

Determinants of Malaria Control Programs for Children Under 5 Years at Mubende Regional Referral Hospital in Central Uganda

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ABSTRACT

Malaria, a life-threatening disease transmitted by infected female *Anopheles* mosquitoes, poses a significant global health challenge. In 2017, there were approximately 219 million malaria cases worldwide, with the WHO African Region accounting for 92% of them and Uganda contributing 4%. This study aimed to evaluate the factors impacting malaria control programs for children under 5 years attending Mubende Regional Referral Hospital in Central Uganda. A descriptive cross-sectional study involving 162 participants, mainly caregivers of children under 5 years, was conducted using simple random sampling. A significant portion (42%) of the children were under 12 months old. Caregivers were primarily in the 25-40 years age bracket (49.4%), and the majority were married (48.8%). Approximately 32.1% of caregivers had attained tertiary education, while nearly half (48.8%) identified as peasants. A high level of awareness about malaria was observed, with 99.4% of respondents knowledgeable about the disease, and 76.5% recognizing the responsible vector. Moreover, 75.3% reported that their children slept under bed nets, with 70.4% confirming daily use. However, low utilization of insecticide-treated bed nets (ITNs) was attributed to concerns about excessive heat, perceived risks associated with ITN chemicals, and the cost of nets.

Keywords: malaria, control programmes, children, age

INTRODUCTION

Malaria is a life-threatening disease caused by the infection of red blood cells with protozoan parasites of the genus *Plasmodium* that are transmitted to people through the bites of infected female *Anopheles* mosquitoes [1-6].

In 2017, an estimated 219 million cases of malaria occurred worldwide compared to 217 million cases in 2016. Most malaria cases in 2017 were in the WHO African Region (200 million or 92%), followed by the WHO South-East Asia Region with 5% of the cases and the WHO Eastern Mediterranean Region with 2%. Fifteen countries in sub-Saharan Africa and India carried almost 80% of the global malaria burden. Five countries accounted for nearly half of all malaria cases worldwide: Nigeria (25%), Democratic Republic of the Congo (11%), Mozambique (5%), India (4%) and Uganda (4%) [7-16].

In 2017, there were an estimated 435 000 deaths from malaria globally, compared

to 451 000 estimated deaths in 2016. Children aged under 5 years were the most vulnerable group affected by malaria and accounted for 61% (266 000) of all malaria deaths worldwide. Malaria affects the lives of almost all people worldwide [7, 17-21].

The Malaria Indicator Survey, conducted in late 2014, and more recent entomological surveillance suggests that *Plasmodium falciparum* remains the species responsible for the vast majority of malaria cases in Uganda. *Plasmodium malariae* accounts for less than 1 percent of cases as a single infection, but is more commonly found as a mixed infection with *Plasmodium falciparum* (up to 3 percent of child infections in highly endemic areas). *Plasmodium vivax* and *ovale* are rare accounting for less than 2% of malaria cases in Uganda [22-27].

At the dawn of the new millennium, African leaders committed to reducing the

Kabugho

burden and mortality from malaria in the region by implementing strategies of the Roll Back Malaria Initiative [28-31]. This commitment was to be realized by the coverage of at least 60% of at-risk populations with appropriate anti-malaria interventions.

Severe anemia prevalence, which is strongly associated with Plasmodium falciparum infection in children under five years of age, is a good measure of the health impact of malaria control interventions [32-33]. Half of children age 6-59 months (53 percent) suffered from some degree of anaemia: 24 percent were classified as mildly anaemic, 27 percent as moderately anaemic, and 2 percent as severely anaemic. The prevalence of anaemia showed an overall decrease with

METHODOLOGY

Study Design

This study was a descriptive cross-sectional study using quantitative and qualitative approaches.

Study Area

The study was conducted at MRRH located in Mubende district, central Uganda.

Study Population

The target population was parents of children under 5 years of age seeking health services at MRRH.

Inclusion Criteria

Parents of children under 5 years of age who consent to participate in the study and are seeking health care at MRRH

Exclusion Criteria

1. Parents of children under 5 years of age who refused to consent to participate in the study.
2. Parents of children above 5 years of age.
3. Parents whose area of residence is outside the catchment area of MRRH

Sample Size Determination

The sample size was calculated using the formula Kish Leslie (1965) below:

$$n = z^2p(1-p) / e^2$$

Where n = Estimated minimum sample size required

P= Proportion of a characteristic in a sample (88% [MOH, 2018])

Z=1.96 (for 95% Confidence Interval)

e = Margin of error set at 5%

$$n = (1.96)^2 \times 0.88 (1 - 0.88)$$

age from a high of 78 percent among children age 9- 11 months to a low of 39 percent among children age 48-59 months. Children in rural areas were found to be anaemic than those in urban areas (54 percent and 48 percent, respectively).

Subsequent trials of ITNs in diverse transmission settings have demonstrated that ITNs can reduce all-cause mortality in children under-five by around 20%, lower the risk of clinical malaria illness by around 50%, reduce parasitemia by 13% and reduce the risk of high-density parasitemia by 20-29%. ITNs have also been shown to affect a number of other malaria metric indices, including reductions in severe anemia and splenomegaly [34-45].

$$(0.05)^2$$

n = 162 participants.

Sampling Technique

Simple random sampling technique was used. Every parent with a child below 5 years has an equal chance of being selected for the study. Here, caretakers of children were given questionnaires randomly at department of the hospital.

Data Collection Methods

The data for the study was collected by use of self-administered questionnaires. The questionnaire will contain 3 parts. The social demographic part had the age of the child, age of parent, social economic status, residence and religion. The 2nd part assessed knowledge about malaria control programs while the 3rd part assessed the level of utilization of ITNs in children under five years. Research assistants were requested and trained to help in data collection.

Data Analysis

Data was entered in Microsoft excel and exported into SPSS. Baseline characteristics were described by using percentages for categorical data. For categorical variables, data was presented in 2x2 tables that show proportions and sums. We described baseline characteristics by using mean, and standard deviation (SD) for continuous

Kabugho

variables and percentages for categorical data. Statistical analyses were performed using SPSS. Level of statistical significance was $\alpha = 0.05$, 95% confidence interval was calculated and used to assess for statistical associations. Probability values less than 0.05 were statistically significant.

Ethical Consideration

The researcher sought approval from the KIU Research and Ethics Committee. The researcher also obtained an introduction

Majority of the children, 68 (42%) were below the age of 1 year while the least 20 (12.3%) were in the age bracket of 2-3 years. Most parents/Caregivers, 80 (49.4%) were in the age bracket of 25-40 years while the least 4(2.52%) were above 50 years of age. Most children 91 (56.2%) were females while the least were 71 (43.8%) were males. Most parents/Caregivers 79 (48.8%) were married while the least 10 (6.2%) were cohabiting. Most parents/Caregivers 52

letter from the faculty of clinical medicine and dentistry, KIU a Further approval was sought from MRRH administration. Participants were allowed to withdraw their consent voluntarily without coercion. This didn't affect the quality of care their children received from the hospital. Access to data was limited only to people involved in the study including the principal investigator, research assistants and research supervisors.

RESULTS

(32.1%) had attained tertiary level of education while the least 29 (17.9%) had no formal education. Most parents/Caregivers 79 (48.8%) were peasants while the least, 15 (9.3%) were formally employed. Most parents/caregivers 102 (63%) resided in rural areas while the least 60 (37%) resided in urban areas. Most parents/caregivers, 55 (33.9%) were Catholics while the least 15 (9.3%) were affiliated to Faith of Unity (Table 1).

Kabugho

Table 1: Socio demographic characteristics of children and parents/caregivers

Variable	Frequency (n=162)	Percentage (%)
Age of a child		
<1	68	42
1-2	42	25.9
2-3	20	12.3
3-5	32	19.7
Age of the parent/ caregiver		
<18	16	9.9
18-25	37	22.8
25-30	40	24.7
30-40	40	24.7
40-50	25	15.4
>50	4	2.5
Gender of a child		
Male	71	43.8
Female	91	56.2
Marital status		
Married	79	48.8
Single	35	21.6
Separated	24	14.8
Widowed	14	8.6
Cohabiting	10	6.2
Level of study		
No formal education	29	17.9
Primary	38	23.4
Secondary	43	26.5
Tertiary	52	32.1
Occupation		
Employed	15	9.3
Self employed	30	18.5
Peasant	79	48.8
Housewife	17	10.5
Student	21	12.9
Religion		
Catholic	55	33.9
Anglican	40	24.7
Muslim	28	17.2
Born again Christians	24	14.8
Others (Faith of Unity)	15	9.3
Area of Residence		
Urban	60	37
Rural	102	63

Kabugho

Table 2 shows Socio demographic factors influencing malaria control programs in children under 5 years of age attending MRRH

Variable	Under- utilizing / Not utilizing MCP n=48 (29.6%)	Utilizing MCP n= 114 (70.4%)	OR (95% CI)	P-Values
Age of the parent/ caregiver				
<18	10(62.5%)	6(37.5%)	7.60(3.44-46.10)	0.000
18-25	9(24.3%)	28(75.7%)	2.38(0.13-11.93)	0.162
25-30	10(25%)	30(75%)	1.01(0.70-8.05)	0.174
30-40	12(30%)	28(70%)	1.26(0.70-8.05)	0.840
40-50	5(20%)	20(80%)	Ref	
>50	2(50%)	2(50%)	5.75(3.18-97.96)	0.001
Gender of a child				
Male	31(43.4%)	40(56.3%)	3.31(1.69-10.97)	0.012
Female	17(18.7%)	74(81.3%)	Ref	
Marital status				
Married	14(17.7%)	65(82.3%)	Ref	
Single	14(40%)	21(60%)	3.30(0.36-11.38)	0.061
Separated	8(33.3%)	16(67.7%)	2.40(0.19-11.45)	0.696
Widowed	9(64.3%)	5(35.7%)	6.07(0.41-26.51)	0.021
Cohabiting	3(30%)	7(70%)	1.8(0.41-56.51)	0.792
Level of study				
No formal education	13(44.8%)	16(55.2%)	3.47(1.15-9.95)	0.032
Primary	14(36.8%)	24(63.2%)	1.94(0.36-11.38)	0.414
Secondary	11(25.6%)	32(74.4%)	1.59(0.46-14.58)	0.279
Tertiary	10(19.2%)	42(80.8%)	Ref	
Occupation				
Employed	2(13.3%)	13(86.7%)	2.33(0.18-25.03)	0.510
Self employed	3(10%)	27(90%)	Ref	
Peasant	36(45.6%)	43(54.4%)	7.750(1.04-10.54)	0.046
Housewife	3(17.6%)	14(82.4%)	1.59(3.44-24.10)	0.560
Student	4(19.0%)	17(81%)	1.80(0.13-14.68)	0.779
Area of Residence				
Urban	5(8.33%)	55(91.7%)	Ref	
Rural	43(42.2)	59(57.8%)	8.03(1.56-9.62)	0.001

Study results according to table 2 above indicate that age of a child, age of the parent/ caregiver, gender of a child, marital status of the caregiver, level of study of the parent/caregiver, occupation of the parent/caregiver and area of residence were statistically significantly associated with malaria control programs in children under 5 years of age attending Mubende Regional Referral Hospital in the study in the model at 5% level. Children of parents/caregivers below 18 years of age were 7 times more likely not to utilize MCP compared to children whose parents were 40-50 years of age (OR=7.60: 95%CI,

3.44-46.10: P=0.000). Older parents/caregivers above 50 years of age were 5 times more likely not to utilize MCP compared to children whose parents were 40-50 years of age (OR=5.75: 95%CI, 3.18-97.96: P=0.001). Male children were 3 times more likely not to utilize MCP compared to female children (OR=3.31: 95%CI, 1.69-10.97: P=0.012). Children of widowed parents/caregivers were 6 times more likely not to utilize MCP compared to children of married parents/caregivers (OR=6.07: 95%CI, 0.41-26.51: P=0.021). Children of parents/caregivers with no formal education were 3 times more likely

Kabugho

not to utilize MCP compared to children of parents/caregivers who attained tertiary level of education (OR=3.47: 95%CI, 1.15-9.95: P=0.032).

Children from families of peasant parents/caregivers were 7 times less likely to use MCP compared to children from self-employed families (OR=7.750, 95% CI: 1.04-10.54, P=0.046). Children residing in rural areas were 8 times less likely to use MCP compared to children living in urban areas (OR=8.03, 95% CI: 1.56-9.62, P=0.001). Among the parents/caregivers, 122 (75.3%) correctly identified mosquitoes as the carriers of malaria. However, 22 parents (13.6%) believed that malaria was caused by pregnancy, 61 (37.6%) thought it was linked to rainy weather, 46 (28.4%) attributed it to cold weather, and only 12

(7.4%) held the least common belief. Most parents/caregivers 142 (87.6%) stated fever as a symptom of malaria, the least 45 (27.8%) stated loss of appetite and sour test as symptoms of malaria. Majority of the respondents 161 (99.4%) knew about treated mosquito net as a way of preventing malaria. Most parents/caregivers 91 (56.2%) indicated that ITNs had side effects while the least 71 (43.8%) said ITNs had no side effects. On side effects of ITNs, 46 respondents accounting for 28.4% stated that ITNs brought excessive heat to children, while 34 (20.9%) said that ITNs contained dangerous chemicals. Majority of the parents/caregivers, 117 (72.2%) believed that Treated mosquito nets were important in prevention of malaria while the least, 45 (27.8%) didn't believe so

Table 3 shows Knowledge and attitude towards malaria control programs in parents of children under 5 years of age attending MRRH

Variable	Frequency (n=162)	Percentage (%)
Know what malaria is		
Yes	161	99.4
No	1	0.6
Causes of malaria		
Mosquitoes	122	75.3
Pregnancy	22	13.6
Rain	61	37.6
cold weather	46	28.4
Witchcraft	12	7.4
symptoms of malaria		
Fever	142	87.6
vomiting	78	48.1
Tiredness	82	50.6
Headache	81	50
Others (loss of appetite, sour test)	45	27.8
Heard of a treated mosquito net as a way of preventing malaria		
Yes	161	99.4
No	1	0.6
ITNs have any side effects		
Yes	91	56.2
No	71	43.8
Side effects of ITNs		
Excessive heat	46	28.4
Chemicals are dangerous	34	20.9
Treated mosquito nets are important in prevention of malaria		
Yes	117	72.2
No	45	27.8

Study results according to table 4 below indicate that majority of the parents/caregivers 125 (77.2%) had at least one ITN at their homes, 124 (76.5%)

stated that their children slept under a net but only 114 parents/caregivers accounting for 70.4% indicated that their children slept under ITN every day, 11

Kabugho respondents (6.8%) indicated that their children slept under ITNs only in wet season while 37 (22.8%) stated that their children weren't sleeping under ITNs. Only 78 respondents (48.1%) were provided ITNs by the government while 47 (29%) bought ITNs.

Parents/caregivers were asked what hindered them from using ITNs, 20 (12.3%) cited excessive heat, 18 (11.1%) said chemicals used in ITNs were dangerous to their children's health while 31 (19.1%) said they were expensive.

Table 4 shows the level of ITNs utilization for children under 5 years of age attending MRRH

Variable	Frequency (n=162)	Percentage (%)
Have a treated mosquito net at home		
Yes	125	77.2
No	37	22.8
Number of ITNs at home		
1	40	24.7
2	49	30.2
3	23	14.2
4	9	5.5
>4	4	2.5
Your children sleep under a net		
Yes	124	76.5
No	23	23.5
How the nets were acquired		
Government	78	48.1
Bought it	47	29
How often the mosquito net for the child is applied		
Every night	114	70.4
Only in wet season	11	6.8
Do not use it	37	22.8
What hinders you from applying the mosquito net		
Excessive heat	20	12.3
Chemicals are dangerous	18	11.1
Expensive	31	19.1

DISCUSSION

In this study assessing the factors influencing malaria control program in children under 5 years of age at MRRH, Male children were 3 times more likely not to utilize MCP compared to female children. This could be because parents consider females as a weaker gender hence putting more effort on girls to protect them from any diseases. Similarly in a Tanzanian study, males were more at risk of malaria illness compared to

females [36]. Contrary, a study carried out in rural Nigeria did not show any difference between the sexes [37-40]. Children of parents/caregivers below 18 years of age were 7 times more likely not to utilize MCP compared to children whose parents were 40-50 years of age. This could be attributed to the fact that younger parents don't have sufficient knowledge about MCP.

Kabugho

Children of widowed parents/caregivers were 6 times more likely not to utilize MCP compared to children of married parents/caregivers. This is attributed to the fact that widows lack financial support to access ITNs [41-43]. A review of literature on Social Economic Status and malaria showed that they were interlinked [38]. Children of parents/caregivers with no formal education were 3 times more likely not to utilize MCP compared to children of parents/caregivers who attained tertiary level of education.

Children of peasant parents/caregivers were 7 times more likely not to utilize MCP compared to children whose parents/caregivers were self-employed. This is due to the fact that most peasants in Uganda have poor economic status which results in inadequate health care facilities and therefore increasing vulnerability of the population to malaria due to limited access to ITNs.

Children living in rural areas were 8 times more likely not to utilize MCP compared to children living in urban areas. This is attributed to the fact that parents in rural areas don't have quick access to ITNs compared to their urban counterparts. In a related study, conducted in Tanzania, Malaria parasitemia was nearly three times as high in rural (20%) than in urban areas (7%).

161 parents/caregivers accounting for 99.4% knew what malaria is. Most parents/caregivers (75.3%) knew that malaria was spread by mosquitoes. However, parents had misconceptions about malaria, for instance 13.6% of the parents/caregivers thought malaria was caused by pregnancy, 37.6% thought rain caused malaria, and 28.4% thought malaria existed as a result of cold weather while the least 7.4% thought malaria was caused by witch craft. Such misconceptions lead to low uptake of MCP. In a clinical study conducted in 20 post-conflict internally displaced persons (IDP) camps of Gulu District the majority of respondents had ever heard about malaria (85%) and attributed its transmission to mosquito bites (80%), a number of misconceptions were

discovered. In terms of transmission, 15 respondents thought malaria was transmitted by cold weather, 53 respondents faulted dirt, while 35 respondents said not sleeping under a net. In terms of cause, the majority rightly identified the mosquito (91%), but 28 suspected cold foods, 3 mentioned playing in the rain, and 19 mentioned cold weather, while 6 cited eating mangoes.

Most parents/caregivers (87.6%) stated fever as a symptom of malaria, the least, 27.8% stated loss of appetite and sour test as symptoms of malaria. Majority of the respondents, 99.4% knew about treated mosquito net as a way of preventing malaria. This is an indication that respondents had fair knowledge on malaria. In a related study conducted in Harcourt City, Nigeria by Charles, Njideka (2016), most of the women mentioned fever (86.2%), tiredness and sleepiness (66.1%), sour/bitter taste in the mouth (58.1%), and loss of appetite (55%), as common symptoms of malaria.

Most parents/caregivers, 56.2% indicated that ITNs had side effects while the least 43.8% said ITNs had no side effects. On side effects of ITNs, 46 respondents accounting for 28.4% stated that ITNs brought excessive heat to children, while 20.9% said that ITNs contained dangerous chemicals. Majority of the parents/caregivers, 72.2% believed that Treated mosquito nets were important in prevention of malaria while the least, 27.8% didn't believe so. Similarly, a study in Western Kenya revealed that although malaria was found to be an important disease, ITNs were believed to be only partially beneficial because of the perception that malaria had multiple causes, and further to this, fear was expressed that chemicals used to treat ITNs were associated with use of family planning, excessive heat was often cited as a reason for not deploying the child's ITN. Other important reasons for non-adherence were disruption of sleeping arrangements, indicating that ITNs were not readily redeployed in the face of shifting sleeping patterns due to visitors, funerals, house construction and other

Kabugho

events. Lack of motivation and technical problems like room to hang child's net

Age of a child, age of the parent/caregiver, gender of a child, marital status of the caregiver, level of study of the parent/caregiver, occupation of the parent/caregiver and area of residence were statistically significantly associated with malaria control programs in children under 5 years of age attending Mubende Regional Referral Hospital in the study in the model at 5% level.

99.4% of the respondents knew what malaria is and 75.3% knew that malaria

also affected consistency in utilization of an ITN [39].

CONCLUSION

was spread by mosquitoes. This indicates that parents had knowledge on malaria however parents had misconceptions about malaria, 13.6% of the parents/caregivers thought malaria was caused by pregnancy, 37.6% thought rain caused malaria, and 28.4% thought malaria existed as a result of cold weather while the least 7.4% thought malaria was caused by witch craft. Such misconceptions lead to low uptake of MCP.

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Kabugho

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