Jagua Publication

www.jpub.org

Current Research in Interdisciplinary Studies 2(8) (2023): 1 –18

Research Article

# Prevalence of Malaria and Associated Factors Among Children Under 5 Years Following Mass Net Campaign and Indoor Residual Spraying in Amolatar District

**Orech Sam[1]*, Akello Anne Ruth[1], Opollo Marc Sam[1], Ocean Francis[1], Eluk Job[1]**

[1]Lira University Faculty of Public Health, P.O.BOX 1035, LIRA, Uganda.

How to cite:
Sam et al. 2023. "Prevalence of Malaria and Associated Factors Among Children Under 5 Years Following Mass Net Campaign and Indoor Residual Spraying in Amolatar District". Current Research in Interdisciplinary Studies 2(8): 1 – 18.
https://doi.org/10.58614/cris281

Received:
May 11, 2023
Accepted:
August 12, 2023
Published:
August 23, 2023

Corresponding author:
Orech Sam
samorech62@gmail.com

**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.

**Keywords:** An outbreak; Disease prevention; Endemic; Epidemic, Indoor-residual spray; Mosquito Net distribution.



## 1. Introduction

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, (25th-31st 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.

## 2. Methodology

### 2.1. 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.

### 2.2. Study area

The study was carried out in Amolatar district, located in Lango sub-region, Northern Uganda. 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.

### 2.3. 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.

### 2.4. 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.

### 2.5. Exclusion

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

### 2.6. 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.

### 2.7. 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.

### 2.8. 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.

### 2.9. 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.

### 2.10. Quality control

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.

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).

### 2.11. Ethical considerations

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.

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.

Privacy protection

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

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. Results

### 3.1. 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).

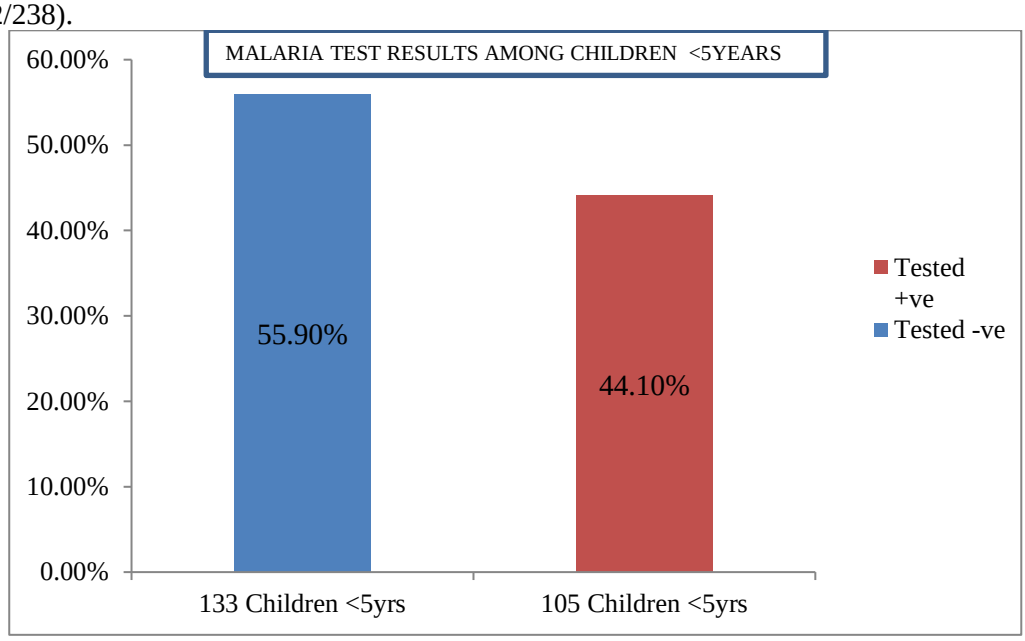


**Figure 1.** Showing malaria test results among children <5years

### 3.2. Socio Demographic characteristics

From Table 1 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 1.** 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 below 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 2.** 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) | | | |

### 3.3. 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 3.** 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 4.** 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) | | | |

### 3.4 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 5.** 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 6.** 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) | | | |

### 3.4. 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 7.** 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*

## 4. Discussion of findings

### 4.1. 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.

### 4.2. 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).

### 4.3. 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).

## 5. 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.

**Acknowledgment**

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.

First and foremost, I thank God Almighty for his mercy upon keeping me healthy up to this state not forgetting my spiritual leaders for their vigorous spiritual support upon this move. Special thanks go to my supervisor Ms Akello Anne Ruth, Reviewers Dr. Marc Sam Opolo and Mr. Ocen Francis for their experience, expertise, intellectual and academic guidance has made me to come up with this report. My heartfelt thanks also go to my fellow associates for their optimal cooperation and attention granted during consultations.

Finally, I would also extend my sincere thanks to my family members to include my beloved wife Mrs. Evaline Orech, Children Isaac, Nathan & Faith, Brothers and Sisters, beloved parents while not forgetting my mother on her absence and Aunt Milly; for a holistic support amidst hard conditions, may all be blessed.

**Reference**

[1] Abdishu, M., Gobena, T., Damena, M., Abdi, H., Birhanu, A. J. P. H., Medicine, & Therapeutics. (2022). Determinants of Malaria Morbidity Among School-Aged Children Living in East Hararghe Zone, Oromia, Ethiopia: A Community-Based Case–Control Study. 13, 183.

[2] Abong'o, B., Gimnig, J. E., Torr, S. J., Longman, B., Omoke, D., Muchoki, M., . . . Samuels, A. M. (2020). Impact of indoor residual spraying with pirimiphos-methyl (Actellic 300CS) on entomological indicators of transmission and malaria case burden in Migori County, western Kenya. Scientific reports, 10(1), 1-14.

[3] Abossie, A., Yohanes, T., Nedu, A., Tafesse, W., &Damitie, M. (2020). Prevalence of malaria and associated risk factors among febrile children under five years: A cross-sectional study in Arba Minch Zuria district, south Ethiopia. Infection and drug resistance, 13, 363.

[4] Al-Awadhi, M., et al. (2021). "Current Status and the Epidemiology of Malaria in the Middle East Region and Beyond."Microorganisms9(2): 338.

[5] Al-Mekhlafi, H. M., Madkhali, A. M., Ghailan, K. Y., Abdulhaq, A. A., Ghzwani, A. H., Zain, K. A., . . . Darraj, M. A. (2021). Residual malaria in Jazan region, southwestern Saudi Arabia: the situation, challenges and climatic drivers of autochthonous malaria. Malaria journal, 20(1), 1-14.

[6] Ameyaw, E. K., Kareem, Y. O., & Yaya, S. (2020). Individual, community and region level predictors of insecticide-treated net use among women in Uganda: a multilevel analysis. Malaria journal, 19(1), 1-9.

[7] Asingizwe, D., Poortvliet, P. M., Koenraadt, C. J., Van Vliet, A. J., Ingabire, C. M., Mutesa, L., &Leeuwis, C. (2019). Role of individual perceptions in the consistent use of malaria preventive measures: mixed methods evidence from rural Rwanda. Malaria journal, 18(1), 1-19.

[8] Asingizwe, D., Poortvliet, P. M., Koenraadt, C. J., Van Vliet, A. J., Murindahabi, M. M., Ingabire, C., . . . Feindt, P. H. (2018). Applying citizen science for malaria prevention in Rwanda: an integrated conceptual framework. NJAS-Wageningen Journal of Life Sciences, 86, 111-122.

[9] Beavogui, A. H., Delamou, A., Camara, B. S., Camara, D., Kourouma, K., Camara, R., . . . Djimde, A. (2020). Prevalence of malaria and factors associated with infection in children aged 6 months to 9 years in Guinea: Results from a national cross-sectional study. Parasite Epidemiology and Control, 11, e00162.

[10] Cheaveau, J., Mogollon, D. C., Mohon, M. A. N., Golassa, L., Yewhalaw, D., & Pillai, D. R. (2019). Asymptomatic malaria in the clinical and public health context. Expert review of anti-infective therapy, 17(12), 997-1010.

[11] Choi, L., Pryce, J., & Garner, P. (2019). Indoor residual spraying for preventing malaria in communities using insecticide-treated nets. Cochrane Database of Systematic Reviews(5).

[12] Dao, F., Djonor, S. K., Ayin, C. T.-M., Adu, G. A., Sarfo, B., Nortey, P., . . . vectors. (2021). Burden of malaria in children under five and caregivers' health-seeking behaviour for malaria-related symptoms in artisanal mining communities in Ghana. 14(1), 1-11.
[13] Echodu, R., Oyet, W. S., Iwiru, T., Apili, F., Lutwama, J. J., Opiyo, E. A., & Otim, O. (2020). Household Predictors of Incidence of Malaria in Northern Uganda: Its Implication for Future Malaria Control.
[14] Gaston, R. T., &Ramroop, S. (2020). Prevalence of and factors associated with malaria in children under five years of age in Malawi, using malaria indicator survey data. Heliyon, 6(5), e03946.
[15] Guerra, C. A., et al. (2019). "Characterising malaria connectivity using malaria indicator survey data."Malariajournal18 (1): 1-12.
[16] Iyer, M., Skelton, J., de Wildt, G., & Meza, G. (2019). A qualitative study on the use of long-lasting insecticidal nets (LLINs) for the prevention of malaria in the Peruvian Amazon. Malaria journal, 18(1), 1-14.
[17] Kakmeni, F. M. M., et al. (2018). "Spatial panorama of malaria prevalence in Africa under climate change and interventions scenarios."International journal of health geographics17(1): 1-13.
[18] Kané, F., Keïta, M., Traoré, B., Diawara, S. I., Bane, S., Diarra, S., . . . Doumbia, S. (2020). Performance of IRS on malaria prevalence and incidence using pirimiphos-methyl in the context of pyrethroid resistance in Koulikoro region, Mali. Malaria journal, 19(1), 1-9.
[19] Kapesa, A., et al. (2018). "The current malaria morbidity and mortality in different transmission settings in Western Kenya."PloS one13(8): e0202031.
[20] Kish, L. (1965). Sampling organizations and groups of unequal sizes. American sociological review, 564-572.
[21] Lucantoni, L., et al. (2017). "The need to compare: assessing the level of agreement of three high-throughput assays against Plasmodium falciparum mature gametocytes."Scientific reports7(1): 1-12.
[22] Mbacham, W. F., et al. (2019). Current situation of malaria in Africa. Malaria Control and Elimination, Springer: 29-44.
[23] Megnekou, R., Djontu, J. C., Nana, B. C., Bigoga, J. D., Fotso, M., Fogang, B., &Leke, R. F. (2018). Accuracy of One Step malaria rapid diagnostic test (RDT) in detecting Plasmodium falciparum placental malaria infection in women living in Yaoundé, Cameroon. Malaria journal, 17(1), 450.
[24] Moshi, I. R., Ngowo, H., Dillip, A., Msellemu, D., Madumla, E. P., Okumu, F. O., . . . Manderson, L. (2017). Community perceptions on outdoor malaria transmission in Kilombero Valley, Southern Tanzania. Malaria journal, 16(1), 1-8.
[25] Mpimbaza, A., et al. (2020). "The age-specific incidence of hospitalized paediatric malaria in Uganda."BMC infectious diseases20(1): 1-12.
[26] Mpimbaza, A., Walemwa, R., Kapisi, J., Sserwanga, A., Namuganga, J. F., Kisambira, Y., . . . Staedke, S. G. (2020). The age-specific incidence of hospitalized paediatric malaria in Uganda. BMC infectious diseases, 20(1), 1-12.
[27] Namuganga, J. F., Epstein, A., Nankabirwa, J. I., Mpimbaza, A., Kiggundu, M., Sserwanga, A., . . . Opigo, J. (2021). The impact of stopping and starting indoor residual spraying on malaria burden in Uganda. Nature communications, 12(1), 1-9.
[28] Nangobi, P., Onyango, G., Kagaba, S., & Pratt, B. A. (2020). Baseline Assessment for an Anticipated PMI Malaria Reduction Activity.
[29] Nyarko, S. H., Cobblah, A. J. M. r., & treatment. (2014). Sociodemographic determinants of malaria among under-five children in Ghana. 2014.
[30] Oguttu, D. W., et al. (2017). "Rapid reduction of malaria following introduction of vector control interventions in Tororo District, Uganda: a descriptive study."Malaria journal16(1): 1-8.

[31] Ogwang, R., Akena, G., Yeka, A., Osier, F., &Idro, R. (2018). The 2015–2016 malaria epidemic in Northern Uganda; What are the implications for malaria control interventions? Acta tropica, 188, 27-33.
[32] Okia, M., Hoel, D. F., Kirunda, J., Rwakimari, J. B., Mpeka, B., Ambayo, D., . . . Govere, J. (2018). Insecticide resistance status of the malaria mosquitoes: Anopheles gambiae and Anopheles funestus in eastern and northern Uganda. Malaria journal, 17(1), 1-12.
[33] Okwa, O. O. (2020). Malaria: Knowledge, Attitude, and Practices in Some Sub-Saharan African Communities. Biopsychosocial Perspectives and Practices for Addressing Communicable and Non-Communicable Diseases, 31-48.
[34] Okyere, B., Owusu-Ofori, A., Ansong, D., Buxton, R., Benson, S., Osei-Akoto, A., . . . MarfoBoaheng, J. (2020). Point prevalence of asymptomatic Plasmodium infection and the comparison of microscopy, rapid diagnostic test and nested PCR for the diagnosis of asymptomatic malaria among children under 5 years in Ghana. PloS one, 15(7), e0232874.
[35] Oluwasogo, A., et al. (2016). "Malaria Control & Elimination."
[36] Scott, N., Hussain, S. A., Martin-Hughes, R., Fowkes, F. J., Kerr, C. C., Pearson, R., . . . Wilson, D. P. (2017). Maximizing the impact of malaria funding through allocative efficiency: using the right interventions in the right locations. Malaria journal, 16(1), 1-14.
[37] Spraying, W. I. R. an operational manual for indoor residual spraying (IRS) for malaria transmission control and elimination. 2015. Retrieved from Geneva: http://apps. who. int/iris/bitstream/10665/177242/1/9789241508940_eng. pdf.
[38] Tangena, J.-A. A., Hendriks, C. M., Devine, M., Tammaro, M., Trett, A. E., Williams, I., . . . Kafy, H. T. (2020). Indoor residual spraying for malaria control in sub-Saharan Africa 1997 to 2017: an adjusted retrospective analysis. Malaria journal, 19(1), 1-15.
[39] Tassew, A., Hopkins, R., &Deressa, W. (2017). Factors influencing the ownership and utilization of long-lasting insecticidal nets for malaria prevention in Ethiopia. Malaria journal, 16(1), 1-9.
[40] Thellier, M., et al. (2020). "Changes in malaria epidemiology in France and worldwide, 2000–2015."Medecine et maladies infectieuses50(2): 99-112.
[41] Wanzira, H., Eganyu, T., Mulebeke, R., Bukenya, F., Echodu, D., &Adoke, Y. (2018). Long lasting insecticidal bed nets ownership, access and use in a high malaria transmission setting before and after a mass distribution campaign in Uganda. PloS one, 13(1), e0191191.
[42] Wanzira, H., et al. (2017). "Factors associated with malaria parasitaemia among children under 5 years in Uganda: a secondary data analysis of the 2014 Malaria Indicator Survey dataset."Malaria journal16(1): 1-9.
[43] Wanzirah, H., Tusting, L. S., Arinaitwe, E., Katureebe, A., Maxwell, K., Rek, J., . . . Dorsey, G. (2015). Mind the gap: house structure and the risk of malaria in Uganda. PloS one, 10(1), e0117396.