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PREVALENCE OF MALARIA AND ASSOCIATED FACTORS AMONG CHILDREN UNDER 5 YEARS FOLLOWING MASS NET CAMPAIGN AND INDOOR RESIDUAL SPRAYING IN AMOLATAR DISTRICT

BY

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AWARD OF THE DEGREE OF MASTER OF PUBLIC HEALTH

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DECLARATION

I, ORECH SAM declare that the research report entitled "Prevalence of malaria and associated factors among children under 5 years following mosquito net campaign and indoor residual spraying in Amolatar district" is my own academic effort. To the best of my knowledge this report has never been submitted to any higher institution of learning for any academic award or publication.

ORECH SAM

SIGNATURE:  DATE: 28TH AUGUST 2022

APPROVAL

The undersigned agrees that the research report entitled “Prevalence of malaria and associated factors among children under 5 years following mass net campaign and indoor residual spraying in Amolatar district” was developed by Orech Sam and I took full responsibility of supervision.

SUPERVISOR:

SUPERVISOR:

Signature:  Date: 18th November, 2022

MS AKELLO ANNE RUTH

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It has not been an easy task to come out with this report, numerous consultations from colleagues and constructive guidance from my supervisors amidst the lock down of Covid-19 pandemic and later on Ebola epidemic.

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ABBREVIATIONS AND ACRONYMS

ACT	Artemisinin-based combination therapy
AOR	Adjusted Odds Ratio
CDC	Centers for Disease Control and Prevention
CI	Confidence Interval
DHS	Demographic and Health Survey
DHT	District Health Teams
HH	Household Head
HMIS	Health Management Information System
IPTp	Intermittent preventive treatment (of malaria) during pregnancy
IQR	Inter-Quartile Range
IR	Incidence Rate
IRS	Indoor residual spraying
LLIN	Long-lasting insecticidal net
MIS	Malaria indicator survey
MOH	Ministry of Health
MPH	Master of Public Health
mRDT	Malaria Rapid diagnostic test
NMCD	National Malaria Control Division
NPHC	National population and housing census
Pf	*Plasmodium falciparium*
PMI	U.S.President's Malaria Initiative
SDGs	Sustainable Development Goals
SP	Sulfadoxine-pyrimethamine
UBOS	Uganda Bureau of statistics
UDHS	Uganda Demographic and Health Survey
UNCST	Uganda National Council for Science and Technology
USAID	United State Agency for International Development
VHTs	Village Health Teams
WHO	World Health Organization

OPERATIONAL DEFINITIONS

Prevalence of malaria in this study referred to the number of positive falciparium malaria Rapid Diagnostic Test samples from children under five years expressed as a percentage of the Population

An outbreak: Is occurrence of more cases of disease than expected over a particular period of time in a given area among a specific group of people.

Disease prevention: Activities designed to protect the patients and other members of the public from actual or potential health threats and their harmful consequences.

Endemic: Habitual presence of a disease within a given geographical area.

Epidemic: Occurrence in a community or region of a group of illness of similar nature, clearly in excess of normal expectation.

Indoor Residual Spraying (IRS): Is the application of a long-lasting, residual insecticide to potential malaria vector resting surfaces such as internal walls, eves, and ceilings of all houses or structures (including domestic animal shelters) where such animal vectors might come into contact with the insecticide (Spraying).

Malaria: Is a disease caused by the plasmodium parasite, which is spread by female Anopheles mosquitoes, also known as “night-biting” mosquitoes because they most commonly bite between dusk and dawn. For this study malaria will be denoted by positive PF. mRDT on children under 5 years.

Mass net distribution/campaign: Is an approach to rapidly scale up LLINs coverage for the prevention and reduction of morbidity and mortality caused by malaria.

ABSTRACT

Background

Mass LLINs distribution campaign and Indoor Residual Spraying (IRS) have been identified by the WHO as effective approaches for malaria prevention and control.

Despite the scale up of interventions towards control and elimination of malaria, it's still endemic in 91 countries worldwide with 3.3 billion people at risk of developing. In 2015, 212 million malaria cases occurred globally resulting into 429,000 deaths, 92% were in Africa. In 2019, 409,000 people died of malaria, mostly vulnerable children in sub-Saharan Africa.

Methods

A community based, cross-sectional research design using quantitative data collection method was used. Semi-structured questionnaire were employed. Bivariate and multivariate logistic regression analysis were done to identify factors associated to the prevalence of malaria among <5yrs.

Results

The intended respondents (238) were interviewed and up to 44.1% (105/238) children tested positive for malaria. At multivariate analysis, Children living with married caretakers (AOR=2.54, 95% CI=1.23-5.25) had statistically significant association with malaria prevalence, Children of caretakers with poor perception towards LLIN use had 68% increased odds of getting malaria. Whereas, children who stay far away from water bodies (AOR=0.07, 95% CI=0.01-0.56) had reduced odds of getting malaria

Conclusions and recommendations

Malaria remains the major public health problems among children under 5 years in Amolatar district. Children living with married caretakers, Caretakers with poor perception towards LLIN use and living near water bodies were the risk factors to malaria. DHTs to strengthen malaria prevention and control strategies among children <5 years, health information dissemination about eliminating stagnating water bodies, and addressing poor perception of mothers of children <5years.

CHAPTER ONE: INTRODUCTION AND BACKGROUND

1.1 Introduction to the study

Mass Long lasting insecticide treated nets (LLINs) campaigns and indoor residual spraying (IRS) are major vector control strategies for malaria prevention in malaria prone areas. Children < 5 years old are the most vulnerable groups to malaria infection because of a poorly developed immune system. According to WHO malaria control strategies, countries have set targets that led to malaria control and elimination with interventions among high risk groups particularly for children < 5 years.

According to a study conducted in Koulikoro health districts of Mali, comparing the effect of LLINs alone and LLINs together with IRS on the prevalence of malaria among children under 10 years, the findings showed that the prevalence of malaria was significantly lower in the areas where LLINs + IRS (3.2%) were used compared to the control areas with LLINs only (11.5%) (Kané, F., Keïta, M., Traoré et al., 2020).

Similarly, in a study done in Migori county, western Kenya to determine the impact of IRS on malaria prevalence, findings also showed lower prevalence of malaria (20.6%) in the intervention areas compared to 30.4% in non-intervention areas (Abong'o, B., Gimnig, J. E., Torr, et al., 2020).

Despite the scale up of interventions geared towards control and eventual elimination of malaria, the disease is still endemic in 91 countries worldwide with 3.3 billion people at risk of developing malaria in any given year. In 2015, 212 million cases of malaria occurred globally resulting into 429,000 deaths of which 92% were in Africa. Also in 2019, an estimated 409,000 people died from malaria and that most were young people in sub-Saharan Africa. High malaria burden has been identified as one of the causes of poverty in many developing countries, Uganda inclusive because the treatment costs are very high yet payment is usually out-of-pocket. However, with scale up of interventions in most endemic countries, global reduction of malaria burden has been reported (Oguttu, D. W, Matovu et al., 2017).

Uganda has the 3rd highest global burden of malaria cases (5%) and 8th highest level of deaths (3%). It also has the highest proportion of malaria cases in East Africa and Southern Africa 23.7% (Okwa 2020).

According to the Ministry of Health (MoH), malaria accounts for 24-45% of outpatients' visits in public health facilities and is a leading cause of death among in-inpatients aged below five years. Plasmodium falciparium is the predominant species causing malaria in Uganda. The

major malaria parasite vectors in the country are *Anopheles gambiae* complex and *Anopheles funestus*. Malaria transmission in Uganda is perennial with two peaks in April to June and October to December, corresponding to rainfall seasons during which the vector biting density is high. The goal of Uganda's malaria control policy is to reduce morbidity and prevent mortality attributed to malaria (Wanzira, Katamba et al., 2017).

Determining the prevalence of malaria by the study was useful as it reflected the burden of a disease in the studied population. This was not limited to the burden in terms of monetary costs; it also reflected the burden in terms of life expectancy, morbidity/pain involved, quality of life/workman hours lost to attending to sick children, or other indicators. Knowledge of the burden of the disease helped decision makers to determine where investments in health care should be targeted.

1.2 Background to the study

In 2019, a global estimation of 229 million cases of malaria occurred, with estimated death of 409,000 people. Children aged under 5 years are the most vulnerable group affected by malaria and in 2019, they accounted for 67% (274 000) of all malaria death worldwide (Al-Mekhlafi, H. M., Madkhali, A. M., Madkhali et al., 2021).

According to a WHO report, African Region has a disproportionately high share of global malaria burden. In 2019, the region was home to 94% of malaria cases (Al-Mekhlafi, H. M., Madkhali, A. M., Madkhali et al., 2021).

Uganda is among the 15 countries most affected by malaria in the world. The national malaria indicator survey of 2009 reported that 45% of Ugandan children aged five years carried malaria parasites. The national malaria prevalence according to microscopy in children under age of 5 had decreased consistently from 42% in 2009 to 19% in 2014-2015 and finally to 9% in 2018-19 respectively (Ameyaw, E. K., Kareem, Y. O., & Yaya, et al., 2020). However, these declines have not been uniform around the country, and malaria prevalence declines have been greatest in regions where IRS has been implemented coupled with LLINS usage and good health seeking behavior (Namuganga, J. F., Epstein, A., Nankabirwa, et al., 2021).

The Northern parts of Uganda districts have experienced changing dynamics of malaria transmission despite the increasing use of LLINs and IRS. Vector population species shifted and insecticide resistance had been linked with this incident. The finding shows that of the 93.5% children tested for malaria, 52.4% had pfPR by RDT, and 32.7% by thick-film microscopy (TFM). The sensitivity of RDT to detect asexual parasites was 97.5% and

specificity was 69.7%, compared to TFM by local technicians (Ameyaw, Kareem et al., 2020), and a malaria epidemic was experienced in 2015.

Accordingly, a study done in Kitgum district showed that malaria epidemic was experienced between the year 2015 and 2016. The burden rose above the estimated malaria normal channels graph. At its peak, the number of malaria cases attending Kitgum hospital was over 20 times above the normal channels graph. The total number of cases per 1000 population increased from 7 in 2014 to 113 in 2015 and 114 in 2016. Similarly, test positivity rate (TPR) increased from 10.55 to 54.6% between 2014 and 2016. This trend was also observed for malaria attributable hospitalizations and malaria in pregnancy (Ogwang, R., Akena, G., Yeka et al., 2018).

According to malaria surveillance weekly report of week 4, (25^{th}-31^{st} January) 2021, Amolatar district reported malaria test positivity rate of 68% compared to DHIS2 of January to May 2020, where TPR in Amolatar stood at 60% for mRDT and 50% for microscopy. Malaria contributes over 50% of the total OPD attendances, 40% of in-patient admissions with a fairly significant percentage of mortality. The proportion of malaria in pregnancy was about 40% with IPTp3 coverage of over 45% (Nangobi, P., Onyango, G., Kagaba et al., 2020).

Therefore, malaria remains the highest cause of morbidity and mortality in most parts of Uganda with a contribution of 30-50% of outpatient visits, 15-20% of admissions and up to 20% of inpatient death (Lucantoni, Loganathan et al., 2017).

It's upon this background that this study was set out to determine the prevalence of malaria among under-fives in Amolatar after implementation of two most effective interventions so that the stakeholders get to know how much needs to be done in improving the coverage of the two, given the results of this study.

1.3 Problem statement

Uganda is a country with many factors hindering its development, including diseases mainly malaria as well as poverty, which are closely linked. Malaria disease has impacted humans for thousands of years, and it has continued to do so even though methods of preventing and curing malaria are now available.

Uganda has the 3rd highest global burden of malaria cases (5%) and 8th highest level of deaths (3%). It also has the highest proportion of malaria cases in East Africa and Southern Africa estimated at 23.7% (Okwa 2020).

In addition, Uganda is ranked the sixth highest in terms of number of annual deaths due to malaria in Africa, with approximately 16 million cases by 2015. The entire population is at risk due to resistance of *Anopheles gambiae* and *Anopheles funestus* to pyrethroid insecticide. The result of the study in Uganda shows that oxidases played a role in the resistance of *Anopheles gambiae* to pyrethroid (an insecticide that was approved for use in treating nets, until 2018), while other mechanisms might also played a role in the resistance of *Anopheles gambiae* in Lira and Apac from 30.2% to 78.8% (Okia, M., Hoel, D. F., Kirunda, et al., 2018).

Malaria still remains the highest cause of morbidity and mortality in the eight districts of Lango sub region, Amolatar inclusive. According to the DHIS2 of January-May 2020, test positivity rates in the districts of Amolatar, Dokolo, Lira, Alebtong and Otuke stood at above 60% for mRDT and 50% for microscopy. Overall, malaria contributes over 50% of the total OPD attendances, 40% of in-patient admissions with a fairly significant percentage on mortality. The proportion of malaria in pregnancy is about 40% with IPTp 3 coverage of over 45% (Nangobi, P., Onyango, G., Kagaba et al., 2020).

The National Malaria Control Division of the Ministry of Health, since 2014, with the support from USAID/PMI, UKAID and development partners has been implementing Indoor Residual Spraying in the 14 high malaria prevalence districts from Northern and Eastern Uganda including Amolatar. The district has been able to conduct nine (9) rounds of Indoor Residual Spraying from 2014 to 2021- around April to May every year with coverage of above 90%, and 3 rounds of universal coverage campaign for Long Lasting Insecticidal Nets distribution (2014, 2017 and 2020).

In addition, ICCM at community from 2018 to date and a number of social behaviour change communication activities at health facilities and community levels have continuously been

implemented. Despite of these interventions, Amolatar has continued to have high numbers of malaria cases compared to other IRS implemented districts in the same region.

Although the contribution of control interventions towards malaria decline in Uganda has been investigated, there is a paucity of data on the prevalence of malaria among children under five years in Amolatar district. This study therefore seeks to fill this gap by determining the prevalence of malaria following mass nets (LLINS) campaign and IRS among under-fives.

1.4 Main objective

The general objective of the study was to determine the prevalence of malaria and its associated factors among children under 5years following mass net (LLINs) campaign and indoor residual spraying in Amolatar district.

1.4.1 Specific Objectives

The specific objectives were to;

1. To determine the prevalence of malaria among children under 5 years following mass LLINS and IRS in Amolatar district.
2. To assess the factors associated with malaria prevalence among under 5 years following LLINS usage and IRS in Amolatar district
3. To assess the perception of mothers/caretakers of children under 5years on the use of LLINs and IRS in malaria prevention in Amolatar district.

1.5 Research questions

1. What was the prevalence of malaria among children under 5 years after mass LLINS and IRS in Amolatar district?
2. What are the factors associated with malaria prevalence among children under 5 years following LLINS usage and IRS in Amolatar district?
3. What was the perception of mothers/caretakers of children under 5years on use of LLINs and IRS in malaria prevention in Amolatar district?

1. 6 Scope of the study

The scope of the study covered time scope, and geographical scope.

1.6.1 Time scope

The study was conducted in between June to December 2021; this involves time for generation of research proposal, proposal defense, data collection, report and manuscript writing and

dissemination of results to the respective stakeholders. The investigator reviewed literatures in between 2015 to 2021.

1.6.2 Geographical scope

The study was conducted in Amolatar district. Amolatar is located in Lango sub region, northern part of Uganda. The district is composed of heterogeneous groups of people while the natives of the district are the Lango.

1.7 Justification

A study conducted in Uganda on factors associated with malaria prevalence, shows that living in modern homes (housing with screened ventilators, adequate light and improved drainage and pavements) was less likely associated to malaria episodes compared to traditional homes (housing with poor lighting system, no drainage, proximal to water body, with busy compound) while controlling for age, gender, and household wealth with malaria incidence of 39% in children living in modern homes compared to children living in traditional homes (Wanzirah, H., Tusting, L. S., Arinaitwe et al., 2015).

Findings from this study would enable address the risk factors associated to the prevalence of malaria among children under 5 years in order to promote continuous behaviour change communication on malaria prevention, hence malaria elimination.

In addition, gaps in LLINs policies and interventions in Uganda that needs to be sensitive to community and regional level factors that affect usage of LLINs on malaria prevention will be highlighted.

Also, strategies to enhance women's knowledge on malaria prevention were indispensable in improving LLINs use, this study aimed to address this through the district stakeholders.

Furthermore, information from this study would enable identify the influence of malaria risk factors to allow a formulation of national malaria control strategy

1. 8 Significance of the study

The findings of this study would be expected to benefit the following;

Government and other decision makers in policy formulation to help come up with additional interventions on malaria elimination and thus improve health of the general public and achieving the sustainable development goal 3 (good health and wellbeing) towards Uganda vision 2040.

The findings will also enable scale up of correct malaria prevention practices and management measures coupled with strengthening social behaviour change communication towards malaria prevention to sustain the practices in the community of Amolatar district and the country at large.

More so the findings will inform the DHT of Amolatar, as well as the community on the prevalence rate of malaria among under five years, so as to develop measures toward elimination of malaria in the community.

1.9 Conceptual framework and narrative of framework

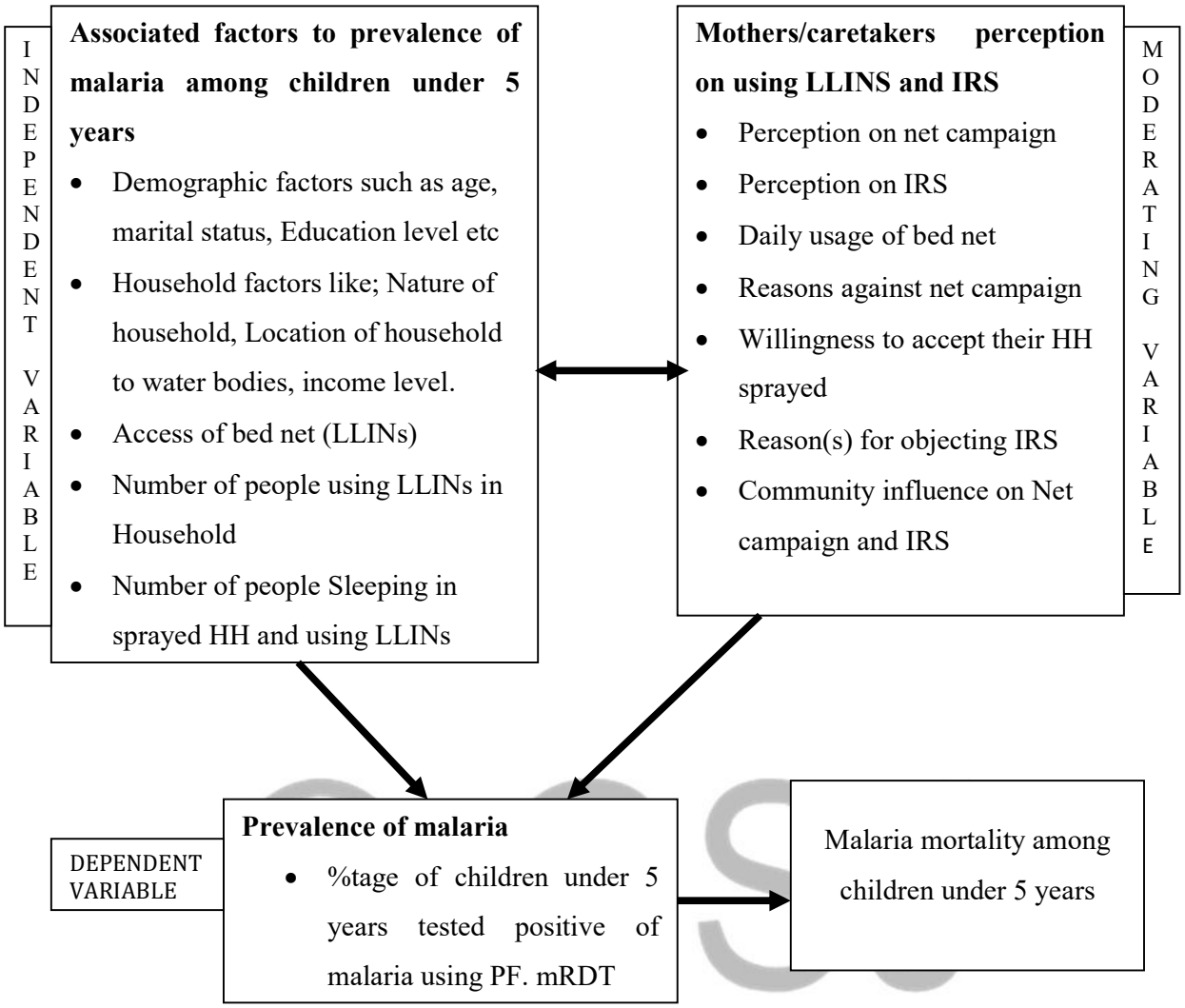

Fig 1: Represent the conceptual framework of the study adopted from integrated model for malaria behaviour (Asingizwe, D., Poortvliet, P. M., Koenraadt et al., 2018).

Framework Narrative

It consists of three variables; associated factors with malaria prevalence among children under 5 years following mass net distribution campaign (LLINs) and Indoor Residual Spraying (IV), Mothers/caretakers perception (Moderating Variable), and prevalence of malaria (DV). In the framework, it's conceptualized that the prevalence of malaria will be eliminated by addressing the factors associated with malaria prevalence i.e. by effectively adhering to mass net campaign (LLINs) and IRS, living far from water bodies, and by addressing mothers/caretakers perception (Choi, L., Pryce, J., & Garner., 2019).

CHAPTER TWO: LITERATURE REVIEW

2.0 Introduction

General observation on literature review showed that LLINs policy and interventions need to be sensitive to the community and at regional level a strategy to enhance knowledge of caretaker of children <5 years on malaria prevention, including existing policies on IRS needs to be scaled up. This evidence was collated through various methods to include a search on Google scholar and HINARI in 2016 to July 2021 using the search terms “malaria”, “prevalence”, “children under five years”, “bed nets”, “IRS”, “LLINs and IRS” and reviewing so many articles.

2.1 The prevalence of malaria among children under 5 years

A study conducted in Arba Minch Zuria district, South Ethiopia shows that prevalence of malaria among febrile children was 22.1% (tested positive for malaria); 50.0%, 48.33% and 1.66% were positive for *plasmodium falciparium, plasmodium vivax* and mixed infections of both parasites, respectively. Malaria infections were associated to the use of LLINs and proximity to stagnant water (Abossie, A., Yohanes, T., Nedu, A., Tafesse, W., &Damitie, M. 2020).

In addition, a study conducted in Guinea showed high malaria prevalence among children under 5 years tested at 35%. Highest prevalence of malaria was observed in Forest Guinea (48%), Lower Guinea (32%), middle Guinea (28%) and Upper Guinea (31%), with plasmodium falciparium being the most common malaria parasite found in children country wide (94.2%) (Beavogui, Delamou et al. 2020). This study was also in line to the study conducted in Mali, where malaria prevalence among children under 5 years (6-23, 24-4, and 42-59 moths) was at 25%, 40.65, and 43.4% respectively. It was also observed that the prevalence was higher in the Central Region (39.8%), followed by the South Region (38.7%) and lastly the Northern Region (20.8%) (Gaston and Ramroop 2020).

Historically, the global community has focused on the control of symptomatic malaria among children under 5 years. However, interest in asymptomatic malaria has been growing, particularly in the context of malaria elimination.

Diagnostic tools with a low limit of detection have allowed development of a more detailed understanding of asymptomatic malaria and its impact. These highly sensitive diagnostics such as mRDT and microscopy have demonstrated that the prevalence of asymptomatic malaria is greater than previously thought (Megnekou, R., Djontu, J. C., Nana, B. C., Bigoga, J. D.,

Fotso, M., et al., 2018). In addition, it is now possible to detect the malaria reservoir among children under 5 years (Children having plasmodium in their blood unknowingly), something that was previously not feasible. Asymptomatic malaria has previously not been treated, but research has begun to examine whether treating individuals with asymptomatic malaria may lead to health benefits by understanding the importance of asymptomatic malaria in ongoing transmission. Therefore, with malaria elimination, asymptomatic malaria can no longer be ignored, especially in light of new ultra-sensitive diagnostic tools (Cheaveau, J., Mogollon, D. C., Mohon, M. A. N., Golassa, L., Yewhalaw, D., et al., 2019).

A study conducted in Ghana indicated a high point prevalence of asymptomatic malaria among children under 5 years by microscopy, RDT, and nPCR to be 23.2%, 31.2%, and 36.8% respectively (Okyere, Owusu-Ofori Okyere, B., Owusu-Ofori, A., Ansong, D., Buxton, R., Benson, S., et al., 2020).

Accordingly, a study conducted in Uganda on the risk factors associated to the prevalence of malaria among children under 5 years with a sample size of 4939 children, showed that 974 children tested positive for malaria, resulting in an observed malaria prevalence of 19.7% from 43.3%. This was attributed to the event of indoor residual spraying that significantly reduced a child's risk of malaria (Roberts and Matthews 2016).

2.2 Factors associated with malaria prevalence following LLINs and IRS in its prevention.

In a community based cross sectional survey conducted in Nigeria in different households among mothers with children below five years, showed that most respondents associated malaria with infected female anopheles' mosquito bites at 99.7% and reported to have sought treatment within 24 hours of noticing the first symptoms of malaria. 37% preferred to use herbs while 17% would take their children to the clinic or dispensary for treatment. 28% of care givers were aware of preventive measures such as ITNs. There was low ownership and use of ITNs among the respondents were only 19% was observed, 29% new about spraying, 29% wearing long sleeved and 13% draining stagnant water (Oluwasogo, Henry et al., 2016) .

In Ghana, malaria accounted for 10.4 million in outpatient department (OPD) visits in 2016 and was responsible for a case fatality rate of 0.32 among children under 5 years. That the same year (2016), the East Akim District of eastern Region of Ghana, which is well known for its mining activities, including artisanal mining, recorded prevalence of 34.1% with the malaria rapid diagnostic test (mRDT) among children 6 to 59 months, the highest in the

region. Several studies have been sought to link the activities of artisanal mining of gold with the increased prevalence of malaria. Deforestation, un rehabilitated mining pits containing stagnant water bodies and other mining related activities are known to promote the proliferation of female anopheles mosquitoes, the vector for *plasmodium* parasite responsible for most of the malaria cases in Ghana. lack of adequate housing, with unsealed windows and doors allowing free entry of mosquitoes, and living less than 25 m from stagnated water body have also been found to be the factors associated with increase exposure to malaria risk (Dao, Djonor et al., Dao, F., Djonor, S. K., Ayin, C. T.-M., Adu, G. A., Sarfo, B., Nortey, P., 2021)

Utilization of long-lasting insecticide nets is regarded as the key strategy in malaria prevention and control. Results of the study conducted in Ethiopia indicate that long-Lasting insecticidal nets are also regarded as a key weapon in the armory of effective malaria vector preventive measures (Tassew, A., Hopkins, R., & Deressa, W., 2017).

According to a study done in Nigeria, Long Lasting Insecticides Treated mosquito nets campaign (LLINs) and indoor residual spraying (IRS) are among the most effective health interventions in reducing the prevalence of malaria disease in endemic areas among the most vulnerable persons; children under age of 5 years, pregnant women and travelers or migrants coming from areas with little or no malaria transmission, who lacked immunity. Sleeping under mosquito nets is one of the best ways for families to protect against malaria (Scott, Hussain et al., 2017). The World Health Organization has reported this as a success story contributing to the decline in the number of malaria cases at the end of 15-year Millennium Development Goals period.

Accordingly, out of the total 663 million malaria cases averted in the past 15 years in the sub-Saharan Africa, 67-73% has been attributed to the extensive distribution of LLINs and insecticide-treated nets (ITNs). This finding is also in line to the study conducted in Peru to eliminate malaria to meet the WHO target of more than 90% reduction by 2030 (Iyer, M., Skelton, J., de Wildt, G., & Meza, G., 2019).

In line to utilization, studies documented that the perceived self-efficacy (belief in one's ability to use malaria preventive measures), and the perceived response efficacy (people's beliefs about the effectiveness of malaria preventive measures) influence the consistent use of these measures. Similarly, Asingizwe et al. indicated that perceived response efficacy of LLINs remains an important reason for using them in case of reduction in malaria incidence and associated low malaria risk perception. Accordingly, both perceived self-efficacy and response

efficacy will positively influence the intentions for the consistent use of malaria preventive measures. If a high proportion of people in the community sleep under LLINs, and accept IRS, then many people in the community may intend to follow the apparent social norm and may plan to consistently do the same (Asingizwe, D., Poortvliet, P. M., Koenraadt, C. J., Van Vliet, A. J., Ingabire et al., 2019).

Additionally, a study done in Bioko Island Equatorial Guinea, showed a substantial reduction in malaria parasite prevalence in children by 43.3% in 2014 to 10.5 % in 2016, and 10.6% of people had *plasmodium falciparium* with and without history of travel and 8.8 without history of travel following distribution of LLINs (Guerra, Citron et al., 2019).

In addition to net usage in preventing and elimination of malaria, Indoor residual spraying (IRS) is also a key tool for controlling and eliminating malaria by targeting vectors. To support the development of effective intervention strategies it is important to understand the impact of vector control tools on malaria incidence and on the spread of insecticide resistance. Achieving IRS of over 85% is adequate to reduce malaria prevalence and therefore, malaria prevalence has declined through decades of control and treatment, with the implementation of insecticide-based vector control proving crucial. IRS is an insecticide-based vector control tool for controlling and eliminating malaria in a variety of malaria epidemiological settings. The utility of IRS as an intervention was first demonstrated during the global malaria eradication campaign (GMEP, 1955-1968) when DDT spraying in combination with case treatment, environmental management and housing improvements, decreased the global population at risk by 700 million. By 1978, the GMEP had resulted in the elimination of malaria from 37 countries. This success led to the expansion of IRS use in Africa where, subsequently, many IRS campaigns have been successful in controlling malaria in arrange of different environments (Tangena, J.-A. A., Hendriks, C. M., Devine, M., Tammaro, M., Trett, A. E., et al., 2020).

Uganda is illustrative of a country where malaria burden remains high and progress on prevention has slowed in recent years. Malaria control efforts in Uganda have primarily focused on LLINs. In 2013-2014, Uganda became the first country to implement a universal LLIN distribution campaign, which was repeated in 2017-2018. In 2018-2019, Uganda had the highest coverage of LLINs in the world, with 83% of households reported owning at least one LLIN (Namuganga, J. F., Epstein, A., Nankabirwa, J. I., Mpimbaza, A., Kiggundu, M., et al., 2021).

Similarly, the trend of the average number of LLIN per household significantly increased from the baseline with a greater percentage of households owning more than3 LLINS after the campaign. Over 855 of LLINs owned both at the baseline and after the mass campaign were treated brand with deltamethrin. However the largest source of LLINs at baseline was government health facility (39.885%) while the mass campaign was the largest source of LLINs owned during the second survey assessment (Wanzira, H., Eganyu, T., Mulebeke, R., Bukenya, F., Echodu, et al., 2018).

In contrast to LLINs, the implementation of IRS in Uganda has been focal and limited. In 2006, IRS was introduced into Uganda for the first time since the 1960s. In 2007-2009, the IRS program was shifted to ten high burden districts in the north, leading to large reductions in malaria burden. In 2014, the IRS program was relocated from these ten northern districts to 14 districts in the eastern part of the country, where it has been sustained. The discontinuation of IRS in the ten northern districts was followed by a marked resurgence in malaria cases, promoting the implementation of a single round of IRS in these ten districts in 2017 (Namuganga, J. F., Epstein, A., Nankabirwa, J. I., Mpimbaza, A., Kiggundu, M., et al., 2021).

2.3 The perception of mothers/caretakers on the use of LLINs and IRS in malaria prevention

A study conducted in Tanzania shows that, the use of bed nets for malaria prevention has been stressed in a number of campaigns and malaria prevention programmes. Most of the respondents believe that there is outdoor malaria transmission since they use interventions while indoors, but they are unaware of changing mosquito host-seeking behavior. Participants pointed out that they were frequently bitten by mosquitoes during the evening when outdoors, compared to when they were indoors. Most participants stay outdoors in the evening to undertake domestic tasks that cannot be conducted indoors.

There is a confusion regarding ongoing malaria transmission within the study areas, despite the high use of available interventions such as LLINs. People use these interventions, but still get fevers and so seek medical care so they feel that the disease is far from disappearing.

The use of bed nets is seen to be the only protection from malaria since many programmes have stressed this intervention compared to IRS (Moshi, I. R., Ngowo, H., Dillip, A., Msellemu, D., Madumla, E. P., et al., 2017).

Also, a study conducted in Rwanda on individual perception showed that participants very often use LLINs (66.6%), and accept IRS (73.9%) (Asingizwe, D., Poortvliet, P. M., Koenraadt, C. J., Van Vliet, A. J., Ingabire, et al., 2019). The intentions to use malaria preventive measures were

consistently driven by perceived response efficacy, and subjective norms, and hindered by perceived barriers. The intentions were also positively associated with actual use of LLINs, and acceptance of IRS. They also believed that repetitive episodes of malaria are caused by the perceived low effectiveness of anti-malaria medications. Lack of LLINs increased the perceived added value of LLINs, and together with increased malaria burden increased the perceived response efficacy (Asingizwe, D., Poortvliet, P. M., Koenraadt, C. J., Van Vliet, A. J., Ingabire, et al., 2019).

Further, the Rwandan study (Asingizwe, D., Poortvliet, P. M., Koenraadt, C. J., Van Vliet, A. J., Ingabire, et al., 2019). showed that perceived barriers to use LLINs and acceptance of IRS include feeling too hot when sleeping under the LLINs, discomfort, irritability, and presence of bed bugs or other insects after spraying, were reported. These factors were reported to hinder the use and acceptance of malaria preventive measures. Consequently, perceived barriers will negatively influence behavioural intentions. Previous studies indicated that both ownership of at least one LLIN and access (having sufficient LLINs) are strong determinants for its use. Therefore, not having enough LLINs (having at least one LLIN) and access (having enough LLINs: one per two people) will moderate the effect of intention on the use of LLINs (Asingizwe, D., Poortvliet, P. M., Koenraadt, C. J., Van Vliet, A. J., Ingabire, et al., 2019).

Furthermore, findings from Northern Uganda reveal that the high usage of IRS and LLINs by households are similar to those observed in East Africa region (Echodu, Oyet et al., 2020) of Kenya and Tanzania to 84%. However, LLINs is the major malaria vector tool used to prevent malaria in Africa followed by IRS. Therefore, the high usage of IRS and bed nets could be explained perharps on the basis of perception; that given a choice between residual insecticides sprayed indoors and treated bed nets, insecticides are not acceptable to 100% of the 24 households identified to be predisposed, or to a minor extend that bed nets are not a requirement once indoor spraying has taken place. Lack of bed nets was observed as a driving force to spraying insecticides indoor. For intervention, the households relay mostly in treatment after contracting malaria while the household with no bed nets relies primarily on clearing grasses around the house to remove mosquito hiding places. There appears to be a perception that bed nets are unnecessary once IRS was applied (Echodu, R., Oyet, W. S., Iwiru, T., Apili, F., Lutwama, J. J., al., 2020).

2.4 Summary of literature and research gaps

Following the reviewed and segregated data in literature, it is evidenced that a number of factors interplay and influence prevalence of malaria among children under 5 years following mass LLINs campaigns and IRS that include few public health workers to promote continuous

social behaviour change communication in relation to the population served was identified, which strengthened the need to conduct the study.

Additionally, literatures indicated gaps in not using LLINs due to not hanging nets, limited perceived benefit of nets and religious beliefs, as well as myths and misconceptions among target beneficiaries. All these increase the prevalence of malaria cases among children under 5 years.

Also, literature showed gaps in LLINs policies and interventions in Uganda that need to be sensitive to community and regional level factors that affect usage. Strategies to enhance women's knowledge on malaria prevention are indispensable in improving LLINs use.

CHAPTER THREE: METHODOLOGY

3.0 Introduction

This chapter describes the study area, study populations, study design, sample size, sampling procedure, study variables, data collection methods, techniques, data management, data analysis and ethical considerations.

3.1 Study design

The study was a community based-descriptive cross-sectional research using a quantitative data collection method. The study therefore used community structures to access study participants.

3.2 Study area

The study was carried out in Amolatar district, located in Lango sub-region, Northern Uganda. Amolatar district is bordered by Apac district, Kwania district to the North, Dokolo district to the Northeast, Kaberamaido district to the East, Buyende district to the Southeast, Kayunga district to the South and Nakasongola to the West. The administrative headquarters of the district of Amolatar is 85 kilometers (53 mi), by road, South of Lira City. This location lies about 185 kilometers (115 mi), by road, Northwest of Kampala, the capital of Uganda and the largest city in the country. Amolatar is covered by two large water bodies of Lake Kyoga and Lake Kwania. Amolatar experience two rainy seasons per year, with heavy rains from March to May and sometimes light rains between September and December. The peak incidence of clinical malaria follows the peaks of the rain with a delay of about 4 to 6 weeks.

Amolatar is amongst the 135 districts in Uganda. It has 16 local administrative units and a catchment population of 147,166 persons (UBOS, 2014 census report).

The main economic activities of residents include subsistence farming (maize, millet, sorghum, cassava, simsim, cotton, beans and groundnuts), fishing, animal rearing and bee keeping.

3.3 Study population

The study population were children <5 years and the target population were mothers/caretakers of children <5 years in Amolatar district from which the sample was drawn.

3.4 Inclusion and exclusion criteria

3.4.1 Inclusion

The mothers/caretakers of children under the age of 5 years and was a true resident of the household or if had migrated from another area must have stayed for six months and more, participated in the study. Consent of the caretaker and assent of the children was ideal.

3.4.2 Exclusion

The mothers/caretakers of children under the age of 5 years who was severely ill to talk during the interview.

3.5 Sampling size determination

The sample size was estimated using Kish Leslie 1965 formula for a single proportion (Kish 1965).

$$N = \frac{Z^2 * P(1-P)}{e^2}$$

Where; N- The sample size

Z - Z-score at confidence level of 95% (1.96)

P – Estimate of prevalence of malaria in children under age 5 years

e - Margin of error (+/-5%).

According to the study done on age-specific prevalence of hospitalized pediatric malaria in Uganda, malaria prevalence in children aged 0-59 months in the country on average stood at 16.9% in 2018-2019 (Mpimbaza, Walemwa et al., 2020). Substituting the value in the formula;

$$N = \frac{1.96^2 * 0.169(1-0.169)}{0.05^2}$$

N = 216 (sample size)

To cater for non-responses, 10% of the sample size was added to get the actual sample size. This implied that, N= (10/100) *216 + 216 = 237.6 = 238 respondents (mothers/caretakers of children under 5 years) and 238 of their children under 5 years were tested.

3.6 Sampling methods and techniques

Probability sampling methods were used, focusing on clusters at the district, a list of all the 15 sub-counties were generated and a simple random sampling by ballot technique was used to select at least 5 representative sub-counties. From the 5 sub-counties, lists of all the parishes in each sub county were then generated and using simple random sampling, two (2) parishes in each sub county were selected. At the parish, lists of all the villages were also generated and simple random sampling by ballot technique was then used to select three (3) villages from each parish. At the

village level, sampling proportionate to size and simple random sampling were employed using a table of random numbers of households with children under five generated from the VHT/Village register where at most 9 respondents were obtained to take part in the study.

Table 1 showing sampling procedure to obtaine the respondents

District	Sub-counties	Parishes	Villages	Respondents
	Simple random sampling by Ballot technique	Simple random Sampling	Simple random sampling by Ballot technique	Simple random Sampling using Random number Table
15 Sub-Counties	Muntu (5 parishes)	Nakatiti (7 villages)	Kitaleba "A"	9
			Nakatiti	9
			Agule	8
		Abaler (6 villages)	Alumyomiwangi	7
			Adyang Lit	7
			Apokmitimogo "C"	7
	Agwingiri (4 parishes)	Alemere (13 villages)	Farm t/c	7
			Kizimba "A"	7
			Oulo	7
		Alyecmeda (17 villages)	Abko t/c	7
			Barayom	7
			Akuri "A"	7
	Agikdak (4 parishes)	Alobokwe (9 villages)	Alwitlongo	7
			Alobokwe	7
			Acanmakweri	7
		Agikdak (9 villages)	Awekiryeko	7
			Onenomac	7
			Acapa	7
	Awelo (5 parishes)	Atomoro (8 villages)	Agonyi	7
			Dilikup	7
			Ageno-Obanga	7
		Atero (11 villages)	Oboloagit	7
			Putaoyitoyat	7
			Atero	7
	Nalubwoyo	Amolatar	Ocamolum "B"	7

	(4 parishes)	(6 villages)	Amolatar "B"	7
			Amolatar "A"	6
		Nalubwoyo	Opir	5
		(15 villages)	Kida "A"	8
			Kibugu	9
Totals	5sub counties Selected	10 parishes	30 villages	238 respondents

3.7 Study procedure

After ethical clearance was obtained from Gulu University Research Ethics Committee (GUREC), permission to collect data was sought from the Chief Administrative Officer (CAO) through the District Health Officer (DHO) of Amolatar district; through to the sub county accounting officers (SACO), the parish local council II (LCII) and the village local council I (LCI); where required number of households with children under five years in each village was reached for interviews and sample removal from the children. The study participants were then informed of the purpose of the study "to determine the prevalence of malaria among children under 5 years following mass net campaign and indoor residual spraying in Amolatar district" and that their participation was entirely voluntary. This would enable detection of asymptomatic cases of malaria and who were referred for treatment to the VHTs or the nearest health facility. The risk involved of children crying when collecting blood sample was also well explained to the participants. They were also informed that they were free to withdraw at any time without coercion. To confirm participation in the study, the caretaker was required to sign/thumb print a consent form and an assent form for the child under five years.

3.8 Data collection methods, tools and procedure

Both semi-structured questionnaires and observations checklists for quantitative data were used. The questionnaires were pre-tested by researcher in the field before actual data collection to ensure data validity. The pre-testing was carried out on 9 participants in one of the villages in Amolatar town council that was not part of the study setting, to help determine the effectiveness of the questionnaires and adjustments made where necessary. The questionnaires were written in English and translated in Lango language with the help of the traditional leaders. Translated questionnaires were checked for accuracy through back translation. Eight (8) data collectors comprising of 4 health workers and 4 VHTs were trained on data collection, blood sample collection and screening for *plasmodium* spp. a causative agent for malaria disease using PF.

mRDT on children under 5 years. All the data collected was entered in excel sheet, saved and kept under lock and key.

Quantitative data collected

Semi-structured questionnaires and observation check lists were used to collect data that comprised of socio-demographic characteristics, use of LLINs and IRS, and mothers/caretaker's perception on using LLINs and IRS in malaria prevention. The investigator used face-to-face interviews to gather participants' views on usage of LLINs and IRS as interventions for malaria elimination; and a blood sample was requested from the respondents' child under 5 years to determine the prevalence of malaria among children under 5 years in Amolatar district. After the interview, the respondents were then debriefed and appreciated for their participation by giving each of them 5000/=. At most, 8 interviews were conducted by each data collector under close supervision of the investigator each day.

3.9 Measurement of study variables

3.9.1 Dependent variables

The prevalence of malaria among children under 5 years was detected using results from plasmodium falciparum malaria rapid diagnostic test (PF. mRDT).The following procedure was followed:-

The Research Assistants began by checking the expiry date on the test packet, put on the new pair of gloves for each child, opened the packet and removed the test, pipette and then wrote the name of the child on the test, then open the alcohol swab, grasp the child's 4^{th} finger on the left hand and cleaned the finger using alcohol swab. Allowed the finger to dry before pricking, open the lancet and pricked the child's finger to get a drop of blood; the lancet was then discarded in the safety box. The data collector then gently squeezed the bulb of the pipette and touched its tip to the drop of blood. S/he gently released the bulb of the pipette and drew the blood up to the first line of the pipette; touch the tip of the pipette to the sample hole marked "s" and squeezed gently to transfer the blood and discarded the pipette in the safety box. Then put two (2) drops of buffer in the assay hole marked "A". Waited for 20 minutes then read the results. For positive, a line in "C" and a line in "T" meant the child had falciparium malaria, and for negative, a line in "C" and no line in "T" meant the child had no falciparum malaria, for invalid results, no line in "C" and a line or no line in "T" meant the test was invalid. The gloves and alcohol swabs were also discarded in the non-sharp biohazard pill. The children found positive of falciparium malaria were referred to the nearest health facility for malaria treatment and the mothers appreciated for their time. In all the steps, Covid-19 guidelines were observed.

3.9.2 Independent variables

Factors associated with prevalence of malaria, and mothers'/caretakers' perception on usage of LLINs and IRS as interventions for malaria prevention and elimination was assessed using the semi-structured questionnaire and responses summarized into proportions.

3.10 Data management and analysis

The principal investigator reviewed the field questionnaires to ensure completeness and accuracy of the information collected. The coded data was entered in Epidata software and cleaned. Data was analyzed using STATA version 15. During the analysis, the principal investigator conducted univariate, bivariate and multivariate analyses. Hosmer-Lemeshow test was used to test for the goodness of fit of the final logistic regression model by backward elimination method

Univariate analysis; was used for both categorical and continuous variables. Categorical variables like sex, education, marital status, and religion were summarized using proportions, percentages and frequencies while continuous variable like age, was summarized using mean, mode, range and standard deviation. This was presented in table and graph.

Bivariate analysis; was used to assess the association between independent and dependent variables. The results were expressed in chi-square values and p-values at 95% confident interval, and statistical significance was set at a P-value 0.2, presented in table.

Multivariate analysis; variables that were significant at bivariate analysis were reconsidered for multivariate analysis. The result was expressed in adjusted odds ratio at 95% confident interval and independent variables with p-value of <0.05 were considered significantly associated with prevalence of malaria among the under-fives. Significant variables from bivariate analysis were run in a logistic model using the backward elimination method and the result presented in table.

3.11 Quality control

3.11.1 Validity

This was ascertained by pre-testing the questionnaires prior to data collection, sticking to inclusion and exclusion criteria; and adjusting appropriately to increase the validity of the results being collected.

3.11.2 Reliability

A cronbach test was done from the pretest and these had a reliability coefficient of r=0.85. During data collection, questioners were checked for completeness and corrected. Furthermore the study tools were adopted and modified from other studies (Asingizwe, Poortvliet et al. 2019)

3.12 Ethical considerations

3.12.1 Approval

The proposal was presented to and reviewed by Gulu University Research and Ethics Committee and also administrative clearance was obtained from CAO's office through the DHO Amolatar district, through the sub county accounting officers (SACO), to the parish local council II (LCII) and to the village local council I (LCI) prior to data collection.

3.12.2 Informed Consent

A written informed consent and assent were obtained from the eligible research participants (mothers/caretakers and children under 5 years) after thorough explanation of research objectives, and the main goal of the study, risks from the study and how to mitigate the risks was communicated to them in the language they better understood and why their participation was necessary.

3.12.3 Privacy protection

Privacy was maintained by interviewing respondents in private places away from others, sticking to research and ethical procedures.

3.12.4 Confidentiality

For confidentiality to be guaranteed, the principal investigator avoided identifiers such as names on participants' information but rather used codes and put passwords on the laptop containing participants' data; and kept under lock and key control with secret pass word. Honesty was also adopted throughout the research process- in collecting and reporting data and the results of the study. All questions used and sources were clearly distinguished and acknowledged by means of references. At the end of the study, after five years period has elapsed, the questionnaires will be burnt.

3.13 Study limitations

Some of the limitations expected to be experienced during the study and the possible mitigation measures included the following;

Selection bias especially for individuals with whom the research team could not communicate with effectively, this was solved by recruiting individuals who were skilled in communicating with these participants.

3.14 Disseminations of findings

The results of the study were submitted to Lira University in partial fulfillment of the requirements for the award of the degree of master of public health; Published in scientific journal, and dissemination meeting would be held in Amolatar district.

3.15 Covid-19 management.

Use of masks, hand washing, hand sanitizer and social distancing were observed at every step for Covid-19 prevention. The principal investigator advocated for vaccination of the research team and reported of any signs and symptoms of Covid-19 from the community to the authorities of Amolatar.

CHAPTER FOUR: RESULTS

4.1 Prevalence of malaria among children under five years

The study aimed at finding the prevalence of malaria and associated factors among children under-fives following mass distribution of long-lasting insecticide treated mosquito nets (LLINs) and indoor residual spraying (IRS) in Amolatar district. All the intended respondents (238) were interviewed and up to 44.1% (105/238) of the children had malaria. A majority 88.7% (211/238) of the respondents knew the signs and symptoms of malaria where the most common symptom mentioned was fever 42.0% (100/238), followed by vomiting 30% (71/238) and the least was convulsion 0.84% (2/238).

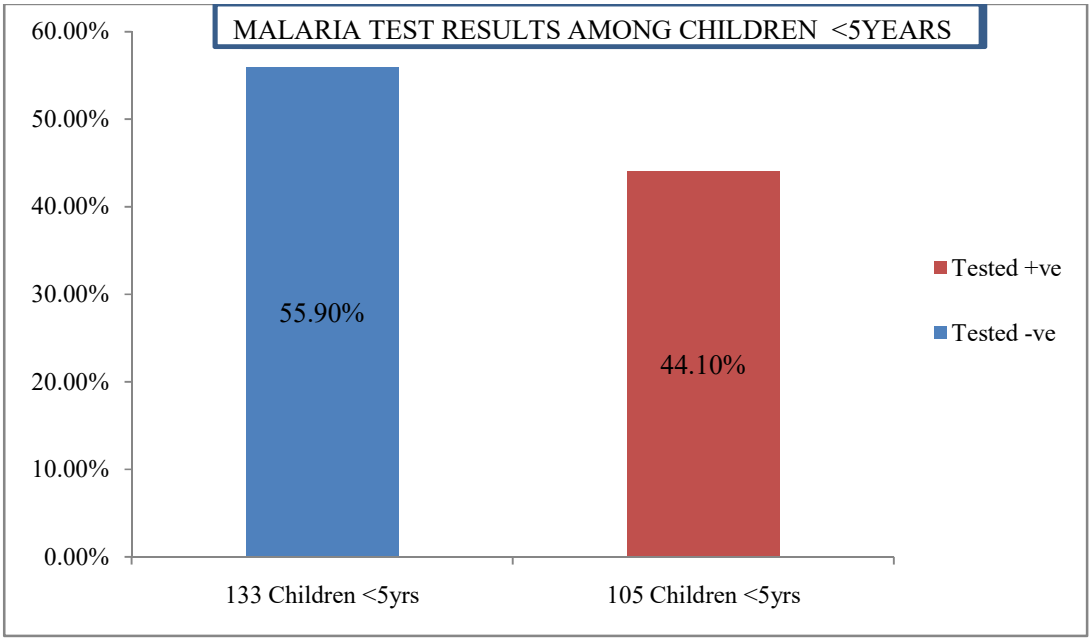

Figure 2 Showing malaria test results among children <5years

4.2 Socio Demographic characteristics

From table1 below, most of the caretakers were female 83.1% (198/238), aged between 25 and 34 years 38.2% (91/238), and married 73.5% (175/238) and Catholic 45.4% (108/238). Half of the caretakers had attained primary school 50% (119/238), only 3.4% (8/238) had University education. Most of them were peasants 86.6% (206/238) and had at least a child aged below 5 years in the household 63% (150/238). More than half of the children were aged between 1 and 3 years, and lived in temporary homes 68.5% (163/238). Most of the households had radios 66% (157/238).

Table 2: Socio Demographic characteristics of respondents (N=238)

Variable	Frequency (n)	Percentage (%)
Gender		
Male	40	16.8
Female	198	83.2
Age		
15-24 years	45	18.9
25-34 years	91	38.2
35-44 years	69	29.0
≥45 years	33	13.9
Marital Relationship		
Single	38	16.0
Married	175	73.5
Divorced	11	4.5
Widowed	14	6.0
Religion		
Protestant	72	30.2
Catholic	108	45.4
Muslim	4	1.7
Born again	25	10.5
Others	29	12.2
Level of Education		
No formal education	17	7.1
Primary Education	119	50.0
Secondary Education	94	39.5
Tertiary /University	8	3.4
Occupation		
Peasant	206	86.6
Businessperson	25	10.5
Professional	1	0.4
Unemployed	4	1.7
Others	2	0.8
Average monthly income		
≤100,000/=	212	89.1
100,000/= – 500,000/=	21	8.8

500,000 – 1,000,000/=	5	2.1
No. of under 5years in household		
1 year old children	150	63.0
2 year old children	72	30.3
3 year old children	12	5.0
≥4 year old children	4	1.7
Age of Under5 years		
<1 year	21	8.8
1-3 years	159	66.8
4 years	58	24.4
Type of residential house		
Permanent	20	8.4
Semi-permanent	55	23.1
Temporary	163	68.5
Radio in the household		
Yes	157	66.0
No	81	34.0

Table 3 shows that the age of the caretaker (p=0.15), their marital status (p=0.06), level of education (p=0.07), age of child (p=0.08), type of residence (p=0.19), and the distance to the water body (p=0.02) had associations with the prevalence of malaria among children under five at a cut-off p value of 0.2.

Table 3: Association between Socio Demographic characteristics and prevalence of Malaria

Variable	Prevalence of Malaria		Total	Chi-square	P-value
	Positive n (%)	Negative n (%)			
Gender					
Male	19 (47.5)	21 (52.5)	40	0.2231	0.64
Female	86(43.4)	112 (56.6)	198		
Age					
15-24 years	18(39.1)	28(62.2)	46	5.2440	**0.15***
25-34 years	35(38.9)	55(60.4)	90		
35-44years	32(46.4)	37(53.6)	69		
35-44 years	20(60.6)	13(39.4)	33		
Marital Status					
Single	23(60.5)	15(39.5)	38	7.5628	**0.06***
Married	68(38.9)	107(61.1)	175		
Divorced	6(54.5)	5(45.5)	11		
Widowed	8(57.1)	6(42.9)	14		
Religion					
Protestant	28 (38.9)	44 (74.3)	72	1.7807	0.78
Catholic	50 (46.3)	58 (100.0)	108		
Muslim	2(50.0)	2(50.0)	4		
Born Again	13(52.0)	12(48.0)	25		
Others	12(41.4)	17(58.2)	29		
Education level					
None	9(52.9)	8 (47.1)	17	7.0119	**0.07***
Primary level	61(51.3)	58 (48.7)	119		
Secondary level	32 (34.0)	62 (66.0)	94		
Tertiary/University	3 (37.5)	5 (62.50)	8		
Monthly income					
≤100,000/=	97(45.8)	115(54.2)	212	2.3235	0.31

100,000/= – 500,000/=	6(28.6)	15(71.4)	21		
500,000 – 1,000,000/=	2(40.0)	3(60.0)	5		
Age of Child					
<1 year	8(38.1)	13(61.9)	21	5.1146	**0.08***
1-3 years	64(40.3)	95(59.7)	159		
4 years	33(56.9)	25(43.1)	58		
Type of house					
Permanent	9(45.0)	11(55.5)	20	3.3018	**0.19***
Semi-permanent	30(54.5)	25(45.5)	55		
Temporary	66(40.5)	97(59.5)	163		
Distance to water					
≤ 1Km	70(40.9)	101(59.1)	101		**0.02***
2- 5Km	27(46.6)	31(53.4)			
≥6Km	8(88.9)	1(11.1)			
Radio present					
Yes	67(42.7)	90(57.3)	157		0.53
No	38(46.9)	43(53.1)			

4.3 Factors associated with malaria prevalence among children under 5 years

Most of the care-takers reported having LLINs 92% (219/238); had hanged and slept under the net the previous night 89.5% (213/238). Majority of the respondents had got the nets through the mass distribution campaign 82.8% (197/238) and only two respondents had bought the nets 0.8% (2/238). The findings revealed that up to 18 homes did not have nets 7.6% (18/238). Most of the respondents had allowed IRS in their homes and their house were sprayed within the previous 12 months 98.3% (234/238).

Table 4: showing factors associated with malaria prevalence among <5 years

Variable	Frequency (n)	Percentage (%)
Have a LLIN		
Yes	219	92.0
No	19	8.0
How got the Net		
Did not get the net	18	7.6
Mass distribution campaign	197	82.8
During antenatal care visit	11	4.6
During an immunization visit	9	3.8
Bought	2	0.8
Others	1	0.4
Number of LLINs at home		
0 net	18	7.6
1-2	136	57.1
3-4	74	31.1
>4	10	4.2
When got LLIN		
Don't remember	13	5.5
≤5	34	14.3
6 to 10	103	43.2
≥ 11	88	36.0
Slept under LLIN last night		
Yes	213	89.5
No	25	10.5
Net hanged		
Yes	213	89.5
No	25	10.5

Reasons for not sleeping under LLIN		
Am sleeping under the net	213	89.5
Net too old	20	8.4
Unable to hang	1	0.4
Don't like the smell	1	0.4
It takes too long to be distributed	3	1.3
IRS in the past 12 months		
Yes	234	98.3
No	4	1.7
Reasons for not spraying house		
My household was sprayed	232	97.5
Religious belief	1	0.4
Net too old	1	0.4
The insecticide itches	3	1.3
Health-related issues	1	0.4
Distance of the household from the water body		
≤ 1Km	171	71.8
2- 5Km	58	24.4
≥6Km	9	3.8

Following bivariate analysis, having a mosquito net (p=0.001), number of nets at home (p=0.001), sleeping under the net (p=0.003), and having the net hanged (p=0.001) had associations with the prevalence of malaria among children under 5 years.

Table 5: Association of factors associated with Malaria prevalence among children <5yrs

Variable	Prevalence of Malaria		Total	Chi-square	P-value
	Positive n (%)	Negative n (%)			
Have a mosquito net					
Yes	90(41.1)	129(58.9)	219	10.1601	**0.001***
No	15(78.9)	4(21.5)	19		
Number of LLINs at home					
0 net	14(77.8)	4(22.2)	18	10.7474	**0.01***
1-2	57(41.9)	79(50.1)	136		
3-4	28(37.8)	46(62.2)	74		
>4	6(60.0)	4(40.0)	10		
Slept under LLIN last night					
Yes	87(40.90)	126(59.1)	213	8.8086	**0.003***
No	18(72.0)	7(28.0)	25		
Net hanged					
Yes	86(40.4)	127(59.6)	213	11.5173	**0.001***
No	19(76.0)	6(24.0)	25		
IRS in past 12 months					
Yes	104(44.4)	130(55.6)	234	0.6031	**0.44**
No	1(25.0)	3(75.0)	4		
Distance to water					
≤ 1Km	70(40.9)	101(59.1)	101		**0.02***
2- 5Km	27(46.6)	31(53.4)			
≥6Km	8(88.9)	1(11.1)			

4.4 Perceptions of mothers regarding LLINs and IRS

Most of the respondents had demanded that their houses be sprayed 93.3% (222/238), and had not smeared their walls with anything 68.5% (163/238). Most of the respondents said that the government had played a great role in the prevention of malaria through distribution of LLINs and spraying of houses 69.3% (165/238) and that they would continue using the mosquito nets 89.9% (214/238).

Table 6: Perceptions of caretakers regarding LLINs and IRS use (N=238)

Variable	Frequency (n)	Percentage (%)
House sprayed on demand		
Yes	222	93.3
No	16	6.7
Smeared the walls		
Yes	75	31.5
No	163	68.5
Continue using LLIN		
Yes	214	89.9
No	24	10.1
Government played a role		
Yes	165	69.3
No	73	30.7
What government can do		
Already contented	164	68.9
Conduct vaccination	31	13.0
Empower women	12	5.0
Community sensitization	23	9.7
Others	8	3.4

Following the bivariate analysis, continuing to use LLINs (p=0.02), government played a role (p=0.006) and what the government can do to prevent malaria (p=0.02) had associations with prevalence of malaria among children under five years.

Table 7: Association of mothers' perception regarding use of LLINs and IRS with prevalence of Malaria

Variable	Prevalence of Malaria		Total	Chi-square	P-value
	Positive n (%)	Negative n (%)			
House sprayed on demand					
Yes	98(44.1)	124(55.9)	222	0.00	**0.98**
No	7(43.7)	9(56.3)	16		
Smeared the walls					
Yes	33 (44.0)	42(56.0)	75	0.00	**0.98**
No	72(44.2)	91(55.8)	163		
Continue using LLIN					
Yes	89(41.6)	125(58.4)	214	5.50	**0.02***
No	16(66.7)	8(33.3)	24		
Government played a role					
Yes	63(38.2)	102(61.8)	165	7.69	**0.006***
No	42(57.5)	31(42.5)	73		
What government can do					
Already contented	62(37.8)	102(62.2)		11.81	**0.02***
Conduct vaccination	17(54.8)	14(45.2)			
Empower women	6(50.0)	6(50.0)			
Community sensitization	13(56.5)	10(43.5)			
Others	7(87.5)	1(12.5)			

4.5 Multivariate Analysis

Children living with married caretakers had a more than 2.54-fold increased odds of testing positive from malaria compared to those living with single caretakers. Children who stayed far away from water bodies had reduced odds of testing positive of malaria compared to those who stay near water bodies. Caretakers who had a poor perception towards LLIN use had 0.32 reduced odds of preventing their children from malaria as compared to those who had a good perception of using nets.

Table 8: Multivariate analysis of final logistic regression

Prevalence of Malaria	**aOR**	**p-value**	**95% Confidence Interval**	**Sig**
Marital Status: Single	1.00			
Married	2.54	0.01	1.23-5.25	**
Divorced	1.43	0.61	0.36-5.80	
Widowed	1.22	0.75	0.36-4.10	
Distance from water body: <2km	1.00			
2-5km	0.75	0.37	0.41-1.40	
More than 5km	0.07	0.01	0.01-0.56	**
Continue using LLINs: Yes	1.00			
No	0.32	0.009	0.14-0.76	***
Constant	0.81	0.55	0.41-1.60	

**** p<.01, ** p<.05, * p<.1, aOR adjusted Odds Ratio*

CHAPTER FIVE: DISCUSSION

5.0 Introduction

The study aimed at determining the prevalence of malaria and associated factors among children under-fives following mass distribution of long-lasting insecticide treated mosquito nets (LLINs) and indoor residual spraying (IRS) in Amolatar district. A total of 238 intended respondents were interviewed and a majority 88.7% knew the signs and symptoms of malaria-where the most common symptom mentioned was fever 42.0%, followed by vomiting 30% and the least was convulsion 0.84%. This finding is in line with the previous studies conducted in Arba Minch Zuria district, South Ethiopia (Abossie, A., Yohanes, T., Nedu, A., Tafesse, W., & Damitie, 2020). This can be explained by the fact that the residents were exposed to continuous episodes of malaria infection from which they experienced the signs and symptoms; they constantly received information about malaria on radio, Community health workers and VHTS.

5.1 Prevalence of Malaria among children under five years

In this study, the finding indicates that prevalence of malaria among children under five years in Amolatar district was found to be 44.1%. This is a high prevalence compared to the National target of 24.6% as of July 2022 (MoH Report), given the recent interventions of indoor residual spraying and the mass net campaign in the district. This could be due to the difference in the perception of caretakers towards LLINs use at their homes in relation to preventing malaria. This finding is similar to that of a study conducted in Guinea which reported a prevalence of 35% with the highest prevalence observed in Forest Guinea (48%), Lower Guinea was at 32%, middle Guinea at 28% and Upper Guinea at 31% (Beavogui, A. H., Delamou, A., Camara, B. S., Camara, D., Kourouma, K., et al., 2020). However, the findings are in disagreement with those of studies in Ethiopia and Uganda which reported low prevalence among children under five. A study conducted in South Ethiopia in Arba Minch Zuria district reported a prevalence of 22.1% (Abossie, A., Yohanes, T., Nedu, A., Tafesse, W., & Damitie, 2020) and a study conducted in Uganda reported a prevalence of 19.7% (Roberts and Matthews 2016). The differences in the results of these studies could be attributed to the differences in the study areas which mean differences in factors that interplay to cause spread of the malaria infection among the populations.

5.2 Factors associated with Prevalence of Malaria among children under five years following mass net campaign and IRS

Children living with married caretakers had a more than 2-fold increased odds of testing positive from malaria compared to those living with single caretakers. This could be because some of the married couples give the children to their fellow children to sleep with as soon as

they start walking in order to avoid disturbance from the children in night. The children being young and naive may at times fail to ensure the under-fives sleep under mosquito nets and thus expose the children to mosquito bites that spread the malaria. The finding of this study disagree with that of a survey conducted in Ghana which reported that mother's marital status had no significant relationship with malaria prevalence among under-five children for the five-year period preceding the survey (Nyarko, S. H., Cobblah, A. J. M. r., & treatment. 2014). The differences in the results of these studies could be attributed to the differences in the socio-cultural practices among married mothers which mean differences in the factors associated with malaria prevalence among children under 5 years old.

Children who stayed far away from water bodies had reduced odds of testing positive of malaria compared to those who stay near water bodies. This is because the water bodies are breeding sites of mosquitoes which spread malaria among the people. Therefore, living near water bodies means increased risk of exposure to mosquito bites that spread the malaria as compared to living far away from the water bodies. This finding concurs with that of a study conducted in Ethiopia which reported that children who lived around stagnant water were 2.01 times more likely to have malaria infection than those who lived beyond 2 km away from stagnant water (Abdishu, M., Gobena, T., Damena, M., Abdi, H., Birhanu, et al., 2022). Additionally, the finding of this study is in line with that of a study conducted in artisanal mining communities in Ghana which reported that residing close to stagnant water (≤ 25 m) from an artisanal mining site was statistically significantly associated with prevalence of malaria (Dao, F., Djonor, S. K., Ayin, C. T.-M., Adu, G. A., Sarfo, B., et al., 2021).

5.3 Perceptions of mothers/caretakers regarding LLINs and IRS

The current study results show that caretakers who had a poor perception towards LLINs use had 0.32 reduced odds of preventing their children from malaria as compared to those who had a good perception of using nets. This is because poor perception leads to less usage of the mosquito nets. For the parents who perceive that the nets are not effective in preventing malaria, their children are less likely to sleep under nets compared to those who perceive nets as good in preventing malaria. Therefore, failure to sleep under the nets exposes the children to mosquito bites thus increasing chances of getting malaria infection. This finding is in line with results of other studies which have documented that the perceived response efficacy (people's beliefs about the effectiveness of malaria preventive measures) influences the consistent use of these measures. For example Asingizwe et al indicated that perceived response efficacy of LLINs remains an important reason for using them, because it positively influences the intentions for the consistent use of malaria preventive measures (Asingizwe, D., Poortvliet, P. M., Koenraadt, C. J., Van Vliet, A. J., Ingabire, et al., 2019).

CHAPTER SIX: CONCLUSION AND RECOMMENDATIONS

6.1 Conclusion

The study found out that malaria infection is highly prevalent among children under five years in Amolatar district despite mass net campaigns (LLINS) and IRS implementation. Being married, living near the water bodies and poor perception towards LLINs use and IRS had statistically significant relationships with malaria prevalence.

6.2 Recommendations

There is need for the district health team to strengthen malaria prevention and control activities through constant active health education campaigns at community level in order to curtail the high malaria burden among under five children. This will help in improving the perceptions of married mothers/caretakers on malaria preventions among children under 5 years.

Concerted efforts should be focused on ending negative perceptions of married mothers in taking full responsibility to ensure their children are not exposed to mosquito bites at night while sleeping LLINs.

Government should sponsor scientific innovation tailored toward development of malaria vaccine to cover the entire population against malaria infection especially vulnerable populations thus reduction of infant and maternal mortality related to malaria induced anemia.

The district health teams in collaboration with the local government of Amolatar district should focus on health information dissemination about eliminating stagnant water bodies around homes, LLINs utilization, wearing long-sleeved clothes while still outdoor at night, as well as screening of windows and ventilators of houses to curtail mosquitoes that spread malaria.

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APPENDICES

APPENDIX I: INFORMED CONSENT FORM FOR PARENTS OF CHILDREN < 5 YEARS

Title of the study

Prevalence of malaria and associated factors among children under 5 years following mosquito net campaign and indoor residual spraying in Amolatar district

Study objective.

To determine the prevalence of malaria and associated factors among children under 5 years following mass net campaign (LLINs) and indoor residual spraying (IRS) in Amolatar district.

Study procedure

Eligible participants will be randomly selected with the guide from the local council LCI/VHT of each village. The participants will then be informed on the purpose of the study, ask if interested in the study or not. If participant accepted to participate in the study, then s/he will be requested to render about 45 minutes of his/her time in order to complete both interviews and questionnaire and the test result for their children with the researcher and all the collected information will be kept confidential. The participants will be given 5000/= appreciated verbally for their valuable time and their children will also be given sweets and no phone interview will be conducted.

Purpose of the study:

The study intends to determine the prevalence of malaria and associated factors among children under 5 years following mass net campaign and indoor residual spraying in Amolatar district.

Benefits

The study attracts no monetary value or any direct benefits by accepting to participate in this study. However, findings of this study are intended to benefit the government and other decision makers in policy formulation to help come up with new interventions on malaria eradication and thus improved health of the children as well as the general public; and achieving the sustainable development goal 3(good health and wellbeing) and Uganda vision 2040.

Compensation/ reimbursements

I understand that the study attracts no huge sum of monetary value in whatever form and my participation will be totally free, however I will be given 5000/= only as a token for participation.

Risk

No risks will be imposed to my life as a result of this study. However, a little pain to the child is expected for a small drop of capillary blood sample that will be requested from my child

under 5 years, to determine the prevalence of malaria among children under 5 years; whose result will be given to me in 20 minutes time.

Rights to refusal or withdrawal

My participation is entirely voluntary and I am free to take part or withdraw at any time without cohesion.

Confidentiality

The study results will be used only for research purposes. The researcher will conceal the identity of the participants by using codes on the names, the paper and the computer records will be kept under lock and key with password for protection. No identifying information will be published from this computer.

Available sources of information

Any further questions you have concerning this study will be answered by the researcher.

Name: ORECH SAM

Telephone: +256774044962/ +256754495952

Email: samorech62@gmail.com

Also, if you have any issues pertaining to your rights and participation in the study, please contact the chairperson, Gulu University Research Ethics Committee, Dr. Gerald Obai Tel: No., 0772305621; email: lekobai@yahoo.com/lekobai@gmail.comor the Uganda National Council for Science and Technology, on plot 6 Kimera road, Ntinda, Kampala on Tel: 0414705500.

STATEMENT OF CONSENT

ORECH SAM has clearly explained to me what will be done, the risks, the benefits involved and my rights in regards to this study. I understand that my decision to participate in the study is entirely voluntary and will not change my choice to participate in any future studies.

In the use of this information, my identity will be concealed. I am aware that I may withdraw at any time. I acknowledge that by signing this form, I will not claim any form of legal rights but merely indicate that I have been informed about the research study in which I am voluntarily agreeing to participate. A copy of this form will be provided to me.

Do you have any questions?

May I begin the interview now? Y/N

…….. ……

Name and Signature of the mother/caretaker **Date**

…….. ……

Name and signature of researcher/ assistant **Date**

APPENDIX II: DATA COLLECTION TOOLS

QUESTIONNAIERS AND OBSERVATIONS CHECK LIST FOR QUANTITATIVE DATA.

Title: Prevalence of malaria and associated factors among children under 5 years following mass net campaign and indoor residual spraying in Amolatar district.

Date…….....

SECTION A: DEMOGRAPHIC CHARACTERISTICS

Qn1. Gender of respondent.

1. Male
2. Female

Qn2. How old are you?

1. 15-24
2. 25-34
3. 35-44
4. ≥45

Qn3. Marital status

1. Single
2. Married
3. Divorced
4. Widowed

Qn4. What is your religion?

1. Protestant
2. Catholic
3. Muslim
4. Born again
5. Others

Qn5. What is your highest level of education achieved?

1. No formal education
2. Primary
3. Secondary
4. Tertiary/ University

Qn6. What is you occupation?

1. Peasant
2. Business person
3. Professional
4. Unemployed

5. Others

Qn7. What is your average monthly income in Ug.SHS (USD)?

1. ≤100,000/=
2. 100,000/= – 500,000/=
3. 500,000 – 1,000,000/=
4. ≥1,000,000/=

Qn8. How many children under 5 years do you have in this household?

1. 1
2. 2
3. 3
4. ≥4

Qn9. How old is the child that I will ask you about? .....

Qn10. Type of residential house (observe)

1. Permanent
2. Semi-permanent
3. Temporary

Qn11. Location of the household from the water body (swamp, lake, river and damp)

1. ≤ 1Km
2. 2- 5Km
3. ≥6Km

Qn12. Do you have a radio in the household?

1. Yes
2. No

SECTION B: PREVALENCE OF MALARIA

Qn13. Do you know of any signs and symptom of malaria in children <5years? 1. Yes 2. No (if no skip qn.14)

Qn14. What signs and symptoms does the child present with?

1. Vomiting
2. Shaking Chills
3. Fever
4. Headache
5. Flue like illness
6. Nausea
7. Convulsion
8. Muscle aches
9. Diarrhea

Qn15. What is the body temperature of the child? 1. ≤37 ^{0}C 2. ≥38 ^{0}C

Qn16. What is the diagnostic test result of the child?

1. Positive 2. Negative

SECTION C: FACTORS ASSOCIATED WITH MALARIA PREVALENCE AMONG CHILDREN UNDER 5 YEARS

Qn17. Does your household have any mosquito nets? 1. Yes ☐ 2. No ☐

Qn18. How did you get the net(s)?

1. Mass distribution campaign
2. During antenatal care visit
3. During an immunization visit 4. Bought 5. Others specify……

Qn19. How many mosquito nets (LLINs) do you have in your households?

1. 1to 2 Net(s) ☐ 2. 3 to 4 Nets ☐ 3. ≥5 Nets ☐

Qn20. How many months ago did your household get mosquito net (LLINs)?

1. ≤5 ☐ 2. 6 to 10 ☐ 3. ≥ 11 ☐

Qn21. Did you sleep under LLIN the previous night? 1. Yes ☐ 2. No ☐

Qn22. Did this child also sleep under LLIN previous night? 1. Yes ☐ 2. No ☐

Qn23. Is the net hung? Observe 1. Yes ☐ 2. No ☐

Qn24. What are the reasons why you did not sleep under the net?

1. No mosquitoes
2. Net too old
3. Unable to hang
4. Too hot
5. Don't like the smell
6. Chemicals in net not safe
7. It takes too long to be distributed

Qn25. At any time in the past 12 months, has any one come into your home to spray the interior walls against mosquitoes? 1. Yes 2. No

Qn26. Was your house sprayed? 1. Yes 2. No

Qn27. Was the house where this child slept the previous night sprayed?

1. Yes 2. No

Qn28. How many months ago was the house last sprayed?

1. 2 to 4 moths
2. 5 to 7 moths
3. ≥8 months

Qn29. What was the reason(s) for not spraying the house?

1. Religious belief

2. Fear of the chemical used for spraying
3. We already have nets
4. The insecticide itches
5. Health related issues
6. Others

SECTION D: MOTHER/CARETAKER PERCEPTION ON USE OF LLINS AND IRS

Qn30. How often does your child sleep under LLIN?

1. Daily
2. Once in a while
3. When it rains

Qn31. Was your house sprayed when you demanded? 1. Yes 2. No

Qn32. After spraying your house, did you place something on, or smeared the walls before 6 months elapsed? 1. Yes 2. No

Qn33. After spraying your house did you and your child continue sleeping under LLIN?

1. Yes 2. No

Qn34. Has the government adequately contributed in preventing malaria, by distributing LLINs and spraying to your households? 1. Yes 2. No

Qn35. If no, what other thing should the government do to prevent and eliminate malaria?

1. Vaccinate against malaria
2. Enhance women knowledge on malaria prevention
3. Health educate on benefits of daily sleeping under LLIN and spray houses
4. Others specify……...

Thank you for your participation.

End.

APPENDICES (LANGO VERSION)

APPENDIX I: FORM ME KWONGERE PI ONYWAL OTINO ITE MWAKA 5 IKWEDA

Wi ikweda

Rwom a two atipa iyi akina otino ite mwaka 5 iyonge gamente poko tanarwa kede kiro yi wudi obuto iye iyi Amolatar district.

Pen kop me ikweda

Pi moko rwom a two atipa iyi akina otino ite mwaka 5 iyonge gamente poko tanarwa kede kiro yi wudi obuto iye iyi Amolatar district

Kit yore ame ikweda awot kede

Dano ame bino bedo ikweda man obino kwanyo kede alulu kun won kom me wang tic (LCI) / dakatal me kin paco me wang tic acel acel en atelo. Jo nono obino miyo gi ngeyo pen kop me ikweda man, kun openyo gi ka oye dok iyi ikweda man onyo pe. Ka oye gini obino kwayo gi me jalo cawa gi aromo dakika 45 pi bedo ikare me dok iyi apenyogo ame atim ikweda apenyo kede gamo adwogi me two atipa ame apimo ikom atin gi ame tie ite mwaka 5. Dok ngec ame omio gin ducu obino gwoko acalo gi me imung. Jo ducu ame odok iyi ikweda man obino miyo cente aromo 5000/= kun otino omio cwit kede ikweda ame abeo cim pe obino penyo.

Tyen kop me ikweda ni:

Tyen kop me tiom ikweda man tie pi nyang rwom me two atipa iyi akina otino ite mwaka 5 iyonge gamente ipoko tanarwa kede kiro yi wudi obuto iye iyi Amolatar district.

Berere

Pe tye kit culoro kono ka cente aromo ciling 5000/= me wilo cabunoro keken ame ibino nwongo pi bedo iyi ikweda ni me pwonyere pi nwongo ngecogo. Ento adwogi me ikweda ni tye pi nwongo ngecogo apir gi tek ame romo konyo gamente kede otela mogo imoko cik me donyo kede yore opore me lweny ikom two atipa dong atwal kede dwoko ping rwom me too otino acalo adwogi me two atipa kede yot kom a lwak kede cobo golo nama 3 me (sustainable development goal) kede neno a Uganda me 2040.

Cul/dwoko cente otino

Pe amito kit culoro keken me cente pi bedo itimo ikweda ni. Aniang aber ni pe obino cula kono ka abino nwongo cente aromo ciling 5000/= pi bedo itimo ikweda me nwongo ngeci.

Gum arac.

Pe tye kit gumoro keken arac ame twero timere ikwo na acalo adwogi me bedo iyi ikweda man me pwonyere pi nwongo ngec. Ento obino kwaya me jalo cawa na aromo dakika 45 me dok iyi apenyogo ame icawa okene twero miyo kwon a doko atetek. Kede dok obino kwaya me kwanyo atin ton me remo ite lwet cing atina me konyo timo ikweda me ngeyo rwom me two atipa iyi akina otino ite mwaka 5 kun adwogi me apima obino miya ngeyo iyonge dakika 20 ikom cawa na ame ajalo me timo ikweda man.

Twero me kwero onyo ya oko iyi ikweda ni

Bedo na itimo ikweda me pwonyere ni obedo dyere ame dang atye itwero me bedo iye onyo ya oko icawa moro keken abongo ginoro keken arac ame twero timere ibedo na ikin lwak.

Imungere.

Adwogi me ikweda ni obino tic kede acalo gi nwongo ngec me pwonyere. Ngecoro keken amako nga aan abedo ame otio kede pi ikweda me pwonyere ni pe obino yaro ooko. Nyinga pe bino kato icoc kakanoro keken ibalo me form ame otio kede pi timo ikweda ni. Ngec ducu ame oketo ping icoc me papara kede computer obino pungo adding ikupulu kede agony medo kede password me computer.

Ngecogo atye kede kwene oya iye.

Kit apenyoro keken amako timo ikweda ni ngat agamo obedo ngat otimo.

Nyige: ORECH SAM

Nama cim mere: +256774044962/ +256754495952

Email: samorech62@gmail.com

I yore ocele, ka itie kede koporo amako twero ni kede bedo iyi ikweda ni me pwonyere, itwero kubere kede adwong ame loo Gulu University Research Ethics Committee, Dr. Gerald Obai I nama cim mere: 0772305621; email: lekobai@yahoo.com/lekobai@gmail.comonyo kubere kede Uganda National Council for Science and Technology, I plot 6 Kimera road, Ntinda, Kampala I nama cim: 0414705500.

KWONGERE ME YE

ORECH SAM otita ngo ame atimere, gum aracogo aya iye, Berere kede twero na ikop amako timo ikweda man me nwongo ngec. Aniang aber ni moko tama me bedo itimo ikweda ni obedo jale dok pe bino loko tama pi bedo ikweda kit man iyi anyim. Ikare me tic ingecogo ame onwongere iyi ikweda ni, nying onyo kit ngecoro keken amaka pe obino yaro ooko. Angeo aber ni atwero ya oko itimo ikweda ni icawa moro keken. Aniang aber ni keto cinga iform man pe kwanyo twero ame atye kede it cik, ento keto cing iye tye ka pi moko ni anyang ikom ngec amako ikweda ni dang aye me dyere iye acalo cuny owinyo. Pot balo me form an dang amiya abedo kede.

Itie kede apenyoro?

Atwero dong cako penyi?

…… ……

Capa cing toto/ngat agwoko atin **Nino dwe**

…… ……

Capa cing ngat atimo ikweda **Nino dwe**

PENKOP II: GI TIC ME RAYO NGEC IKOM IKWEDA
APENYA KEDE JAMI MOGO ME ANENA IRAYO NGEC IKOM IKWEDA

Wi ikweda: Rwom a two atipa iyi akina otino ite mwaka 5 iyonge gamente poko tanarwa kede kiro wudi obuto iye iyi Amolatar district.

Nino dwe…….

DUL ME A: KITE IPONE ADANO

Apeny1. Ngat agamo apeny.

1. I coo

2. Dako

Apeny 2. Itie kede imwaka adi?

1. 18-24

2. 25-34

3. 35-44

5. ≥45

Apeny 3. Nyomere ni ngo.

1 Pe ru anyomere

2. Anyomere

3. Opokere oko

4. Dako/ico too

Apeny 4. Dini ni obedo mene?

1. Ogeri

2. Otoli

3. Ocilam

4. Olongkole

5. En okene

Apeny 5. Rwom me kwani ogik kakwene?

1. Pe akwano icukul

2. Perepere

3. Cinia

4. Kakwan amalo yonge cinia / University

Apeny 6. Itio tie ango?

1. Apur

2. Acatwil

3. Atic agamente

4. Pe ru anwongo tic

5. En okene

Apeny7. Ikine me dwe acel inwongo ciling arwom mene, cente me Uganda. (Me lobo America)?

1. ≤100,000/=
2. 100,000/= – 500,000/=
3. 500,000 – 1,000,000/=
4. ≥1,000,000/=

Apeny 8. Itie kede otino ite mwaka 5 gin adi ipaco ni kan?

1. 1
2. 2
3. 3
5. ≥4

Apeny 9. Atin ame a penyi pire ni tie mwaka adi? .....

Apeny 10. Kodi oot me buto ango ame tie paco kan? (Neni)

1. Oot ibati ocweo ibirik
2. Oot ibati ocweo ilobo
3. Oot lum

Apeny 11. Bor a paco ni kede kan ame pii pong iye rwom mene (akao, nam, dam)

1. Pe room mairo acel (1)
2. Mairo 2 tuno 5
3. Kato mairo abicel (6)

Apeny 12. Itie kede radio paco ni kan?

3. Ee
4. Pe

DUL ME B: RWOM ME TWO ATIPA

Apeny13. Ingeo anyutoro me two atipa ikom itino ite mwaka 5? 1. Ee 2. Pe (ka pe kal apeny.14)

Apeny 14. Anyut ango ame two atipa nyute kede ikom otino?

1. Ngokere
2. Myel akom
3. Lyeto
4. Abar wic
5. Aburu molo iwume
6. Colo cunye me ngokere
7. Kang
8. Kome tutura
9. Cado

Apeny 15. Rwom me lyeto me kom atin nono tie adi? 1. Tuno 37 ^{0}C 2. Kato 38 ^{0}C

Apeny 16. Apima me two atipa iremo atini nono tie anguto ni ngo?

1. Tie kede two atipa iremo mere 2. Pe kede two atipa iremo mere

DUL ME C: RWOM ME JAME AKOBO TWO ATIPA IYONGE POKO TANARWA (MEN OKETO YAT IYE) KEDE KIRO WUDI AME OBUTO IYE (OBUMO INDOOR RESIDUAL SPRAYING)

Apeny 17. Iyi odi tanarwa moro tie iye? 1. Ee ☐ 2. Pe ☐

Apeny 18. Inwongo tanarwa iyore ango?

1. Kare ame gamente tie apoko tanarwa ikin paci
2. Iyi apima me yaco
3. Kare me agwera
4. Awilo awila
5. Yore okene kobiwa……

Apeny 19. Itie kede tanarwa gin adi iyi paco ni ka (men oketo yat iye)?

1. Pe kato gin ario (2) ☐ 2. Tanarwa 3 wot iyi 4 ☐ 3. Kato gin 5 ☐

Apeny 20. Okato dwete adi ame inwongo tanarwa iyi paco ni kan (LLINs)?

1. Pe tuno dwete 5 ☐ 2. Dwete 6 tuno iyi dwete 10 ☐
3. Katao dwete11 ☐

Apeny 21. Ibuto ite tanarwa idi wor okato ni? 1. Ee ☐ 2. Pe ☐

Apeny 22. Atini dang obuto ite tanarwa iwor okato ni? 1. Ee ☐ 2. Pe ☐

Apeny 23. Tanarwa tie ongabo malo? Neni 1. Ee ☐ 2. Pe ☐

Apeny 24. Tyen kop ango omio pe ibuto ite tanarwa?

1. Ober pe tie ioda
2. Tanarwa oti oko
3. Gin me ngabo malo pe
4. Tanarwa lyet
5. Me amaro ngwec yat ikom tanarwa
6. Yat ikom tanarwa yilo koma
7. Tero kare alalac me dok poko tanarwa

Apeny 25. Ikine me mwaka acel (dwete 12) dano moro obino kan me kiro yi odi kan obuto iye?

1. Ee 2. Pe

Apeny 26. Ento odi obin okiro? 1. Ee 2. Pe

Apeny 27. Oot atin ni obuto iye iwor okato ni dang okiro?

1. Ee 2. Pe

Apeny 28. Otyeko dwete adi ame okiro iye ooti ni?

1. Dwete 2 tuno 4
2. Dwete 5 tuno 7
3. Katao dwete 8

Apeny 29. Tyen kop ango omio pe okiro yi ooti?

1. Dini wa pe ye ni kir oot obuto iye
2. An onwongo atie alworo yat ame okirom kede yio oot
3. Wan otie kede tanarwa apol paco kan
4. Yat okiro kede oot yilo kom jo
5. Atie kede two ame pe yeya buto iyi oot ame okiro yat iye
6. Tyen kop okene

DUL ME D: TAM ATOTO IKOM TIC ITANARWA KEDE KIRO YI OOT OBUTO IYE

Apeny 30. Atini buto ite tanarwa kare mene?

1. Idiwor ducu
2. Icel icel
3. Ka kot ocwee

Apeny 31. Ooti obin okiro imita ni? 1. Ee 2. Pe

Apeny 32. Iyonge kiro ooti, iketo ginoro onyo ipuo kor apama ame okiro kede yat ame dwete 6 pe ru okato? 1. Ee 2. Pe

Apeny 33. Iyonge kiro ooti yin kede atini imede kede buto ite tanarwa?

1. Ee 2. Pe

Apeny 34. Itamo ni gamente otimo ginoro ducu amite me gengo two atipa, ibeo ipoko tanarwa kede kiro yi wudi ame obuto iye? 1. Ee 2. Pe

Apeny 35. Ka pe, ngo okene ame gamente myero ti me juko two atipa dong atwal?

1. Gwero jo kede yat pi two atipa
2. Pwonyo toto me medo ngec gi igengo ober akobo two atipa
3. Pwonyo otedero kare ducu iber abuto ite tanarwa idiwor ducu kede kiro yi wudi wa
4. En okene kobi wa ……

Apwoyo pi gamo apeny magi.

APPENDIX III: BUDGET

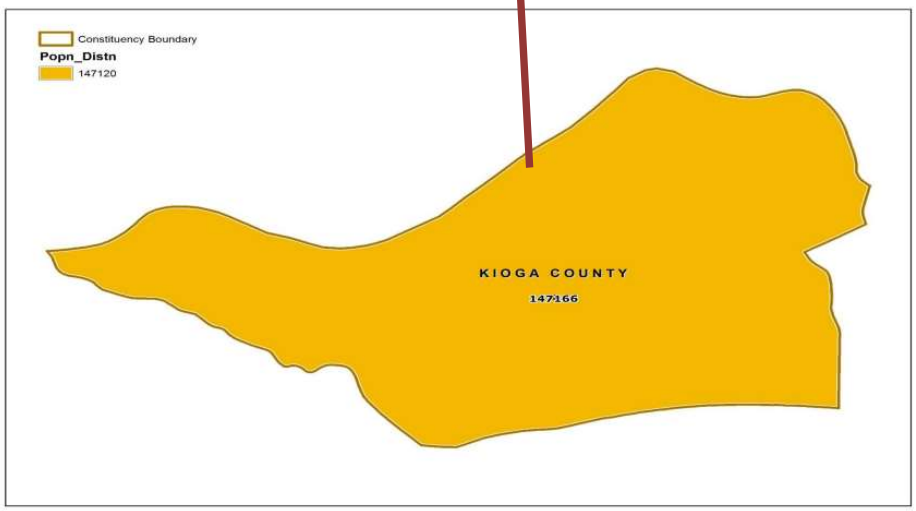
S/No	Activity	Qty	Rate	Amount
1.	Proposal submission to REC, for ethic approval	1	250,000	250,000
2.	Communication (airtime)	4 months	30,000	120,000
3.	Data bundle (airtime)	4 months	30,000	120,000
4.	Training of 4health workers and 4 VHTs on data collection	8 persons	40,000	320,000
5.	Data collection	4 days	40,000	1,280,000
6.	PF. mRDT	6 packets	25,000	150,000
7.	Photocopying papers	3 reams	20,000	60,000
8.	Printing proposal	3 copies	30,000	90,000
9.	Binding proposal	3 books	5,000	15,000
10.	Data entry	1	120,000	120,000
11.	Printing dissertation	4 copies	30,000	120,000
12.	Publication of report	1	3,000,000	3,000,000
13.	Refreshment and lunch	Lump sum	300,000	300,000
14.	Miscellaneous		300,000	300,000
15.	Research fee	1	500,000	500,000
16.	Participants compensation	238	5000	1,190,000
17.	Community guides (LCI/VHT)	30	10,000	300,000
18.	Hire of transport	4	50,000	50,000
Total			**4,785,000**	**8,285,000**

APPENDIX IV: WORK PLAN

S/No	Activity	Time line April to December 2022								
		APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1.	Concept presentations									
2.	Students' orientation on the timelines and expectations of the dissertation									
3.	Allocate supervisors to students									
4.	Orientate students Maximize Supervisor – Student engagements									
5.	Proposal writing workshop, fast-track									
6.	**Proposal defense**									
7.	Submit proposals for Ethics approval									
8.	Training of research assistant									
9.	Purchase of mRDT									
10.	Data collection									
11.	Data entry									
12.	Data analysis and write up									
13.	Submission of dissertation for examination									
14.	Viva Voce									
15.	Dissemination of reports to stakeholders									
16.	University Graduation									
17.	Publication									

APPENDIX V: MAP OF UGANDA SHOWING AMOLATAR DISTRICT

AMOLATAR DISTR



APPENDDIX VI: ETHICS APPROVAL

PREVALENCE OF MALARIA AND ASSOCIATED FACTORS AMONG CHILDREN UNDER 5 YEARS FOLLOWING MASS NET CAMPAIGN AND INDOOR RESIDUAL SPRAYING IN AMOLATAR DISTRICT - GUREC-2021-118

Dear Orech Sam!

Thank you for your protocol titled, '**PREVALENCE OF MALARIA AND ASSOCIATED FACTORS AMONG CHILDREN UNDER 5 YEARS FOLLOWING MASS NET CAMPAIGN AND INDOOR RESIDUAL SPRAYING IN AMOLATAR DISTRICT**' Your protocol has been submitted on **2021-09-12**.

Your protocol reference number is **GUREC-2021-118**. Please, use this number for all your future correspondences with REC on this particular protocol.

We shall get back to you with 1-2 weeks time.

Best Regards

Gulu University REC
Host Institution: Gulu University
Admin: Mr. Robert Kiduma
Contact Information: (mkiduma@yahoo.com)