is headed by the county executive committee member of health assisted by the chief officer of health. The technical affairs of the department are managed by the county director of health. The department is divided into three directorates including; medical services, public health and health policy and partnership.

The directorate of public health takes care of level 1,2 and 3 health care namely community health services, dispensaries and health centers respectively. Nyando Sub-County falls under the public health arm which is led by the sub-county health management team except the Nyando sub-county hospital which is under the medical services directorate (KCG, 2018).

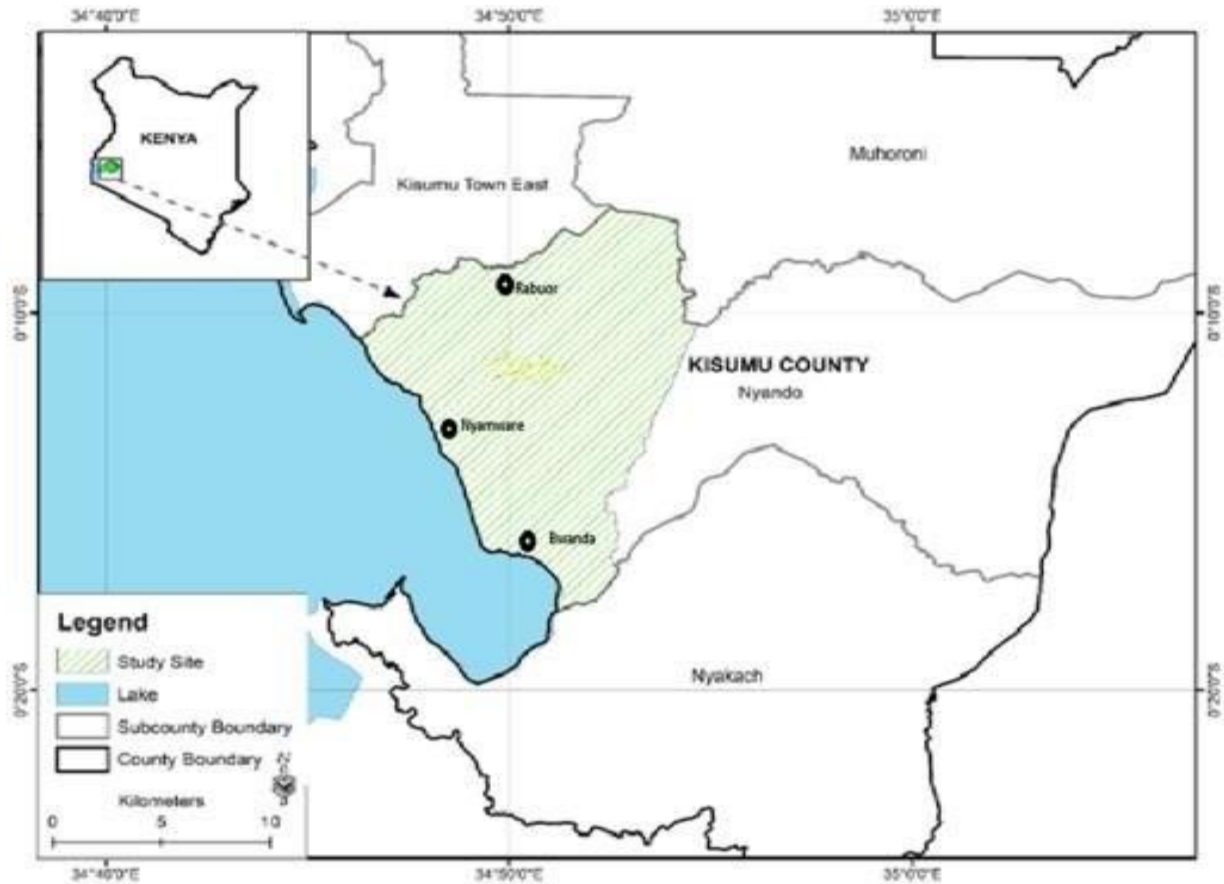


Figure 3.1 Map of Nyando sub-county

3.3 Study Population

The study population comprised of pregnant women visiting ANC clinics of health centres in the study area. The Kenyan policy states that all pregnant women visiting ante-natal clinic should be provided with an LLITN and the health care worker should provide the necessary information on the use. Those attending the first time were not exposed to the necessary information and had not been provided with an LLITN thus ineligible for this study.

3.4 Inclusion and exclusion criteria

Inclusion criteria

Pregnant women visiting ANC clinics of health centres in the study area

Exclusion criteria

Non-residents of the sub-county

3.5 Sample size

The minimum required sample size for the proposed study was determined using the following formulae:

$$n \geq z_{\alpha}^2 \frac{p(1-p)}{d^2} \dots\dots\dots (Lwanga and Lemeshow, 1991)$$

Where;

n is the sample size

*z*_α is the normal standard deviate for a given level of significance (95%, *z*_α = 1.962)

p is the estimate of the proportion of pregnant women utilizing LLITNs

d is the desired level of precision (0.05)

A *p* of 0.59 (59.0%) was used based on the findings of the by Ng’ang’a et al (2021) which indicated the utilization of LLITNs among pregnant women in the Lake Victoria basin, Western Kenya, which includes Kisumu County, was 59.0%. Thus,

$$n \geq 1.962^2 \frac{0.59 (1 - 0.59)}{0.05^2} = 372.5 = 373$$

The minimum required sample size for the proposed study was 373 participants. However, since the study focused on a finite population the minimum required sample size was corrected for the finite population using the formula by Israel (1992) as follows;

$$n / [1 + \{(n - 1) / \text{Pop}\}] = 373 / [1 + \{(373 - 1) / 665\}] = 373 / 1.56 = 240.$$

The sample size for each of the health centres was determined using probability proportionate to the population size approach (Peters & Eachus, 1995). Table 3.2 shows the distribution of the population and the sample among the health centres in Nyando sub-county, Kisumu County.

Table 3.2 Distribution of the sample among the health centres in Nyando sub-county

No.	Health Centre	<i>N</i> (ANC Clients in 2021)	<i>Minimum</i> <i>required n</i>	<i>Actual n</i>
1	Hongo Ogosa	220	79	123
2	Kochieng	91	33	51
3	Koduol Reru	63	23	35
4	Komwaga H	81	29	45
5	Magina	57	21	32
6	Oren	81	29	45
7	Wanganga	72	26	40
Total		665	240	373

3.6 Sampling technique

All the seven government-owned health centres in the study area were sampled. Women attending ANC in these health centres were recruited as they appeared in the facility after the screening by the respective clinicians. Once the study participants met the set criteria, they were included into the study.

3.7 Data collection

Quantitative data were collected using an interviewer-administered structured questionnaire.

3.8 Study variables

The dependent variable in this research were the utilization of LLITNs among pregnant women

Independent variables included;

- Sociodemographic characteristics (age, level of education, marital status, employment status, religion)
- Obstetric characteristics (parity, frequency of ANC visits, gestational age at 1st ANC visit)

- Knowledge-related factors including knowledge of malaria in pregnancy (MiP) dangers, and knowledge of MiP prevention.

3.9 Statistical analysis

Data entry and management was done using Microsoft Excel. Items assessing knowledge on signs and symptoms, malaria transmission as well as prevention and control measures were scored as follows; 1 for every item/question answered correctly; else 0. The total scores for each respondent were then computed. Respondents who scored below the mean knowledge score for the group were classified as having inadequate knowledge while those attained the mean score or more were classified as having adequate knowledge. Quantitative data analysis was done using STATA® v. 13.0. Data were analyzed descriptively using appropriate measures of central tendency. Descriptive analysis of categorical data was done using frequencies, absolute numbers, and proportions. Continuous data were summarized using appropriate measures of central tendencies. Normally distributed continuous data were summarized using means and standard deviations while continuous data exhibiting deviation from normal distribution were summarized using medians and interquartile ranges. Comparison of continuous variables were done by use of an independent t-test. Additionally, bivariate and multivariate analyses were conducted to assess the association between dependent and independent variables. Variables which were found to be significant by chi-square (χ^2) tests were analyzed further by binary logistic regression in order to control for confounding effects. The threshold for significance during hypothesis testing was set at $p \leq 0.05$.

3.10 Ethical clearance

Scientific and ethical clearance was obtained from the of Kenyatta National Hospital/University of Nairobi (KNH/UoN) Ethics and Research Committee (ERC). License to conduct the research

was obtained from National Commission For Science, Technology & Innovation (NACOSTI). Permission letter and informed verbal consent were obtained from the appropriate health departments of Kisumu County. All study participants were requested to give a written informed consent.

CHAPTER FOUR: RESULTS

4.1 Description of sociodemographic characteristics of the study participants

The present study recruited a total of 373 pregnant women as they sought services from various public health centres in Nyando Sub-County, Kisumu County. The Sociodemographic characteristics of the study participants are shown in Table 4.1. Their age ranged from 16 to 44 years with mean \pm standard deviation (SD) age of 30.1 ± 6.85 years. Majority of the study participants were married (51.2%), Christian (92.8%), unemployed (79.4%) and had no health insurance cover (79.4%). Analysis of the highest level of education attained by the study participants revealed that 44.8%, 39.7% and 11.5% of the study participants had attained primary, secondary, and post-secondary education qualifications respectively. Those who had no formal education constituted 4.0% of the study participants. The number of living children of the study participants ranged from one to twelve with a median (interquartile range (IQR)) of 3 (2 to 5) children. Most of the study participants (51.7%) had an average monthly family income (Kshs.) of less than Kshs. 10,000 and spent less than Kshs. 100 on transport in order to reach the index health facility (50.9%).

Table 4.1 Sociodemographic characteristics of the study participants

Characteristic	Number (n=373)	%
Age (years)		
Mean ± standard deviation (sd)	30.1 ± 6.85	
≤ 19	21	5.6
20 - 29	141	37.8
30 - 39	194	52
≥ 40	17	4.6
Marital status		
Currently married	191	51.2
Single	160	42.9
Separated/ Divorced/ Widowed	22	5.9
Religion		
Christian	346	92.8
Muslim	27	7.2
Level of education		
No formal education	15	4
Primary	167	44.8
Secondary	148	39.7
Post-secondary	43	11.5
Working status		
Unemployed	209	56
Employed (Public/Private/Self)	164	44
Has a family business		
Yes	77	20.6
No	296	79.4
Average monthly family income (KSh.)		
< 10,000	193	51.7
10,000 – 20,000	131	35.1
> 20,000	49	13.1
Has a health insurance cover		
Yes	77	20.6
No	296	79.4
Number of living children		
1 to 3	192	51.5
4 to 7	128	34.3
≥ 8	53	14.2
Has other direct dependents		
Yes	123	33
No	250	67
Amount spent on transport (to and from) when visiting the health facility (KSh.)		
Nothing	76	20.4
1 - 100	190	50.9
>100	107	28.7
Previous loss of a child below 5 years old		
Yes	116	31.1
No	257	68.9

Figure 4.1 displays the distribution of the study participants by the health centres they were enrolled from. Study participants who were recruited from Hongo Ogosa, Kochieng and Komwaga HC and Magina health centres were 33.0%, 13.7%, 12.3%, and 12.1% respectively. The rest of the study participants were enrolled from the following health centres: Wanganga (10%), Koduol Reru (9.4%), and Magina health centres (8.8%).

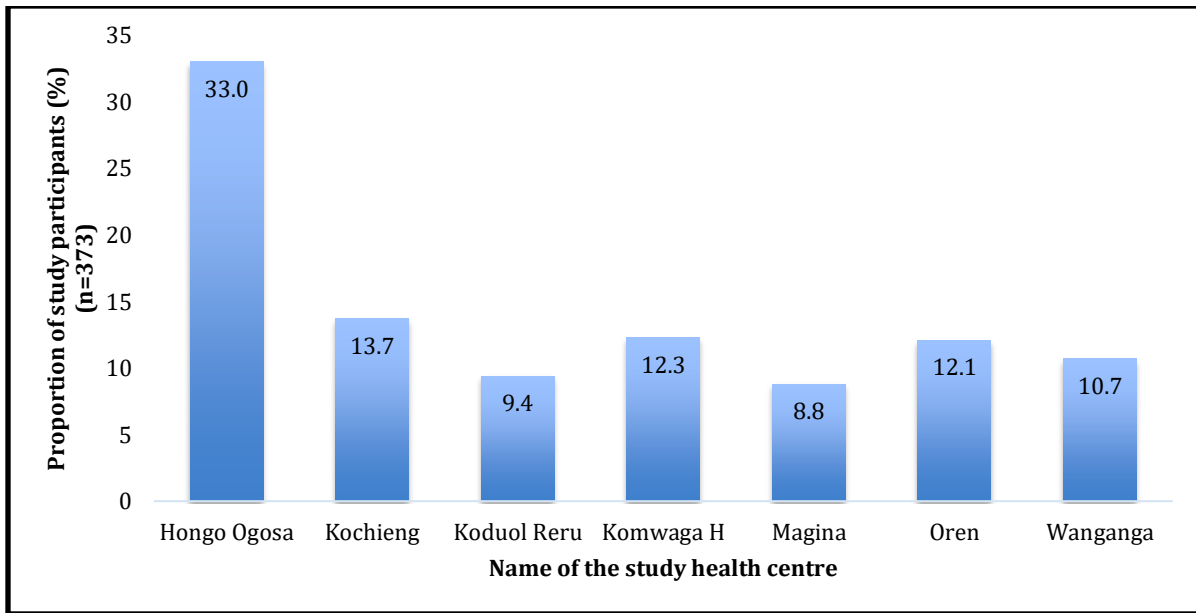


Figure 4.1 Distribution of study participants by study sites.

4.2 Description of obstetric characteristics of the study participants

Enquiries on the gestation age of the respondents in the current research indicated that those who were in first, second and third trimesters were 16.6%, 34.3% and 49.1% respectively. Overall, the mean \pm sd gestational age was 23.8 ± 4.0 weeks. Primigravidae, secundigravidae and multigravida comprised 28.2%, 25.2% and 46.6% of the study respondents, respectively. Most of the respondents reported that they had between one and three living children (51.5%). Further majority of the respondents reported that their current pregnancy was planned (71.3%), had an inter-pregnancy interval of at least two years (60.1%) and they had no other direct dependents besides their biological children (67.0%). The parity of 47.7% and 12.6% of the respondents were 1 to 2

and 3 to 4 respectively. The respondents reported that their current pregnancies were their first (42.4%), second (31.6%), third (16.1%) and fourth or more (9.9%). The proportion of the pregnant women who reported having had previous obstetric complications constituted the minority (20.6%) as exhibited in Table 4.2.

Table 4.2 Obstetric history of the study participants

<i>Attribute</i>	Frequency (n=373)	%
<i>Number of living children</i>		
<i>1 to 3</i>	192	51.5
<i>4 to 7</i>	128	34.3
<i>≥ 8</i>	53	14.2
<i>Has other direct dependents</i>		
<i>Yes</i>	123	33
<i>No</i>	250	67
<i>Pregnancy status</i>		
<i>Planned</i>	266	71.3
<i>Not planned</i>	107	28.7
<i>Number of pregnancies</i>		
<i>First pregnancy</i>	158	42.4
<i>Second</i>	118	31.6
<i>Third</i>	60	16.1
<i>Fourth or more</i>	37	9.9
<i>Gestational age (Trimester)</i>		
<i>First</i>	62	16.6
<i>Second</i>	128	34.3
<i>Third</i>	183	49.1
<i>Gravidity</i>		
<i>Primigravidae</i>	105	28.2
<i>Secundigravidae</i>	94	25.2
<i>Multigravida</i>	174	46.6
<i>Parity</i>		
<i>0</i>	130	34.9
<i>2-Jan</i>	178	47.7
<i>4-Mar</i>	47	12.6
<i>> 4</i>	18	4.8
<i>Inter-pregnancy interval</i>		
<i>< 2 years</i>	149	39.9
<i>≥ 2 years</i>	224	60.1
<i>Previous obstetric complications</i>		
<i>Yes</i>	77	20.6
<i>No</i>	296	79.4

4.3 Utilization of ANC services

Table 4.3 demonstrates the particulars on the utilization of ANC services among the study participants. Those who had made the second, third and fourth ANC contact were 38.6%, 33.0% and 12.9% respectively. Others had made five and six or more contacts (9.7% and 5.9%, respectively). The mean \pm SD gestational age of the study participants at the time of initiation of ANC contact was 21.8 ± 6.0 weeks with most of the study participants initiating ANC contacts in the third trimester (60.5%).

Table 4.3 Details on Utilization of ANC services

<i>Particulars</i>	Frequency (n=373)	%
<i>Number of ANC contacts have you made including the current one</i>		
2	144	38.6
3	123	33.0
4	48	12.9
5	36	9.7
≥ 6	22	5.9
<i>Timing of initiation of ANC</i>		
<i>Mean \pm SD gestational age</i>	<i>21.8 \pm 6.0 weeks</i>	
<i>1st Trimester</i>	64	17.2
<i>2nd Trimester</i>	83	22.3
<i>3rd Trimester</i>	226	60.5

4.4 Details on LLITNs usage among the study respondents

The proportion of the pregnant women who took part in the present survey, who reportedly slept under a LLITN in the night preceding the current study were 86.3% (95%CI 82.5% - 89.5%). In addition, the study participants who reported that they always slept under a LLIN were 129 (34.6%, 95% CI 29.9% - 39.5%). Of the 244 study participants who reported that they slept under a LLITN sometimes, 64 (26.2%), 107 (43.9%), 44(18.0%), 21 (8.6%) and 8(3.3%) cited hot weather, discomfort, dislike of the net by the spouse, odour and forgetfulness, respectively, as the reasons

for not utilizing a LLITN always. Asked about the duration of using the LLITN in the present pregnancy, most of the respondents reported that it is between one and two months (60.3%).

Table 4.4 Acquisition and utilization of LLINs among the study participants

<i>Characteristic</i>	Number (n=373)	%	95% Confidence interval
<i>Slept under a LLITN last night</i>			
<i>Yes</i>	322	86.3	82.5 - 89.5
<i>No</i>	51	13.7	
<i>Frequency of using net</i>			
<i>Always</i>	129	34.6	29.9 - 39.5
<i>Sometimes</i>	244	65.4	
<i>Reasons for not using the net always (n=244)</i>			
<i>Hot weather</i>	64	26.2	
<i>Discomfort</i>	107	43.9	
<i>Dislike of the net by the spouse</i>	44	18	
<i>Odour</i>	21	8.6	
<i>Forgetfulness</i>	8	3.3	
<i>Duration of using the net in this pregnancy (months)</i>			
<i>1 to 2</i>	225	60.3	
<i>3 to 4</i>	75	20.1	
<i>≥ 5</i>	73	19.6	
<i>Source of the net</i>			
<i>Health facility</i>	265	71.0	
<i>Buying</i>	41	11.0	
<i>Other</i>	67	18.0	

Table 4.4 provides selected details on the LLITNs obtained from health facilities by the study participants. Most of the index LLITNs (88.7%) were obtained at the first ANC contact and were provided free of charge (97.4%). Moreover, majority of the study participants had received lessons on how to use the LLITN during acquisition (95.5%) and had never re-treated the LLITN since acquisition (96.2%). Most of the respondents, reportedly, had suffered from malaria 92.2%, 95% CI (89.1% -94.5%). Additionally, those who had suffered from malaria in the current pregnancy were 271 (72.7%, 95% CI 67.9% to 76.9%) (Table 4.5).

Table 4.5 Prevalence of malaria among the study participants

Characteristic	Number (n=373)	%	95% Confidence level
Ever suffered from malaria			
Yes	344	92.2	89.1% -94.5%
No	29	7.8	
Has suffered from malaria in the current pregnancy			
Yes	271	72.7	67.9%-76.9%
No	102	27.3	

4.5 Assessment of knowledge of malaria

A. Assessment on knowledge on signs and symptoms of malaria

Figure 4.2 describes the outputs of the analysis of the knowledge of signs and symptoms of malaria.

Majority of the study participants reported fever and chills as signs and symptoms of malaria at 86.1% and 79.9% for body is hot and body is cold respectively. Body weakness as a sign and symptom of malaria was mentioned by 44.0% of the respondents.

Approximately, sixty-four (64%) percent of the participants reported headache as well as joint and back pains as cardinal signs and symptoms of malaria. The rest mentioned the following as signs and symptoms of malaria; vomiting (23.6%), loss of appetite (10.7%), and diarrhoea (26.5%) (Figure 4.2).

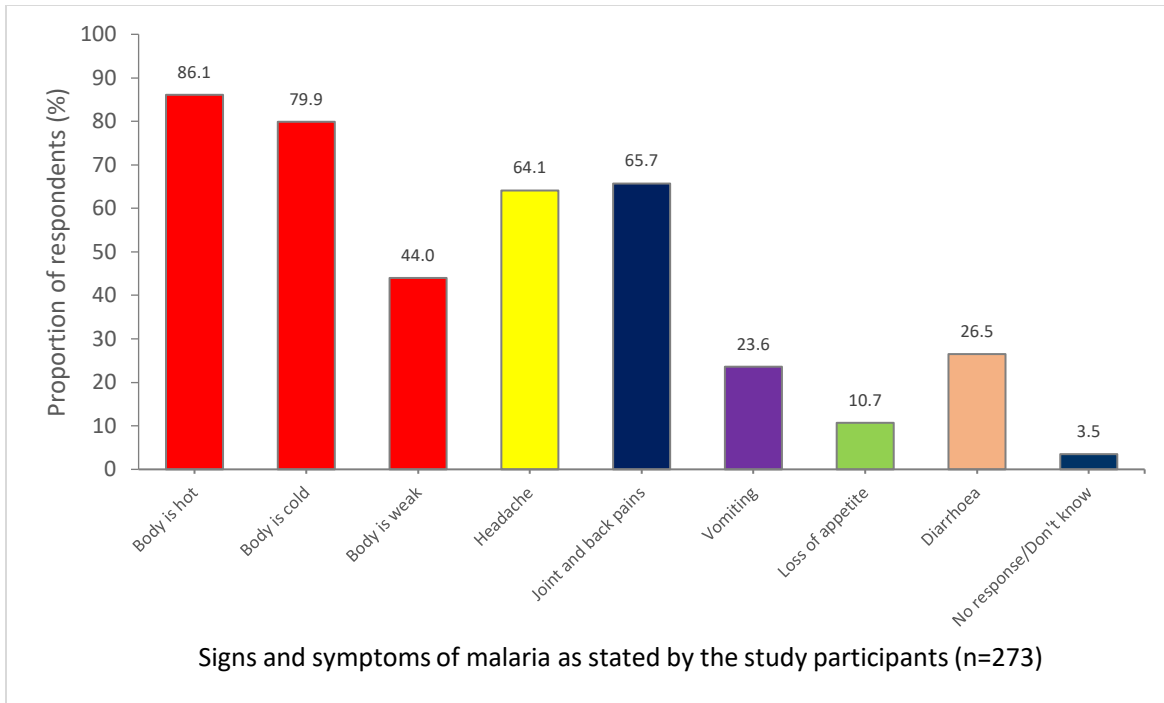


Figure 4.2 Signs and symptoms of malaria

The distribution of the overall knowledge of signs and symptoms of malaria is displayed in Table 4.6. The overall scores ranged from one to eight with eight being the maximum possible score. The mean \pm SD scores was 4.2 ± 1.29 . Those whose scores were three, four, five and six were 18.0%, 30.0%, 25.2% and 12.9% respectively.

Table 4.5 Distribution of the overall knowledge of signs and symptoms of malaria

Knowledge scores	Frequency	Percent (%)	Valid Percent (%)
1	3	0.8	0.8
2	41	11.0	11.0
3	67	18.0	18.0
4	112	30.0	30.0
5	94	25.2	25.2
6	48	12.9	12.9
7	6	1.6	1.6
8	2	.5	.5
Range of scores			
< 3	111	29.8	29.8
4 to 6	254	68.1	68.1
≥ 7	8	2.1	2.1
Classification based on scores			
Inadequate (< 4)	111	29.8	29.8
Adequate (≥ 4)	262	70.2	70.2

4.6 Knowledge of malaria transmission

Table 4.6 shows the outcomes of the assessment of study participants based on their knowledge of malaria transmission. Most of the study participants incriminated mosquito bite as a way of transmitting malaria (83.9%). Furthermore, majority of the respondents reported that mosquitoes breed in stagnant water (57.9%) and hide in dark corners of the house (76.1%). Besides, 32.2% of the respondents mentioned Animal sheds as breeding places for mosquitoes while 43.7% and 7.2% mentioned Bushes and Paddy-fields as potential hiding places of mosquitoes during daytime hours.

Table 4.6 Knowledge and perceptions of mosquitoes and malaria transmission

Knowledge Item	Number (n=373)	%
Knowledge on causes of malaria transmission		
Mosquito bite	313	83.9
Dirty environment	69	18.5
Staying with malaria patient	25	6.7
Don't know	11	2.9
Knowledge on breeding places of mosquito		
Stagnant water	216	57.9
Animal shed	120	32.2
Rotten things	86	23.1
Others	4	1.1
Don 't know	6	1.6
Knowledge on hiding places of mosquitoes during the daytime		
Dark corners of the house	284	76.1
Bushes	163	43.7
Paddy-fields	27	7.2
Others	10	2.7
No response/Don 't know	8	2.1

4.7 Knowledge and information regarding prevention and control measures

The findings on information that was provided by the study participants regarding malaria prevention and control measures are provided on Table 4.8a. Asked about the methods of protecting oneself from contracting malaria, 82.0%, 57.1%, 55.8% and 27.6% of the respondents mentioned taking precautions to prevent mosquito bite, killing mosquitoes, taking prophylactic medicines and keeping personal hygiene as some of the ways to mitigate the threat respectively. Likewise, 83.9%, 69.2%, 66.2% and 39.4% of the study participants, respectively, reported knowing the measures of mosquitoes control, removal of the water collected in ditches, spraying insecticides, cutting bushes and fish farming as appropriate measures of limiting the mosquitoes' population as means of preventing and controlling mosquitoes. The respondents also mentioned using a bed nets (93.3%), cleaning the environment (26.3%), insecticide spraying plastering

(22.3%), the wall/floor (22.3%), keeping away domestic animals and pets (5.4%) as some of the measures of limiting bites from mosquitoes.

Table 4.7 Knowledge and information regarding malaria prevention and control measures

Knowledge Item	Number (n=373)	%
Knowledge on methods to protect from malaria		
Taking precautions to prevent mosquito bite	306	82.0
Killing mosquitoes e.g. spraying	213	57.1
Taking prophylactic medicine	208	55.8
Keeping personal hygiene	103	27.6
Others	5	1.3
No response/Don ' t know	6	1.6
Measures of limiting the mosquito population		
Know the measures	313	83.9
Removal of the water collected in ditches	258	69.2
Spraying insecticides	247	66.2
Cutting bushes	147	39.4
Fish farming	98	26.3
Others	8	2.1
Protection from mosquito bites		
Using a bed-net	348	93.3
Cleaning environment	98	26.3
Insecticide spraying	83	22.3
Plastering the wall/floor	83	22.3
Keeping away domestic animals/pets	20	5.4

The maximum possible scores based on the assessment regarding malaria prevention and control measures were 14. The range of the scores attained by the study participants were 14 with the minimum and maximum scores recorded being three and twelve, respectively, while the mean \pm sd scores were 6.9 ± 1.74 . Most of the respondents attained scores in the range of 6 to 9 (67.8%). Further, majority of the respondents had adequate knowledge and information regarding malaria prevention and control measures (55.5%) (Table 4.9).

Table 4.8 Knowledge and information regarding malaria prevention and control measures

Attribute	Frequency	Percent
Knowledge scores		
3	4	1.1
4	15	4.0
5	65	17.4
6	82	22.0
7	87	23.3
8	54	14.5
9	30	8.0
10	24	6.4
11	11	2.9
12	1	.3
Knowledge scores		
≤ 5	84	22.5
6 to 9	253	67.8
≥ 10	36	9.7
Knowledge level		
Inadequate	166	44.5
Adequate	207	55.5
Total	373	100.0

B. Overall knowledge of malaria

Assessment of the overall knowledge of malaria is describe in Table 4.10. The maximum possible scores based on the 28 knowledge items were 28 scores. Respondents who were classified as having adequate knowledge were 156 (41.8%), 95% CI 36.9% to 46.9% while those who were classified as having inadequate knowledge on malaria were 156 (58.2%, 95% CI 53.1% to 63.1%).

Table 4.9 Distribution of malaria knowledge scores by assessment domains

Overall malaria knowledge scores	Maximum possible scores	Scores Attained			
		Minimum	Maximum	Mean	SD
Signs and symptoms	8	1	8	4.2	1.3
Malaria transmission	6	1	5	3	1
Prevention and control measures	14	3	12	6.9	1.7
Overall	28	8	21	14.1	2.4
		Percentage	95% Confidence level (CI)		
Level of knowledge	Inadequate	58.2	(53.1% - 63.1%)		
	Adequate	41.8	(36.9% - 46.9%)		

4.9 Association between sociodemographic characteristics and use of LLITNs

The outputs on the evaluation of the association between sociodemographic characteristics of the respondents and utilization of LLITNs is reported in Table 4.11. The mean age of the participants who, reportedly, slept under a LLITN in the night prior to the present survey was higher than that of their counterparts who failed to sleep under a LLITN in the night preceding the survey (Mean \pm se 30.9 \pm 0.40 and 29.3 \pm 1.18 years, respectively, $p=0.045$). Compared to those who were nineteen years old or less, respondents who were twenty to 29 years were about eight times more likely to have slept under a LLITN in the night preceding the survey (OR 8.247 (95% CI 2.977 - 22.843), $p<0.001$). Likewise, those who were in the range of thirty to 39 years and forty years are more likely to have slept under a LLITN in the night preceding the survey (OR 6.145 (95% CI 2.368 - 15.951), $p<0.002$ and OR 6.818 (95% CI 1.238 - 37.544), $p=0.034$ respectively). Marital status was also significantly predictive of utilization of LLITNs among pregnant women with those who were married being about three times more likely to have slept under a LLITN in the night prior to the day of the present study compared to their unmarried colleagues (OR 2.893 (95% CI 1.524 - 5.493), $p=0.001$). Analysis of the level of education attained by the respondents indicated an increase in the utilization of LLITNs with increment in educational attainment with those with 95.3%, 91.2% and 82.6% of those with post-secondary, secondary, primary education and those with no formal education self-reporting having slept under a LLITN in the night before the survey. Respondents who were unemployed had approximately two-fold increment in the likelihood of having slept under an LLITN in the night preceding the survey (OR 1.826 (95% CI 1.005 - 3.316), $p=0.046$). The remaining attributes including religion, average monthly family income, having a family business, has a health insurance cover and the amount spent on transport (to and from) the health center were not significant predictors of utilization of LLITNs among pregnant women.

Table 4. 10 Association between sociodemographic characteristics and use of LLITNs

Characteristic	Slept under a LLITN last night		Odds ratio (95% CI)	P-value
	Yes (n=322)	No (n=51)		
Age (years)				
Mean ± se	30.9 ± 0.40	29.3 ± 1.18		0.045
20 - 29	127(90.1)	14(9.9)	8.247(2.977-22.843)	<0.001
30 - 39	169(87.1)	25(12.9)	6.145(2.368-15.951)	<0.002
≥ 40	15(88.2)	2(11.8)	6.818(1.238-37.544)	0.034
≤ 19	11(52.4)	10(47.6)	REF	
Marital status				
Married	176(92.1)	15(7.9)	2.893(1.524-5.493)	0.001
Single/Separated/ Divorced/ Widowed	146(80.2)	36(19.8)	REF	
Education				
Post-secondary	41(95.3)	2(4.7)	17.938(3.134-102.660)	<0.001
Secondary	135(91.2)	13(8.8)	9.087(2.840-29.077)	<0.001
Primary	138(82.6)	29(17.4)	4.164(1.399-12.391)	0.006
No formal education	8(53.3)	7(46.7)	REF	
Religion				
Christian	297(85.8)	49(14.2)	0.485(0.111-2.112)	0.325
Muslim	25(92.6)	2(7.4)	REF	
Working status				
Unemployed	186(89.0)	23(11.0)	1.826(1.005-3.316)	0.046
Employed (Public/Private/Self)	136(82.9)	28(17.1)	REF	
Average monthly family income (KSh.)	13,250.00 ± 491.39	11,460.78 ± 1,277.55		0.181
< 10000	164(85.0)	29(15.0)	0.588(0.233-1.486)	0.257
10000 - 20000	116(88.5)	15(11.5)	2.145(0.704-6.536)	0.171
> 20000	42(85.7)	7(14.3)	REF	
Has a health insurance cover				
Yes	24(92.3)	2(7.7)	1.973(0.452-8.614)	0.357
No	298(85.9)	49(14.1)	REF	
Amount spent on transport (to and from) when visiting the health centre (KSh.)				
Nothing	63(82.9)	13(17.1)	0.730(0.321-1.656)	0.450
1 - 100	166(87.4)	24(12.6)	1.041(0.514-2.110)	0.911
>100	93(86.9)	14(13.1)	REF	

4.10 Obstetric factors associated with the use of LLITNs among pregnant women

Loss of a child (< 5years old) was associated with higher likelihood of utilization of LLITNs among pregnant women 8.651 (2.635-28.397), P<0.001). Higher parity was statistically

significantly associated with higher odds of utilizing the LLITN on the night preceding the day of the study ($p < 0.05$). A higher proportion of pregnant women who had witnessed obstetric complications previously slept under a LLITN the night prior to the survey when compared to their counterparts who had not had previous obstetric complications (97.4% versus 83.4% respectively, OR 7.439(1.767-31.315), $p = 0.001$). Compared to those in the third trimester of pregnancy, pregnant women who were in their second and first trimester had significantly lower odds of having used a LLITN in the night preceding the study (OR 0.083 (95% CI 0.035 - 0.200), $p < 0.001$ and OR 0.233 (95% CI 0.100 - 0.544), $p < 0.001$). Analysis of ANC contacts and the utilization of LLITN among pregnant women showed an upward trend in the utilization of LLITNs with increase in the increase in the number of ANC contacts. Pregnant women who had had three and at least four ANC contacts had, respectively, about 3-fold and 6-fold increased odds of having slept under a LLITN in the night prior to the survey when assessed against the who had made two ANC contacts (OR 6.060 (95% CI 2.278 - 16.124), $p = 0.007$ and OR 2.562 (95% CI 1.280 - 5.127), $p = 0.019$, respectively). Women who had suffered from malaria in the current pregnancy were at significantly higher odds of having slept under a LLITN on the night before the study was conducted (OR 3.3660 (95% CI 1.836 - 6.172), $p < 0.001$). Number of living children, having other direct dependents, pregnancy status, number of pregnancies, inter-pregnancy intervals and ever having suffered from malaria were not statistically significantly associated with utilization of the LLITNs by pregnant women in the night preceding the current survey (Table 4.12).

Table 4. 11 Obstetric factors associated with the utilization of LLITNs

Characteristic	Q19a slept under a llitn last night		Odds ratio (95% ci)	P-value
	Yes (n=322)	No (n=51)		
Previous loss of a child (<5 years old)				
Yes	113(97.4)	3(2.6)	8.651(2.635-28.397)	<0.001
No	209(81.3)	48(18.7)	Ref	
Number of living children				
Mean \pm se	4.0 \pm 0.15	4.8 \pm 0.48		0.062
1 to 3	165(85.9)	27(14.1)	2.049(0.946-4.436)	0.065
4 to 7	114(89.1)	14(10.9)	2.205(0.953-5.102)	0.061
8+	43(81.1)	10(18.9)	Ref	
Has other direct dependents				
Yes	105(85.4)	18(14.6)	0.729(0.397-1.340)	0.308
No	217(86.8)	33(13.2)	Ref	
Parity				
1 to 2	166(93.3)	12(6.7)	5.504(2.736-11.070)	<0.001
3 to 4	46(97.9)	1(2.1)	18.301(2.434-137.608)	<0.001
> 4	17(94.4)	1(5.6)	6.763(0.869-52.667)	0.043
0	93(71.5)	37(28.5)	Ref	
Previous obstetric complications				
Yes	75(97.4)	2(2.6)	7.439(1.767-31.315)	0.001
No	247(83.4)	49(16.6)	Ref	
Pregnancy status				
Planned	233(87.6)	33(12.4)	1.428(0.765-2.665)	0.261
Not planned	89(83.2)	18(16.8)	Ref	
Number of pregnancies				
First pregnancy	125(79.1)	33(20.9)	0.733(0.282-1.904)	0.523
Second	110(93.2)	8(6.8)	2.661(0.859-8.247)	0.081
Third	56(93.3)	4(6.7)	2.710(0.710-10.339)	0.133
Fourth or more	31(83.8)	6(16.2)	Ref	
Gestational age (trimester)				
First	40(64.5)	22(35.5)	0.083(0.035-0.200)	<0.001
Second	107(83.6)	21(16.4)	0.233(0.100-0.544)	<0.001
Third	175(95.6)	8(4.4)	Ref	
Inter-pregnancy interval				
< 2 years	125(82.2)	27(17.8)	0.564(0.311-1.021)	0.057
\geq 2 years	197(89.1)	24(10.9)	Ref	
Number of anc contacts including the current one				
4+ visits	101(95.3)	5(4.7)	6.060(2.278-16.124)	0.007
3 visits	111(89.5)	13(10.5)	2.562(1.280-5.127)	0.019
2 visits	110(76.9)	33(23.1)	Ref	
Ever suffered from malaria				
Yes	298(86.6)	46(13.4)	1.350(0.490-3.714)	0.560
No	24(82.8)	5(17.2)	Ref	
Suffered from malaria in the current pregnancy				
Yes	246(90.8)	25(9.2)	3.366(1.836-6.172)	<0.001
No	76(74.5)	26(25.5)	Ref	

4.11 Association between knowledge on malaria and the use of LLITNs

Table 4.13 presents an evaluation of the association between knowledge and the utilization of LLITNs among pregnant women in the study area. Having knowledge on signs and symptoms on malaria was not statistically significantly associated with having slept under a LLITN on the night before the present study was carried out. On the other hand knowledge on malaria transmission was significantly predictive of utilization of a LLITN by pregnant women in the night prior to the day of the study. Pregnant women whose knowledge on malaria transmission was classified as inadequate had approximately 60% decrement in the likelihood of having slept under a LLITN in the night preceding the current survey (OR 0.373 (95% CI 0.204 - 0.681), $p = 0.001$). Moreover, women who reportedly had slept under a LLITN in the night preceding the survey had higher scores on assessment of knowledge on malaria prevention and control measures compared to their counterparts (mean \pm se: 7.0 ± 0.10 and 6.3 ± 0.17 , respectively, $p=0.013$). Overall knowledge on malaria was not a significant determinant of utilization of LLITNs among pregnant women.

Table 4.12 Association between knowledge and the use of LLITNs among pregnant women

Knowledge item	Slept under a LLITNs last night		Odds ratio (95% ci)	P-value
	Yes (n=322)	No (n=51)		
Signs and symptoms				
Mean \pm standard error (se)	4.1 \pm 0.07	4.4 \pm 0.19		0.128
Inadequate	99(89.2)	12(10.8)	1.443(0.724-2.874)	0.295
Adequate	223(85.1)	39(14.9)	Ref	
Malaria transmission				
Mean \pm se	3.0 \pm 0.06	3.4 \pm 0.15		0.006
Inadequate	85(77.3)	25(22.7)	0.373(0.204-0.681)	0.001
Adequate	237(90.1)	26(9.9)	Ref	
Prevention and control measures				
Mean \pm se	7.0 \pm 0.10	6.3 \pm 0.17		0.013
Inadequate	135(81.3)	31(18.7)	0.466(0.255-0.852)	0.012
Adequate	187(90.3)	20(9.7)	Ref	
Overall				
Mean \pm se	14.1 \pm 0.14	14.0 \pm 0.27		0.887
Inadequate	187(86.2)	30(13.8)	0.970(0.532-1.767)	0.920
Adequate	135(86.5)	21(13.5)	Ref	

4.12 Factors associated with utilization of LLITNs; Logistic regression

The outcomes of binary logistic regression analysis on factors associated with utilization of LLITNs among pregnant women on the night before the present study was done are outlined on Table 4.14. Marital status was associated with using of LLITNs in the night preceding the survey with the married pregnant women having about two-fold increment in the odds of having slept under a LLITN in the night prior to the day of their study when compared to their unmarried counterparts (adjusted odds ratio (aOR) 2.173 (95% CI 1.065 - 4.459), $p < 0.001$). Other factors that were statistically significantly associated with having used a LLITN in the night preceding the survey included; knowledge on malaria prevention and control, level of education, previous loss of a child below 5 years old, having had previous obstetric complications, gestational age and number of ANC contacts made in the current pregnancy.

Table 4.13 Outputs of binary logistic regression analysis

Parameter	AOR	95% confidence interval		P-value
		Lower	Upper	
Intercept	2.016	0.058	70.399	0.699
Age (years)	1.062	0.962	1.172	0.235
Marital status (ref: single/divorced)	2.173	1.065	4.459	<0.001
Level of education (ref: no formal education)				
Primary	2.067	1.011	3.416	0.004
Secondary	1.045	1.007	1.302	0.001
Post-secondary	1.019	1.002	2.224	0.002
Employment status [ref: employed]	0.513	0.213	1.237	0.137
Previous loss of a child below 5 years old [ref: no]	3.051	2.011	4.239	<0.001
Parity [ref: para 0]				
1 to 2	0.686	0.202	2.328	0.545
3 to 4	0.116	0.01	1.386	0.089
> 4	0.33	0.022	5.012	0.424
Previous obstetric complications [ref: no]	1.041	1.006	3.245	0.001
Gestational age (trimester) [ref: first]				
Third	16.232	2.464	106.924	0.004
Second	4.389	1.097	17.558	0.037
Number of ANC contacts made including the current one [ref: one]				
4+ visits	2.201	1.059	7.683	0.010
3 visits	0.512	0.189	1.387	0.188
Suffered from malaria in the current pregnancy [ref: no]	3.327	2.132	4.807	0.015
Knowledge on malaria transmission [ref: adequate]	0.854	0.316	2.308	0.756
Knowledge on malaria prevention and control [ref: adequate]	3.314	1.362	8.059	0.008

CHAPTER FIVE: DISCUSSION

The findings from the current study demonstrate a substantially high level of utilization of LLITNs among pregnant women in Nyando sub-county, Kisumu County with about nine out of ten pregnant women having slept under an LLITN on the night preceding the current survey. The determinants of LLITNs utilization among pregnant women in our study population included marital status, level of education, previous loss of a child below 5 years old, having had previous obstetric complications, gestational age, number of ANC contacts made in the current pregnancy and knowledge on malaria prevention and control. Our findings may have implications on the malaria control program in Kenya and particularly in the lake endemic region and among pregnant women in the region. Further, understanding variable patterns of utilization of LLITNs in this population residing in the lake endemic zone is important in optimizing benefits accrued from ??? prevention and control programs and promoting pertinent national policies which are amenable to local contexts.

Approximately nine out of ten pregnant women in the study area reportedly slept under a LLITN in the previous night. This is contrary to research done in Malawi by Forty et al (2021) where it was reported that 66% of the pregnant women studied had slept under a LLITN in the previous night. Also contrary to our finding, a lower proportion of LLITNs usage among pregnant women was observed in Ghana whereby 61% of the study participants reported using a LLITN the previous night (Ernest et al (2017). A similar study conducted in the same country also reported a significantly lower proportion of LLITNs utilization with 59% of the respondents reportedly having used a LLITN on the prior night (Baume & Franca-Koh, 2021). On the other hand, the proportion reported in the current study is slightly lower than what was reported by a survey done in the malaria-endemic Thai-Myanmar border which indicated that the usage of LLITNs among

pregnant women in the previous night was 95.3% (Poosesod et al, 2021). Our findings are in discordance with those of a study conducted in Western Kenya highlands by Mukabane et al (2022) whereby a significantly higher proportion of study participants (93.17%) stated that they had slept under a LLITN on the previous night. Additionally, a study on integrity, use, and care of treated mosquito nets in Kirinyaga County, Kenya revealed a higher proportion of utilization of LLITN (92.7%) (Nyangi et al, 2020). 74.3% of participants reported that they had slept under the LLITN on the previous night. Research on utilization and associated factors of insecticide treated bed net among pregnant women attending antenatal clinic of Addis Zemen hospital, North-western Ethiopia, reported a significantly lower rate of use of LLITN (74.3%) when compared to what was reported in the present study (Yitayew et al, 2018). Nyamu et al (2020) also reported a higher proportion of utilization of LLITNs in a hospital based cross-sectional study done in Kwale County, Kenya. The study reported that 93.2% of the pregnant women who were interviewed reported having slept under a LLITN on the previous night. The disparities in the findings from various studies is most probably a reflection of the differences in environmental factors, malarial risk perceptions and malaria epidemiological zones.

In the current evaluation of sociodemographic factors associated with utilization of LLITNs among pregnant women showed that marital status was a significant determinant of LLITN usage among pregnant women with higher usage being reported among married pregnant women. It is likely that the higher proportion of LLITNs usage among married pregnant women may be attributed to the physical and psychosocial support offered by the husbands with regard to the use of LLITNs. For example, the husbands may motivate their wives to sleep under a LLITN. They may also assist in the installation of the LLITNs.

Another sociodemographic factor which was found to be a correlate of LLITN use in the present study's population is the level of education with those with higher educational qualifications being more likely to use the LLITNs. In concordance with this finding, Haileselassie et al (2022), in research on regional and socio-economic disparity in use of insecticide-treated nets to prevent malaria among pregnant women in Kenya, observed greater LLITN use among pregnant women with a higher level of education. Similarly, higher LLITNs utilization was observed in women with a higher level of education in a study done in Kilifi County, Kenya (Njoroge et al, 2019). The differences witnessed in these studies could be explained, at least in part, by the variations in sociocultural contexts and differences in the sociodemographic attributes of the studied populations.

The gestation of the current pregnancy was reported to be a significant obstetric determinant of LLITNs utilization among pregnant women in the present survey. Higher proportion of utilization of LLITNs was recorded among women who were in their second and third trimesters. Correspondingly, an Ethiopian study indicated that there was a higher utilization of LLITNS in the third trimester pregnancy compared to the second trimester pregnancy (aOR = 2.19, 95% CI: 1.09, 4.40) (Tesfaye et al, 2022).

In the current survey, knowledge on malaria prevention and control was documented as being significantly predictive of LLITNs utilization among pregnant women. Similarly, a survey conducted in Ghana associated good maternal knowledge of the risks of malaria in pregnancy and the attendant prevention and control measures with increment in the utilization of LLITNs (OR 2.4 (95% CI 1.3 to 4.3), $p=0.025$) (Dunn-Dery et al, 2022). Also, a study conducted in Tanzania reported that a high knowledge score was associated with more than a two-fold increased likelihood of net usage compared to a low score (Nganda et al 2017). Conversely, our finding

contradicts that of a study done in the coastal regional of Kenya where knowledge was not associated with LLITNs utilization among pregnant women indicating a ‘know–do gap’ (Njoroge et al, 2019). These inconsistencies in findings may be attributed to difference in sociocultural factors among the study populations.

The results of the study are subject to some limitations. The survey was cross sectional in nature and thus may have failed to capture the variations in utilization of LLITNs arising from seasonal weather fluctuations. Additionally, because our outcome measure was based on self-report, social desirability bias has the potential to create differential misclassification of the outcome resulting in a spuriously high estimate. For example, women who know LLITN interventions are desirable and recommended may be more likely to report always using them when they did not. Nonetheless, several aspects of the methodology used in the study helped to strengthen the results. For instance, this was a facility-based sample of recently pregnant women thus providing the most recent data. Also, breaking the pregnancy into trimesters and assessing net usage by trimester can better measure the variability of bed net usage that may occur with changes in the seasons, and possible changes in a woman's risk perception as her pregnancy progresses.

CHAPTER SIX: CONCLUSIONS AND RECOMMENDATIONS

6.1 Conclusions

The proportion of the pregnant women who took part in the present survey, who reportedly slept under a LLITN in the night preceding the current study were 86.3% (95% CI 82.5% - 89.5%). The sociodemographic factors associated with LLITNs utilization among pregnant women in the study population included marital status and level of education. The obstetric factors associated with LLITNs utilization among pregnant women included previous loss of a child below 5 years old, having had previous obstetric complications, gestational age, and number of contacts made in the current pregnancy. Besides, knowledge on malaria prevention and control in pregnancy was a predictor of LLITNs utilization among pregnant women. Lastly, there was high prevalence of pregnant women who reported to have contracted malaria in the current pregnancy.

6.2 Recommendations

1. The high prevalence of pregnant women who reportedly had suffered from malaria in the current pregnancy is alarming and begs for further investigation.
2. Targeted health education activities including routine or awareness raising campaigns on utilization of LLITNs among pregnant women should be intensified in the study area and cascaded to cover the whole county
3. Additionally, to optimize the gains in LLITN use among those with access there is a need to come up with strategies of promoting consistent use of LLITN, increasing the number of ANC attendance and need to educate women of reproductive age.

4. The identified modifiable factors associated with LLITN use in the study population if prioritized in the implementation of various strategic interventions can accelerate the already high uptake of LLITN utilization found in this study.

REFERENCES

- Ahorlu, C. S., Adongo, P., Koenker, H., Zigirumugabe, S., Sika-Bright, S., Koka, E., ... & Monroe, A. (2019). Understanding the gap between access and use: a qualitative study on barriers and facilitators to insecticide-treated net use in Ghana. *Malaria journal*, 18(1), 1-13.
- Aikins, M. K., Pickering, H., Alonso, P. L., d'Alessandro, U., Lindsay, S. W., Todd, J., & Greenwood, B. M. (2019). A malaria control trial using insecticide-treated bed nets and targeted chemoprophylaxis in a rural area of The Gambia, West Africa: 4. Perceptions of the causes of malaria and of its treatment and prevention in the study area. *Transactions of the Royal Society of Tropical Medicine and Hygiene*, 87, 25-30.
- Anikwe, C.C., Irechukwu, J.C., Okorochukwu, B.C., Ikeoha, C.C., Obuna, J.A., Ejikeme, B.N. and Anikwe, I.H., 2020. Long-lasting insecticide-treated nets: assessment of the awareness and utilization of them among antenatal clinic attendees in Abakaliki, Southeast Nigeria. *Journal of Tropical Medicine*, 2020.
- Andrade, C. (2015). Understanding relative risk, odds ratio, and related terms: as simple as it can get. *The Journal of clinical psychiatry*, 76(7), 21865.
- Asumah, M.N., Akugri, F.A., Akanlu, P., Taapena, A. and Boateng, F., 2021. Utilization of insecticides treated mosquito bed nets among pregnant women in Kassena-Nankana East municipality in the upper east region of Ghana. *Public Health Toxicology*, 1(2), pp.1-1.
- Baume, C. A., & Franca-Koh, A. C. (2021). Predictors of mosquito net use in Ghana. *Malaria journal*, 10(1), 1-6.
- Division of National Malaria Programme (DNMP) [Kenya] and ICF. 2021. Kenya Malaria Indicator Survey 2020. Nairobi, Kenya and Rockville, Maryland, USA: DNMP and ICF.

- DNMP. Updated guidelines for malaria diagnosis and treatment in Kenya. National Malaria Control Program, Ministry of Health. Nairobi. 2020.
- Dun-Dery, F., Kuunibe, N., Meissner, P., Winkler, V., Jahn, A. and Müller, O., 2022. Determinants of the use of insecticide-treated mosquito nets in pregnant women: a mixed-methods study in Ghana. *International Health*. 2; 0: 1–13
- Eleazar, C., Emenuga, V. and Udoh, I., 2022. Factors affecting usage of insecticide treated nets for malaria control by pregnant women in Enugu, South East Nigeria. *African Journal of Reproductive Health*, 26(1), pp.76-81.
- Ernst, K.C., Erly, S., Adusei, C., Bell, M.L., Kessie, D.K., Biritwum-Nyarko, A. and Ehiri, J., 2017. Reported bed net ownership and use in social contacts is associated with uptake of bed nets for malaria prevention in pregnant women in Ghana. *Malaria journal*, 16(1), pp.1-10.
- Forty, J. and Keetile, M., 2022. Patterns and correlates of ownership and utilization of insecticide-treated bed-nets for malaria control among women of reproductive age (15–49 years) in Malawi. *Journal of Biosocial Science*, 54(2), pp.269-278.
- Guyatt, H., & Ochola, S. (2003). Use of bednets given free to pregnant women in Kenya. *The Lancet*, 362(9395), 1549-1550.
- Haileselassie, W., Habtemichael, M., Adam, R., Haidar, J., David, R.E., Belachew, A., Mengesha, A.T., Koepfli, C., Deressa, W., Parker, D.M. and Kassaw, N.A., 2022. Regional and socio-economic disparity in use of insecticide-treated nets to prevent malaria among pregnant women in Kenya. *International Health*.
- Ibegu, M.I., Hamza, K.L., Umeokonkwo, C.D., Numbere, T.W., Ndoreraho, A. and Dahiru, T., 2020. Use of long-lasting insecticidal nets among women attending antenatal clinic at a tertiary hospital in Bayelsa State, Nigeria 2019. *Malaria Journal*, 19(1), pp.1-6.

- Israel, G. D. (1992). Determining sample size. University of Florida. University Extension Services.
- Kanmiki, E. W., Awoonor-Williams, J. K., Phillips, J. F., Kachur, S. P., Achana, S. F., Akazili, J., & Bawah, A. A. (2019). Socio-economic and demographic disparities in ownership and use of insecticide-treated bed nets for preventing malaria among rural reproductive-aged women in northern Ghana. *PloS one*, 14(1), e0211365.
- Kenya Malaria Indicator Survey. 2020
- Kenya National Bureau of Statistics (KNBS). 2015. KNBS Kisumu County statistical abstract; pp. 1-80.
- Kisumu County Government. 2018. Kisumu County Integrated Development Plan (KCIDP): Kisumu; Kisumu County Government. First County integrated development plan 2013-2017. Kenya vision 2030; pp. 1-285.
- Klu, D., Aberese-Ako, M., Manyeh, A.K., Immurana, M., Doegah, P., Dalaba, M., Acquah, E., Alhassan, R.K. and Ansah, E.K., 2022. Mixed effect analysis of factors influencing the use of insecticides treated bed nets among pregnant women in Ghana: evidence from the 2019 Malaria Indicator Survey. *BMC Pregnancy and Childbirth*, 22(1), pp.1-11.
- Kumar, R., Farzeen, M., Ahmed, J., Lal, M. and Somrongthong, R., 2021. Predictors of knowledge and use of long-lasting insecticidal nets for the prevention of malaria among the pregnant women in Pakistan. *Malaria Journal*, 20(1), pp.1-7.
- Lwanga SK & Lemeshow S. 1991. *Sample size determination in health studies: A Practical manual*. Geneva: WHO.
- Manyeh, A. K., Amu, A., Williams, J., & Gyapong, M. (2020). Factors associated with the timing of antenatal clinic attendance among first-time mothers in rural southern Ghana. *BMC pregnancy and childbirth*, 20(1), 1-7.

- Manu, G., Boamah-Kaali, E.A., Febir, L.G., Ayipah, E., Owusu-Agyei, S. and Asante, K.P. 2017. Low Utilization of Insecticide-Treated Bed Net among Pregnant Women in the Middle Belt of Ghana. *Malaria Research and Treatment*.
- McElroy PD, Ter Kuile FO, Hightower AW, et al. All-Cause Mortality among Young Children in Western Kenya. VI: The Asembo Bay Cohort Project. In: Breman JG, Egan A, Keusch GT, editors. *The Intolerable Burden of Malaria: A New Look at the Numbers: Supplement to Volume 64(1) of the American Journal of Tropical Medicine and Hygiene*. Northbrook (IL): American Society of Tropical Medicine and Hygiene; 2001 Jan. Available from: <https://www.ncbi.nlm.nih.gov/books/NBK2613/>
- Ministry of Health (MOH). 2012. National Guidelines for Quality Obstetrics and Perinatal Care. Nairobi, Kenya: MOH. Mugenda, O. M., & Mugenda, A. G. (2003). *Research methods: Quantitative & qualitative approaches* (Vol. 2, No. 2). Nairobi: Acts press.
- Mukabane, K., Kitungulu, N., Ogutu, P., Cheruiyot, J., Tavasi, N., & Mulama, D. (2022). Bed net use and malaria treatment-seeking behavior in artisanal gold mining and sugarcane growing areas of Western Kenya highlands. *Scientific African*, 16, e01140.
- National Malaria Control Programme, 2018. Kenya Malaria Strategy 2019–2023. Nairobi, Kenya: Ministry of Health; Available at: <http://fountainofafrica.org/wp-content/uploads/2020/01/Kenya-Malaria-Strategy-2019-2023.pdf>. Accessed July 11, 2022.
- Ng'ang'a, P. N., Aduogo, P., & Mutero, C. M. (2021). Long lasting insecticidal mosquito nets (LLINs) ownership, use and coverage following mass distribution campaign in Lake Victoria basin, Western Kenya. *BMC public health*, 21(1), 1-13.

- Nganda, R. Y., Drakeley, C., Reyburn, H., & Marchant, T. (2004). Knowledge of malaria influences the use of insecticide treated nets but not intermittent presumptive treatment by pregnant women in Tanzania. *Malaria Journal*, 3(1), 1-7.
- Njoroge, F. K., Kimani, V. M., Ongore, D., & Akwale, W. S. (2009). Use of insecticide treated bed nets among pregnant women in Kilifi District, Kenya. *East African medical journal*, 86(7).
- NMCP. 2022. Malaria in Pregnancy: National Malaria Control Programme; (July 2022). www.nmcp.or.ke/index.php/malaria-in-pregnancy
- Nyamu, G. W., Kihara, J. H., Oyugi, E. O., Omballa, V., El-Busaidy, H., & Jeza, V. T. (2020). Prevalence and risk factors associated with asymptomatic Plasmodium falciparum infection and anemia among pregnant women at the first antenatal care visit: A hospital based cross-sectional study in Kwale County, Kenya. *PloS one*, 15(10), e0239578.
- Nyangi, M. W., Kigondu, E. M., Irungu, B., Nganga, M., Gachanja, A., Kinyanjui, M., ... & Gathirwa, J. (2020). Integrity, Use, and Care of Treated Mosquito Nets in Kirinyaga County, Kenya. *Research Square*. <https://www.researchsquare.com/article/rs-30842/v1>.
- Oduwole, O.A. and Oyekanmi, E.O., 2021. Ownership and Utilization of Long-Lasting Insecticide Treated Bed Nets during pregnancy in Calabar, Nigeria. *Achievers Journal of Scientific Research*, 3(1), pp.52-57.
- Okafor, C.J. and Ogbonnaya, N.P., 2020. Knowledge, accessibility, and utilization of insecticide treated nets among pregnant women in a selected hospital in South-Eastern Nigeria. *European Journal of Midwifery*, 4.
- Okoyo, C., Githinji, E., Muia, R. W., Masaku, J., Mwai, J., Nyandieka, L., ... & Kanyi, H. M. (2021). Assessment of malaria infection among pregnant women and children below

five years of age attending rural health facilities of Kenya: A cross-sectional survey in two counties of Kenya. *Plos one*, 16(9), e0257276.

- Peters, T. J., & Eachus, J. I. 1995. Achieving equal probability of selection under various random sampling strategies. *Paediatric and perinatal epidemiology*, 9(2), 219-224.
- Poosesod, K., Parker, D.M., Meemon, N., Lawpoolsri, S., Singhasivanon, P., Sattabongkot, J., Cui, L. and Phuanukoonnon, S., 2021. Ownership and utilization of bed nets and reasons for use or non-use of bed nets among community members at risk of malaria along the Thai-Myanmar border. *Malaria journal*, 20(1), pp.1-12.
- Rogerson, S.J., Mwapasa, V. and Meshnick, S.R., 2007. Malaria in pregnancy: linking immunity and pathogenesis to prevention. *Defining and Defeating the Intolerable Burden of Malaria III: Progress and Perspectives: Supplement to Volume 77 (6) of American Journal of Tropical Medicine and Hygiene*.
- Schantz-Dunn, J. and Nour, N.M., 2019. Malaria and pregnancy: a global health perspective. *Reviews in obstetrics and gynecology*, 2(3), p.186.
- Sidiki, N.N., Payne, V.K., Cedric, Y. and Nadia, N.A., 2020. Effect of impregnated mosquito bed nets on the prevalence of malaria among pregnant women in Fouban Subdivision, West Region of Cameroon. *Journal of Parasitology Research*, 2020.
- Scott, J., Kanyangara, M., Nhama, A., Macete, E., Moss, W. J., & Saute, F. (2021). Factors associated with use of insecticide-treated net for malaria prevention in Manica District, Mozambique: a community-based cross-sectional survey. *Malaria journal*, 20(1), 200.
- Tesfaye, T., Alemu, B.M., Egata, G., Bekele, H., Merga, B.T., Eshetu, B. and Balis, B., 2022. Insecticide-Treated Nets Utilization and Associated Factors Among Pregnant

Women in Miesso Woreda, Eastern Ethiopia: Observational Study. *International Journal of Women's Health*, 14, p.445.

- Tizifa TA, Kabaghe AN, McCann RS, van den Berg H, Van Vugt M, Phiri KS. Prevention efforts for malaria. *Curr Trop Med Rep*. 2018 Mar;5(1):41–50. pmid:29629252
- Trinh, L.T.T., Dibley, M.J., Byles, J. (2007). Determinants of antenatal care utilization in three rural areas of Vietnam. *Public Health Nursing* 24(4): 300–310.
- Wangdi, K., Furuya-Kanamori, L., Clark, J., Barendregt, J.J., Gattton, M.L., Banwell, C., Kelly, G.C. and Clements, A.C., 2018. Comparative effectiveness of malaria prevention measures: a systematic review and network meta-analysis. *Parasites & vectors*, 11(1), pp.1-13.
- Wekere, F.C.C., Kalio, D.G., Kua, P.L. and Iwo-Amah, R.S., 2020. Evaluating the relationship between socio-demographic factors, knowledge, ownership and usage of longlasting insecticide-treated bed nets among pregnant mothers in Rivers State University Teaching Hospital. *International Journal of Research and Reports in Gynaecology*, pp.1-12.
- WHO. 2014. *WHO Policy Brief for the Implementation of Malaria in Pregnancy*. Geneva, Switzerland: WHO.
- WHO. 2021 World malaria report. Geneva: World Health Organization.
- WHO. 2021. World malaria report 2021. World Health Organization, Geneva
- Yirsaw, A.N., Gebremariam, R.B., Getnet, W.A. and Mihret, M.S., 2021. Insecticide-treated net utilization and associated factors among pregnant women and under-five children in East Belessa District, Northwest Ethiopia: using the Health Belief model. *Malaria Journal*, 20(1), pp.1-12.

- Yitayew, A. E., Enyew, H. D., & Goshu, Y. A. (2018). Utilization and associated factors of insecticide treated bed net among pregnant women attending antenatal clinic of Addis Zemen hospital, North-western Ethiopia: An institutional based study. *Malaria Research and Treatment*, 2018.

APPENDIX I: PARTICIPANT'S INFORMATION SHEET

Study Title: Factors associated with utilization of Long-Lasting treated Nets among pregnant women in Nyando sub-county, Kisumu County

Investigator: Dr. Charles Chege Kariuki

Introduction

I am **Dr. Charles Chege Kariuki**, a student at the University of Nairobi. I am the carrying out a research on malaria prevention and mosquito nets.

Purpose of the study

To assess the factors associated with use of long lasting treated nets among pregnant women in Nyando sub-county, Kisumu County

Study procedures

The investigator will tell you about the study. He will also answer all your questions about the study. This document, the informed consent form, will be read to you. The study objectives and procedures are provided in this document and you will be given a copy to keep with you. If you accept to participate, we will proceed with the study procedures upon your signing of this document. The investigator will ask you information about the way you live and conduct daily activities.

Risks/Discomforts

The risks arising from taking part in this study are minimal, if not none. Data collection does not involve any invasive procedure

Benefits

Individuals taking part in the study will be educated about malaria in pregnancy.

Compensation

No financial benefits are associated with take part in the study.

Confidentiality

Any records or results related to this research study may be disclosed to or inspected by the authorized persons from the Ministry of Health of Kenya or other authorized regulatory bodies for medical research. Any information about you will have a number on it instead of your name. Only the researchers will know what your number is and we will secure that information up with a lock and key at the study office. The results of this research study may be presented at meetings or in publications; however, your identity will not be disclosed.

Right to Refuse or Withdraw

You do not have to take part in this research if you do not wish to do so. You may stop participating in the research at any time that you wish without losing any of your rights.

Whom to Contact

If you have any questions, you may ask them now or later, even after the study has started. If you wish to ask questions later, you may contact the following:

The Investigator:

Dr. Charles Chege *Kariuki*

Mobile phone no.: 0722138971

Email: charleschege@gmail.com

or

The Secretary,

Ethical Review Committee,

Kenyatta national Hospital/University of Nairobi

uonknh_erc@uonbi.ac.ke

Telephone 2726300 ext. 44102

APPENDIX II: QUESTIONNAIRE

Name of Health Centre: _____

Participant No. _____ Date _____

Part I: Sociodemographic information

1. Age: _____ years
2. Marital status: 1. currently married 2. Single 3. Separated/ Divorced/ Widowed
3. Education: 1. No formal education 2. Primary 3. Secondary 4. College/University
4. Religion: 1. Muslim 2. Christian 3. Other. Specify.....
5. Number of living children: _____
6. Previous loss of a child below 5 years old: Yes No.
7. If yes, cause of death (include some possible options here -----)
8. Working status: 1. Unemployed 2. Employed (Public/Private/Self)
9. Average monthly family income: KSh. _____
10. Do you have a family business? 1. Yes 2. No.
11. Do you have other direct dependents? 1. Yes 2. No.
12. Do you have a health insurance cover? 1. Yes 2. No.
13. How much do you spend on transport (to and fro) when visiting the health centre? KSh. _____

Obstetric characteristics

14. Parity: _____
15. Gestation age: _____ weeks
16. Previous obstetric complications: 1. Yes 2. No

17. Was this pregnancy planned or was it unintended/unplanned? 1. Planned 2.

Unintended/unplanned

Details on ANC contacts

18. How many ANC contacts have you made including the current one?

19. What was the gestation age at first ANC contact? _____ weeks

SECTION B Current LLITNs usage

16. Slept under a LLITN last night? 1. Yes 2. No

17. How often do you use an LLITN?

[1] I use a net Always

[2] I use a net some times

[3] I don't use net at all

18. {If 17 - [2] or [3]}: Why haven't you been using it always? _____

19. {If 17 - [1] or [2]}: For how long have you been using the net in this pregnancy? ___Months

20. {If 16 - [I]}: From where did you get your net?

[1] Health facility

[2] Buying

[3] Others (specify)

21. {If 20 - [I]}: On which visit did you get your net? _____

22. {If 16 - [I]}: Did you get your net for free? 1. Yes 2. No

23. {If 22 - [2]}: How much did you pay for it? KShs _____
24. {If 16 - [I]}: How old is your net? __ Years __ Months
25. {If 16 - [I]}: Is the net treated with an insecticide? 1. Yes 2. No 3. I don't know
26. {If 16 - [I]}: Have you ever re-treated the net since you got it? ? 1. Yes 2. No
27. {If 16 - [I]}: Were you taught how to use the net from where you got it? ? 1. Yes 2. No

SECTION C Knowledge on malaria and LLITNs use

28. Have you ever suffered from malaria? 1. Yes 2. No

29. Which signs and symptoms of malaria do you know?

1. Headache
2. Fever
3. Vomiting and nausea
4. Joint and back pain
5. Poor appetite
6. Diarrhea
7. Others (specify) _____

30. If you fall sick with malaria what do you do?

1. Go to health facilities
2. Buy medicines form retail shops
3. See a traditional healer herbalist
4. Others (specify) _

31. Why do you choose this source of treatment? -----

32. How do you prevent malaria in your household?

1. Chemoprophylaxis (Preventive doses of anti-malarial)
2. Sprays
3. Mosquito coils
4. Repellents
5. Bed nets
6. Environmental measures
7. Others (specify) _

33. Does this method have any side effects on the family members? ? 1. Yes 2. No

3 I don't know

35. When is it necessary to use LLITNs?

- When pregnant
- During rainy seasons
- In childhood (below 5 years of age)
- Other _

36. Do you know how to mount the net for effective use? 1. Yes 2. No

37. What are the benefits of using LLITNs?

1. It prevents Mosquito nuisance
2. It prevents malaria transmission
3. It offers additional privacy in the bedroom?
4. Others (specify) _

38. How do you place your LLITN?

- a. Hanging it over the windows and doors to prevent mosquitoes entering the room 1. Yes
2. No
- b. Hanging it at one corner of the room 1. Yes 2. No
- c. Hanging it over the bed, but the net has contact with the skin while sleeping under it 1. Yes 2. No
- d. Hanging it over the bed and sleeping under it after tucking it under the mattress, preventing contact with the body 1. Yes 2. No

APPENDIX III: INFORMED CONSENT FORM

Study Title: Factors associated with utilization of Long-Lasting treated Nets among pregnant women in Nyando sub-county, Kisumu County

Investigator: Dr. Charles Chege Kariuki

PART I: Study Information

Introduction

I am **Dr. Charles Chege Kariuki**, a student at the University of Nairobi. I am carrying out research on malaria prevention and mosquito nets.

Purpose of the study

To assess the factors associated with use of long lasting treated nets among pregnant women in Nyando sub-county, Kisumu County

Study procedures

The investigator will tell you about the study. He will also answer all your questions about the study. This document, the informed consent form, will be read to you. The study objectives and procedures are provided in this document and you will be given a copy to keep with you. If you accept to participate, we will proceed with the study procedures upon your signing of this document. The investigator will ask you information about the way you live and conduct daily activities.

Risks/Discomforts

The risks arising from taking part in this study are minimal, if not none. Data collection does not involve any invasive procedure

Benefits

Individuals taking part in the study will be educated about malaria in pregnancy.

Compensation

No financial benefits are associated with take part in the study.

Confidentiality

Any records or results related to this research study may be disclosed to or inspected by the authorized persons from the Ministry of Health of Kenya or other authorized regulatory bodies for medical research. Any information about you will have a number on it instead of your name. Only the researchers will know what your number is and we will secure that information up with a lock and key at the study office. The results of this research study may be presented at meetings or in publications; however, your identity will not be disclosed.

Right to Refuse or Withdraw

You do not have to take part in this research if you do not wish to do so. You may stop participating in the research at any time that you wish without losing any of your rights.

Whom to Contact

If you have any questions you may ask them now or later, even after the study has started. If you wish to ask questions later, you may contact the following:

The Investigator: Dr. Charles Chege Kariuki, *Mobile phone no.:* 0722138971, *Email:* charleschege@gmail.com

or

The Secretary, Ethical Review Committee, Kenyatta national Hospital/University of Nairobi,
uonknh_erc@uonbi.ac.ke, Telephone 2726300 ext. 44102,

PART II: Certificate of Consent

By signing this form I certify to all of the following:

1. I have read the foregoing information, or it has been read to me in the presence of a witness.
2. I have had the opportunity to ask questions about it and any questions that I have asked have been answered to my satisfaction.
3. I voluntarily agree that I take part in this research study and I understand that I will receive a signed copy of this Informed Consent Form.
4. I understand that I can ask additional questions about this research study at any time, to the investigator
5. I understand that I am free to withdraw myself from the research study at any time without justifying my decision and without it affecting my medical care.
6. I authorize the release of any records or results, including my medical records, relating to this research study to authorized representatives of the Sponsor or its affiliated organizations, the Ethics Committees, or authorized regulatory bodies for research in humans in the country.

If illiterate, a literate witness must sign. Participants who are illiterate should include their thumbprint as well.

OR



Signature of the participant

Thumbprint of participant

(If illiterate or unable to sign)

Name of the participant: _____ / _____ / _____

First name

Last name

Date (Day/month/year)

First and last name of the witness _____

Signature _____

Date _____ (DD/MM/YYYY)

Investigator (or person requesting consent)

I certify that I have explained to the study participant whose name is listed above the nature and purpose of the study, potential benefits, and reasonably foreseeable risks associated with participation in this research study. **I confirm that the consent has been given freely and voluntarily.** I have answered any **questions asked by the participant** and have witnessed the above signature.

A copy of this form has been provided to the participant. _____

Name of person taking the consent

Signature of Researcher /person taking the consent

Date (Day/month/year)

APPENDIX IV: QUESTIONNAIRE-SWAHILI VERSION (DODOSO)

Jina la kituo cha Afya: _____

Nambari ya Mshiriki: _____ Tarehe: _____

Sehemu ya I: Taarifa za kijamii na idadi ya watu

20. Umri: _____ miaka

21. Hali ya ndoa: 1. kwa sasa umeolewa 2. Hujaolewa 3. Waliotengana/Wametalikiana/ Mjane

22. Elimu: 1. Hakuna elimu rasmi 2. Msingi 3. Sekondari 4. Chuo/Chuo kikuu

23. Dini: 1. Muislamu 2. Mkristo 3. Nyingine. Bainisha

24. Idadi ya watoto wanaoishi: _____

25. Kupoteza mtoto chini ya umri wa miaka 5 hapo awali: Ndiyo Hapana.

26. Ikiwa ndio, sababu ya kifo (jumuisha chaguzi zinazowezeleka hapa -----)

27. Hali ya kufanya kazi: 1. Kutokuwa na Ajira 2. Kuajiriwa (Hadharani/Binafsi/Binafsi)

28. Wastani wa mapato ya kila mwezi ya familia: KSh. _____

29. Je, una biashara ya familia? 1. Ndiyo 2. Hapana.

30. Je, una wategemezi wengine wa moja kwa moja? 1. Ndiyo 2. Hapana.

31. Je, una bima ya afya? 1. Ndiyo 2. Hapana.

32. Je, unatumia kiasi gani kwa usafiri (kwenda na kurudi) unapotembelea kituo cha afya? KSh. _____

Profaili ya uzazi

33. Usawa: _____

34. Umri wa ujauzito: Wiki _____

35. Matatizo ya awali ya uzazi: 1. Ndiyo 2. Hapana

36. Je, mimba hii ilipangwa au haikutarajiwa/haikupangwa? 1. Iliyopangwa 2.

Isiyotarajiwa/isiyopangwa

Maelezo juu ya mawasiliano ya kliniki ya wajawazito

18. Je, umewasiliana na ANC ngapi ikiwa ni pamoja na ya sasa?

19. Umri wa ujauzito ulikuwa upi wakati wa kuwasiliana na ANC mara ya kwanza? _____ wiki

SEHEMU B Matumizi ya sasa ya vyandarua vya mbu

16. Slept under a LLITN last night? 1. Yes 2. No

17. How often do you use an LLITN?

[1] I use a net Always

[2] I use a net some times

[3] I don't use net at all

18. {If 17 - [2] or [3]}: Why haven't you been using it always? _____

19. {If 17 - [1] or [2]}: For how long have you been using the net in this pregnancy? ___Months

20. {If 16 - [I]}: From where did you get your net?

[1] Health facility

[2] Buying

[3] Others (specify)

21. {If 20 - [I]}: On which visit did you get your net? _____

22. {Kama 16 - [I]}: Je, ulipata chandarua chako bila malipo? 1. Ndiyo 2. Hapana

23. {Kama 22 - [2]}: Umelipia kiasi gani? KShs _____

24. {Kama 16 - [I]}: Chandarua chako kina umri gani? __ Miaka __ Miezi

25. {Kama 16 - [I]}: Je chandarua kimetiwa dawa ya kuua wadudu? 1. Ndiyo 2. Hapana 3.

Sijui

26. {Kama 16 - [I]}: Je, umewahi kutibu tena neti tangu ulipoipata? ? 1. Ndiyo 2. Hapana

27. {Kama 16 - [I]}: Je, ulifundishwa jinsi ya kutumia neti kutoka mahali ulipoipata? ? 1.

Ndiyo 2. Hapana

SEHEMU C Maarifa kuhusu malaria na matumizi ya vyandarua

28. Je, umewahi kuugua malaria? 1. Ndiyo 2. Hapana

29. Je, unafahamu dalili na dalili gani za malaria?

1. [] Maumivu ya kichwa

2. [] Homa

3. [] Kutapika na kichefuchefu

4. [] Maumivu ya viungo na mgongo

5. [] Hamu mbaya

6. [] Kuhara

7. [] Nyingine (taja) _____

30. Ukiugua malaria unafanya nini?

1. [] Nenda kwenye vituo vya afya

2. [] Nunua dawa kwenye maduka ya reja reja

3. Muone mganga wa mitishamba

4. Nyingine (taja) _

31. Kwa nini unachagua chanzo hiki cha matibabu? -----

32. Je, unazuiaje malaria katika kaya yako?

1. Kemoprophylaxis (Vipimo vya kuzuia dhidi ya malaria)

2. Dawa za kunyunyuzia

3. Mviringo wa mbu

4. Vizuizi

5. Vyandarua

6. Hatua za kimazingira

7. Nyingine (taja) _

33. Je, njia hii ina madhara yoyote kwa wanafamilia? ? 1. Ndiyo 2. Hapana

3Sijui

35. Ni wakati gani ni muhimu kutumia LLITNs?

• Wakati wa ujauzito

• Wakati wa misimu ya mvua

• utotoni (chini ya miaka 5)

• Nyingine _

36. Je, unajua jinsi ya kuweka wavu kwa matumizi bora? 1. Ndiyo 2. Hapana

37. Ni faida gani za kutumia LLITN?

1. Huzuia kero ya Mbu
2. Huzuia maambukizi ya malaria
3. Inatoa faragha ya ziada katika chumba cha kulala?
4. Nyingine (taja) _

38. Je, unaiwekaje LLITN yako?

- a. Kuitundika juu ya madirisha na milango ili kuzuia mbu kuingia kwenye chumba 1. Ndiyo 2. Hapana
- b. Kuitundika kwenye kona moja ya chumba 1. Ndiyo 2. Hapana
- c. Kuitundika juu ya kitanda, lakini chandarua kinagusana na ngozi wakati wa kulala chini yake 1. Ndiyo 2. Hapana
- d. Kuitundika juu ya kitanda na kulala chini yake baada ya kuiweka chini ya godoro, kuzuia kugusa mwili 1. Ndiyo 2. Hapana

APPENDIX V: INFORMED CONSENT FORM-(SWAHILI VERSION)

RIDHAA YA KUFAHAMISHWA

**Study Title: Factors associated with utilization of Long-Lasting treated Nets
among pregnant women in Nyando sub-county, Kisumu County**

Investigator: Dr. Charles Chege Kariuki

SEHEMU YA I: Taarifa za Utafiti

Utangulizi

Mimi ni Dkt Charles Chege Kariuki, mwanafunzi katika Chuo Kikuu cha Nairobi. Mimi ndiye ninafanya utafiti juu ya kuzuia malaria na vyandarua.

Madhumuni ya utafiti

Kutathmini mambo yanayohusiana na matumizi ya vyandarua vilivyotibiwa kwa muda mrefu miongoni mwa wanawake wajawazito katika kaunti ndogo ya Nyando, Kaunti ya Kisumu.

Taratibu za masomo

Mpelelezi atakuambia kuhusu utafiti. Pia atajibu maswali yako yote kuhusu utafiti. Hati hii, fomu ya kibali cha taarifa, itasomwa kwako. Malengo na taratibu za utafiti zimetolewa katika waraka huu na utapewa nakala ili ubaki nayo. Ukikubali kushiriki, tutaendelea na taratibu za utafiti unapotia saina hati hii. Mpelelezi atakuuliza habari kuhusu jinsi unavyoishi na kufanya shughuli za kila siku.

Hatari/Masumbuko

Hatari zinazotokana na kushiriki katika utafiti huu ni ndogo, ikiwa sivyo. Ukusanyaji wa data hauhusishi utaratibu wowote vamizi

Faida

Watu watakaoshiriki katika utafiti huo wataelimishwa kuhusu malaria wakati wa ujauzito.

Fidia

Hakuna faida za kifedha zinazohusishwa na kushiriki katika utafiti. Confidentiality

Rekodi au matokeo yoyote yanayohusiana na utafiti huu yanaweza kufichuliwa au kukaguliwa na watu walioidhinishwa kutoka Wizara ya Afya ya Kenya au mashirika mengine ya udhibiti yaliyoidhinishwa kwa utafiti wa matibabu. Taarifa yoyote kukuhusu itakuwa na nambari badala ya jina lako. Watafiti pekee ndio watakaojua nambari yako ni ipi na tutalinda maelezo hayo kwa kufuli na ufunguo katika ofisi ya utafiti. Matokeo ya utafiti huu yanaweza kuwasilishwa kwenye mikutano au katika machapisho; hata hivyo, utambulisho wako hautafichuliwa.

Haki ya Kukataa au Kujitoa

Si lazima ushiriki katika utafiti huu ikiwa hutaki kufanya hivyo. Unaweza kuacha kushiriki katika utafiti wakati wowote unaotaka bila kupoteza haki zako zozote.

Nani wa Kuwasiliana

Ikiwa una maswali yoyote unaweza kuwauliza sasa au baadaye, hata baada ya funzo kuanza. Ikiwa ungependa kuuliza maswali baadaye, unaweza kuwasiliana na wafuatao:

Mpelelezi:

Dr. Charles Chege Kariuki

Mobile phone no.: 0722138971

Email: charleschege@gmail.com

or

Katibu,

Kamati ya Mapitio ya Maadili,

Kenyatta national Hospital/University of Nairobi

Barua pepe: uonknh_erc@uonbi.ac.ke

Nambari ya simu 2726300 ext. 44102,

SEHEMU YA II: Cheti cha Idhini

Kwa kusaini fomu hii ninaidhinisha kwa wote wafuatao:

1. Nimesoma habari iliyotangulia, au imesomwa kwangu mbele ya shahidi.
2. Nimepata fursa ya kuuliza maswali kuhusu hilo na maswali yoyote ambayo nimeuliza yamejibiwa kwa kuridhika kwangu.
3. Ninakubali kwa hiari yangu kwamba nitashiriki katika utafiti huu na ninaelewa kuwa nitapokea nakala iliyotiwa saini ya Fomu hii ya Idhini ya Taarifa.
4. Ninaelewa kuwa ninaweza kuuliza maswali ya ziada kuhusu utafiti huu wakati wowote, kwa mpelelezi.
5. Ninaelewa kuwa niko huru kujiondoa kutoka kwa utafiti wa utafiti wakati wowote bila kuhalalisha uamuzi wangu na bila kuathiri huduma yangu ya matibabu.
6. Ninaidhinisha kutolewa kwa rekodi au matokeo yoyote, ikijumuisha rekodi zangu za matibabu, zinazohusiana na utafiti huu kwa wawakilishi walioidhinishwa wa Mfadhili au mashirika yake husika, Kamati za Maadili, au vyombo vya udhibiti vilivyoidhinishwa kwa ajili ya utafiti wa binadamu nchini.

Ikiwa hajui kusoma na kuandika, shahidi anayejua kusoma na kuandika lazima atie sahihi. Washiriki ambao hawajui kusoma na kuandika wanapaswa kujumuisha alama zao za kidole gumba pia.

_____ **OR**

Sahihi ya Mshiriki

Alama



ya

kidole gumba ya mshiriki

(Ikiwa hajui kusoma na kuandika au hawezi kusaini)

Jina la Mshiriki: _____ / _____ / _____

Jina la kwanza _____ Tarehe ya mwisho _____ (Siku/mwezi/mwaka)

Jina la kwanza na la mwisho la shahidi _____

Sahihi _____

Tarehe _____ (Siku/mwezi/mwaka)

Mpelelezi (au mtu anayeomba idhini)

Ninathibitisha kuwa nimemweleza mshiriki wa utafiti ambaye jina lake limeorodheshwa juu ya asili na madhumuni ya utafiti, manufaa yanayoweza kutokea, na hatari zinazoweza kuonekana zinazohusishwa na kushiriki katika utafiti huu. Ninathibitisha kwamba idhini imetolewa kwa hiari na kwa hiari. Nimejibu maswali yoyote yaliyoulizwa na mshiriki na nimeshuhudia sahihi hapo juu.

Nakala ya fomu hii imetolewa kwa mshiriki.

Jina la mtu anayepokea idhini

Saini ya Mtafiti/mtu anayechukua Tarehe ya idhini

(Siku/mwezi/mwaka)

APPENDIX IV: NACOSTI – RESEARCH LICENSE


REPUBLIC OF KENYA


NATIONAL COMMISSION FOR
SCIENCE, TECHNOLOGY & INNOVATION

Ref No: 743331
Date of Issue: 09/December/2022

RESEARCH LICENSE



This is to Certify that Dr. CHARLES CHARLES CHEGE of University of Nairobi, has been licensed to conduct research as per the provision of the Science, Technology and Innovation Act, 2013 (Rev.2014) in Kisumu on the topic: Factors associated with utilization of Long-Lasting Treated Nets among pregnant women in Nyando sub-county, Kisumu County for the period ending : 09/December/2023.

License No: NACOSTI/P/22/22468

743331
Applicant Identification Number


Director General
NATIONAL COMMISSION FOR
SCIENCE, TECHNOLOGY & INNOVATION

Verification QR Code



NOTE: This is a computer generated License. To verify the authenticity of this document,
Scan the QR Code using QR scanner application.

See overleaf for conditions

APPENDIX V: KNH – UON ERC APPROVAL



UNIVERSITY OF NAIROBI
FACULTY OF HEALTH SCIENCES
P O BOX 19676 Code 00202
Telegrams: varsity
Tel: (254-020) 2726300 Ext 44355

KNH-UON ERC
Email: uonknh_erc@uonbi.ac.ke
Website: <http://www.erc.uonbi.ac.ke>
Facebook: <https://www.facebook.com/uonknh.erc>
Twitter: @UONKNH_ERC https://twitter.com/UONKNH_ERC



KENYATTA NATIONAL HOSPITAL
P O BOX 20723 Code 00202
Tel: 726300-9
Fax: 725272
Telegrams: MEDSUP, Nairobi

Ref: KNH-ERC/AJ477

23rd November, 2022

Dr. Charles Chege Kariuki
Reg. No.H57/11306/2018
Dept. of Public & Global Health
Faculty of Health Sciences
University of Nairobi

Dear Dr. Kariuki,



RESEARCH PROPOSAL: FACTORS ASSOCIATED WITH UTILIZATION OF LONG-LASTING TREATED NETS AMONG PREGNANT WOMEN IN NYANDO SUB-COUNTY, KISUMU COUNTY (P699/08/2022)

This is to inform you that KNH-UoN ERC has reviewed and approved your above research proposal. Your application approval number is **P699/08/2022**. The approval period is 23rd November 2022 – 22nd November 2023.

This approval is subject to compliance with the following requirements;

- i. Only approved documents including (informed consents, study instruments, MTA) will be used.
- ii. All changes including (amendments, deviations, and violations) are submitted for review and approval by KNH-UoN ERC.
- iii. Death and life threatening problems and serious adverse events or unexpected adverse events whether related or unrelated to the study must be reported to KNH-UoN ERC 72 hours of notification.
- iv. Any changes, anticipated or otherwise that may increase the risks or affected safety or welfare of study participants and others or affect the integrity of the research must be reported to KNH-UoN ERC within 72 hours.
- v. Clearance for export of biological specimens must be obtained from relevant institutions.
- vi. Submission of a request for renewal of approval at least 60 days prior to expiry of the approval period. Attach a comprehensive progress report to support the renewal.
- vii. Submission of an executive summary report within 90 days upon completion of the study to KNH-UoN ERC.

Protect to discover

Prior to commencing your study, you will be expected to obtain a research license from National Commission for Science, Technology and Innovation (NACOSTI) <https://research-portal.nacosti.go.ke> and also obtain other clearances needed.

Yours sincerely,



DR. BEATRICE K.M. AMUGUNE
SECRETARY, KNH-UoN ERC

c.c. The Dean, Faculty of Health Sciences, UoN
The Senior Director, CS, KNH
The Assistant Director, Health Information Dept., KNH
The Chairperson, KNH- UoN ERC
The Chair, Dept. of Public & Global Health UoN
Supervisors: Dr. Pamela M Godia, Dept of Public & Global Health UoN