

Research Article

Knowledge, Attitudes, and Practices about Malaria and Its Control in Rural Northwest Tanzania

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Background. We assessed community knowledge, attitudes, and practices on malaria as well as acceptability to indoor residual spraying. **Material and Methods.** A cross-sectional survey was done in a community in Geita district (northwest Tanzania). Household heads ($n = 366$) were interviewed. **Results.** Knowledge on malaria transmission, prevention, and treatment was reasonable; 56% of respondents associated the disease with mosquito bites, with a significant difference between education level and knowledge on transmission ($P < .001$). Knowledge of mosquito breeding areas was also associated with education (illiterate: 22%; literate: 59% ($P < .001$)). Bed nets were used by 236 (64.5%), and usage was significantly associated with education level ($P < .01$). The level of bed net ownership was 77.3%. Most respondents (86.3%) agreed with indoor residual spraying of insecticides. Health facilities were the first option for malaria treatment by 47.3%. Artemether-lumefantrine was the most common antimalarial therapy used. **Conclusions.** Despite reasonable knowledge on malaria and its preventive measures, there is a need to improve availability of information through proper community channels. Special attention should be given to illiterate community members. High acceptance of indoor residual spraying and high level of bed net ownership should be taken as an advantage to improve malaria control.

1. Introduction

Malaria is a major public health problem in Tanzania causing an enormous burden to health and economy. In this country, over 95% of the 38 million people are at risk for malaria infection [1]. The disease is responsible for more than one-third of deaths among children under the age of 5 years and for up to one-fifth of deaths among pregnant women [1]. Malaria contributes to 39.4% and 48% of all outpatients less than 5 years of age and aged 5 years and above, respectively [1]. In terms of hospital admissions, malaria accounts for 33.4% of children under the age of 5 years and 42.1% in

children aged 5 years and above [1]. In Tanzania, most of the malaria attributable cases and deaths occur in rural villages away from effective diagnostic or treatment facilities.

The main focus of malaria control measures in Tanzania includes case management (early diagnosis and prompt treatment with effective drugs), vector control using insecticides treated mosquito nets (ITNs), malaria intermittent treatment in pregnant women, malaria epidemics prevention and control, information, education and communication, and operational research [2]. Despite these strategies, malaria cases and deaths have been increasing in the country, mainly due to injudicious use of antimalarial drugs, delayed

health seeking, and reliance on the clinical judgment without laboratory confirmation in most of the peripheral health facilities [2].

There has been a considerable number of reports about knowledge, attitudes, and practices relating to malaria and its control from different parts of Africa. These reports concluded that misconceptions concerning malaria still exist and that practices for the control of malaria have been unsatisfactory [3–5]. Thus, an advanced knowledge of the community beliefs and practices with respect to the disease is required to obtain and maintain its participation in surveillance and control activities [6].

In Tanzania, support for malaria control at both the national, district, and private sector levels has increased over the past few years. Here we present an example of collaboration in fighting against malaria, between the public sector, the Geita district council (district health department), and private organizations (Geita Gold Mines, Anglo Ashanti Gold Mines Tanzania). The present study was conducted prior to implementation of a house-to-house Indoor Residual Spraying (IRS) program against malaria vector in selected villages of Geita district. The objective was to collect baseline information concerning knowledge, attitudes, and practices of people in the study area regarding malaria. The community's knowledge, perception, and acceptance of IRS was also assessed.

2. Material and Methods

2.1. Study Area. The study was conducted from September to October 2009 in Geita district in northwest Tanzania. The district is one of the 7 districts of Mwanza region lying southwest of Lake Victoria. It lies between 1100 m and 1300 m above sea level. The topography of the district is characterized by hilly areas in the north and west and with a gentle slope towards the south and southeast. The area has two main rainy seasons (November-December and February-May) with a mean annual rainfall of 1264 mm. The annual minimum and maximum temperatures for the area is between 14°C and 30°C.

The people are predominantly subsistence farmers belonging to Sukuma and Zinza ethnic groups. The major economic activities are farming, livestock keeping, trading, fishing, and artisan mining. For the purpose of this study, Nyamalembo village which is located at Mtakuja ward was selected randomly among the 8 villages of the ward. The village is located in the rural area and has 4 “Vitongoji” (subvillages), namely Kampound, Msufini, Kumbayaga, and Magema, with a total population of 2,670. The communities have no health facilities, and villagers depend on the district hospital which is located about 7 km away. Malaria transmission in the Nyamalembo village is seasonal, peaking from February to May during the long rain season.

2.2. Study Design and Population. We performed a cross-sectional survey. Estimation of sample size was based on a 95% confidence level and 80% power to detect an odds ratio of 2, assuming 10% of diseased in the unexposed group.

A sample of 92 households was drawn from each of the four communities/sub-villages of Nyamalembo village by systematic random sampling. Thus, a total of 368 households were eligible for the study; 2 of the selected households refused to participate in the study, resulting in a study population of 366 households.

2.3. Data Collection. A structured questionnaire was pretested and administered by assistant researchers (EO, WM, and PM). The first part of the questionnaire included sociodemographic characteristics of the participants and the second part assessed household's head knowledge on malaria transmission, recognition of symptoms, preventive measures, and ITNs ownership and use. Lastly, the questionnaire assessed the participant's knowledge, perception and acceptance of IRS, and treatment seeking patterns. The questionnaires were translated into Swahili language and pre-tested in the same village.

The head of the household was defined as the person who was perceived by household members to be the primary decision maker in the family and the household was defined as individuals living together and taking meals from a common cooking facility [7]. In absence of the household heads, a responsible adult above 18 years who was appointed by the family was interviewed.

2.4. Ethical Clearance. Ethical clearance to conduct this study was obtained from the district health department under the district medical officer and from the Research and Publication Committee of Weill Bugando University College of Health Sciences, Mwanza, Tanzania. The objectives of the study were explained to community leaders. Full verbal explanation of the study was given to members of selected households. Written consent was then obtained from household heads before inclusion as participants.

2.5. Data Analysis. The data were double entered in Microsoft Excel data sheets, cross checked and transferred, and analyzed using SPSS for Windows version 11.5 (SPSS, Atlanta, GA, USA). Descriptive statistics were carried out to measure relative frequencies, percentages, averages, and relative frequencies of the variables. Cross tabulations of variables were done, and chi-squared test (χ^2) was used to determine the statistical significance of differences of relative frequencies.

3. Results

3.1. Baseline Characteristics of Respondents. A total of 366 households heads were interviewed, including 58% females and 42% males (Table 1). Mean age was 34.6 ± 14.4 years (18–90). About 30% were illiterate. The economic activity carried by the vast majority of the respondents was farming. Detailed socio-demographic characteristics are presented in Table 1.

3.2. Knowledge and Practices about Malaria and Preventive Measures. Tables 2 and 3 present the respondents' knowledge

TABLE 1: Socio-demographic characteristics of respondents in selected households in villages, Geita districts, northwest Tanzania.

Characteristics	<i>n</i>	%
Gender		
Male	154	42.1
Female	212	57.9
Age		
≤19	28	7.7
20–39	220	60.1
40–59	93	25.4
≥60	25	6.8
Marital status		
Married	258	70.5
Unmarried	73	19.9
Widow/widower	22	6
Divorced	13	3.6
Highest level of education completed		
No education	107	29.2
Primary	210	57.4
Secondary	39	10.7
Tertiary qualifications	4	1.1
Others	6	1.6
Main occupations		
Peasant (self-employed in agriculture)	217	89.3
Small scale business	28	7.7
Employed	11	3
Housewife	38	10.4
Unemployed	2	0.5
Others*	70	19.1

Others*: night guards, mines, fishermen, and so forth.

and practices about malaria, its transmission, and preventive measures. In total, 364/366 household heads had heard of malaria locally referred as “Mshana”, meaning high fever. Most respondents associated the disease transmission with mosquito bites (Table 2). There was a significant difference between males and females on malaria transmission knowledge ($P < .03$). A significant association between education level and knowledge on malaria transmission was also observed ($P < .001$). Only 3.7% (4/106) of illiterate people associated malaria transmission with the bites of mosquito which have fed on malaria patients, as compared to 22.8% (59/259) of literate people. Stagnant water was mentioned by almost 2/3 of respondents to be the main areas for mosquito breeding (Table 2). A significant relationship between education level and correct knowledge of mosquito breeding areas was observed ($P < .001$). The major source of information about malaria was the individuals’ experiences on the disease. Other sources of information are presented in Table 2.

The regular use of bed nets for prevention of malaria was mentioned by 64% of the respondents, and a similar number reported to sleep under bed nets a night before the survey (Table 3). Other measures applied were using insecticide

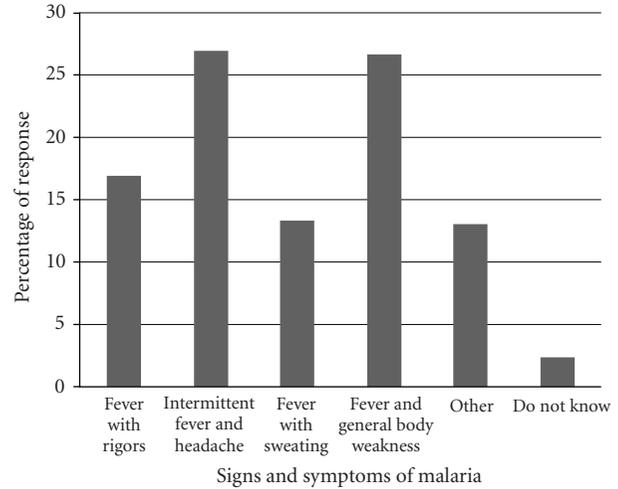


FIGURE 1: Symptoms and signs of malaria mentioned by respondents.

aerosol sprays, destruction of mosquito breeding and resting areas, use of mosquito coils/repellents and treatment of malaria cases. Ways known to prevent mosquito breeding are shown in Table 3. There was a significant difference between males and females on correct knowledge to prevent malaria ($P < .008$). More females, 57.7% (211/366) reported to use ITNs as compared to 30.9% (113/366) men.

Symptoms of malaria such as intermittent fever and headache, fever/high body temperature and general body weakness, and fever with rigors were most frequently mentioned. Other symptoms mentioned were dizziness, abdominal pain, loss of appetite, diarrhea, body pains, and cramps (Figure 1).

3.3. Bed Net Ownership and Use. About 77% of the respondents reported to own bed nets (ITNs or non ITNs), and 74% reported to sleep under the bed nets a night before the survey (Table 4). Education level was observed to be associated with bed net usage behavior ($P < .01$). Only 24.7% (70/283) of illiterate were using bed nets, as compared to 75.3% (213/283) of literate people. About 58% reported that everyone in their family was sleeping under bed nets. Protection from mosquito bites was reported to be the main reasons for using bed nets (Table 4). Of those not having bed nets, reported cost to be the main barrier. On the other hand, 64% of the respondents with bed nets reported to use insecticides commonly referred as “NGAO-pyrethroids” to retreat their bed nets (NGAO is a brand name which means a “shield protecting from mosquitoes” in Swahili language). The time for retreatment is presented in Table 4. Cost of “NGAO” was the main reason of not retreating their bed nets, and retail shops were mentioned to be the main source of “NGAO”.

3.4. Knowledge, Attitudes, and Acceptance of Indoor Residual Sprays. About half of the respondents reported that they had heard of IRS campaigns, and the main sources of information

TABLE 2: Reported knowledge on malaria by households respondents (multiple response), in Geita district, northwest Tanzania.

Variable	<i>n</i>	%
Heard of malaria	364	99.7
Source of information		
Home	61	16.7
Radio program	70	19.1
Hospital/dispensaries	35	9.6
Health workers	1	0.3
I suffered from malaria	196	53.6
Others	3	0.8
Mode of transmission		
By bites of any mosquito	180	49.1
By bites of mosquito which has bitten a malaria patient	63	17.2
Others	31	8.5
Do not know	92	25.1
Causes of malaria		
Germs	30	8.2
Dirt stagnant water	16	4.4
Mosquito bites	174	47.5
<i>Plasmodium</i> organisms	22	6
Does not know	124	33.9
Mosquito breeding areas		
Stagnant water	199	63.4
Tall grasses	81	25.8
Bushes	29	9.2
Others	5	1.6

TABLE 3: Respondent's knowledge and practices about malaria preventive measures in Geita district, northwest Tanzania.

Variable	<i>n</i>	%
Preventive measures		
Using insecticidal bed nets	234	63.9
Using insecticides sprays	13	3.6
Preventing breeding of mosquitoes and resting places	18	4.9
Using mosquito coil/repellents	15	4.1
Treatment	22	6
Others	29	7.9
Does not know	35	9.5
Preventive measures used in the last 24 hours		
Using insecticidal bed nets	236	64.5
Using insecticides sprays	17	4.7
No any method	108	29.5
Others	5	1.4
Ways to prevent mosquito breeding		
Cleaning of house surrounding	117	32
Draining of stagnant water	81	22.1
Clearing of bushes around the house	56	15.3
Others	15	4.1
Does not know	97	26.5

TABLE 4: Respondent's bed nets ownership, use and nonuse in Geita district, northwest Tanzania.

Variable	N	%
Possessing bed nets (treated or untreated)	283	77.3
Used bed nets last night	271	74
Possessing ITNs	223	60.9
Family members who sleep under bed nets daily		
Children and mothers	42	11.5
Everyone in the house	211	57.7
Father and mother alone	83	22.6
Others	30	8.2
Reasons for using bed nets		
Protect from mosquito bites	187	51.1
Protect from malaria	72	19.7
Protect children from malaria	6	1.6
Habit	98	26.8
Others	3	0.8
Reasons of not possessing bed nets		
Expensive	51	61.5
Not available	3	3.6
Reduce surrounding air	1	1.2
Increase room temperature	4	4.8
Cannot prevent malaria transmission	2	2.4
No reasons	5	6
Others	17	20.5
Use of insecticides (NGAO) to re-treat bed nets	181	64.0
Time for re-treatment of bed nets with insecticides (NGAO)		
After 1 month	29	12.6
After 2 or 3 month	66	28.7
After 12 months	4	1.7
Do not treat	6	2.6
Others	125	54.3
Reasons of not using insecticides (NGAO) to re-treat bed nets		
Expensive	34	35.1
Not available	7	7.2
Do not need re-treatment	2	2.1
Others	54	55.7
Source of insecticides (NGAO) for re-treatment of bed nets		
Retail shops	170	75.9
Non governmental organization	8	3.6
Donated by government	1	0.5
Others	45	20.1

were radio programs and government campaigns (Table 5). When asked if they were ready for their houses to be sprayed with insecticides, 86% accepted. Whereas the perceived main benefit of accepting IRS was to kill mosquitoes, only 17% mentioned protection from malaria (Table 5). The reasons of rejecting IRS were mainly bad smell of the insecticides and the fear that insecticides may kill their domestic animals (Table 5).

3.5. Healthcare Seeking Behavior. The majority of the respondents reported to seek treatment for malaria from health

facilities (hospital/dispensaries/health centers) (Table 6). Home treatment or self-treatment was also practiced by many families. Allopathic practitioners (i.e. medical doctors) and traditional healers were also consulted frequently for malaria treatment (Table 6). Education level did not influence significantly the type of treatment respondents would select for malaria treatment (Table 6).

3.6. Drugs Used For Malaria Treatment, Knowledge, and Attitudes on Combination Therapy. The common antimalaria drug used by respondents which were either obtained

TABLE 5: Reported respondent's knowledge, perceptions and acceptance of Indoor Residual Sprays (IRS).

Variable	<i>n</i>	%
Heard of IRS campaign	174	49.2
Source of information about IRS		
Radio program	69	37.9
TV advertisement	20	11
Community health workers	3	1.6
I sprayed my house	22	12.1
Government campaign	30	16.5
Others	38	20.9
Ready for IRS in their houses		
Yes	308	86.3
No	26	7.3
Undecided	23	6.4
Reasons for accepting IRS		
To kill mosquitoes	230	73.5
To kill mosquitoes and indoor insects	16	5.1
To protect the family from malaria	52	16.6
Others	15	4.8
Reasons for not accepting IRS		
Insecticides have bad smell	12	30.8
Insecticides may kill my children	1	2.6
Insecticides may kill my animals	3	7.7
Insecticides may cause infertility	2	5.1
Others	21	53.9

from drug stores, dispensaries/health centers, or hospitals were artemether lumefantrine (ALU) (21.2%), sulfadoxine-pyrimethamine (19.3%), metakelfin (16.9%), amodiaquine (15.5%), paracetamol (13.3%), local herbs commonly referred as “Mbilizi”, “Nkamba” and “Kamuli” (7.2%), quinine (4.4%), and chloroquine (1.7%). A significant association between education level and selection of the type of antimalarial drug was observed ($P < .03$). Illiterate people were observed to use more tradition herbs (57.7%) than literate individuals (37.7%).

With regards to the knowledge and perceptions about the combination therapy, artemether + lumefantrine, 94.8% ($n = 344$) of the respondents had heard of the drug and the main source of information were health facilities (hospital/dispensaries/health centers; 68.3%) and radio/TV (28.7%). Other sources of information were drug shops, 1.4% ($n = 5$), and family members, 1.4% ($n = 5$). Surprisingly, only 35.3% ($n = 122$) of the respondents reported to have used ALU. Headache and dizziness were perceived as the most common side effects of ALU by 62.9% ($n = 17$) of the respondents. Other perceived side effects were nausea, anorexia and abdominal pain (18.5%), arthragia or myalgia (11.1%), palpitation (3.7%), and pruritis or rashes (3.7%).

When asked about their personal opinions on ALU, 56.4% ($n = 119$) of the respondents reported that the drug was good for treating malaria, 11.4% ($n = 24$) reported the drug did not cure malaria, 20.4% ($n = 22$) reported that the

full dose had too many tablets, 9.5% ($n = 20$) said the drug was good for treating children against malaria and 10.4% ($n = 22$) of the respondents reported that the drug had severe side effects.

4. Discussion

Results from surveys on knowledge, attitudes, and practices are applicable to design or improve malaria control programs, and to identify indicators for a program's effectiveness [8]. The results of our study can be incorporated into the decision-making processes, the design of sustainable interventions with active community participation, and the implementation of educational schemes [9].

Our data show that in rural Tanzania people have demonstrated a better understanding of malaria causes, symptoms, treatment and, preventive measures as observed in other reports from different parts of the world [7, 10, 11]. However, the findings revealed a poor or superficial knowledge on malaria transmission, treatment, preventions, and etiology among illiterate respondents. This has major implications for the planning of successful and sustainable control programs. The majority of the respondents associated mosquito bites with malaria transmission, which is a common observation in malaria endemic areas where people suffer frequently from the disease [7, 10–13]. However, in our study only few respondents mentioned a correct transmission route (“the bites of mosquito which has bitten a malarial patient”). About half of the respondents demonstrated a gap of knowledge on malaria transmission by stating that the bite of any mosquito could cause malaria and a quarter of respondents did not knew the mode of transmission. This observation was similar to the findings of Ahmed et al. [7] in Bangladesh. Public health education interventions should always be designed to cover the existing knowledge and should be implemented for a sufficient length of time for it to be effective [14].

Like elsewhere in Africa, the study community identified malaria mainly on the basis of the symptoms of fever/high temperature and general body weakness, fever with rigors and fever with sweating [10, 11, 15–17]. Despite good knowledge of malaria symptoms and signs, anaemia and convulsions were poorly associated with the disease. Lack of clear knowledge on anaemia and convulsions which are associated with malaria in children could lead to delay in seeking appropriate care from health facilities.

In this study, health facilities were the most common sources of malaria treatment in the study population. This observation was similar with other studies in Tanzania [10, 18]. Self-treatment was also practiced by the study participants for treatment of malaria. This was consistent with findings of other studies in India and Bangladesh [7, 19]. Informal allopathic providers such as drug store sales people and traditional healer were also consulted by respondents [7, 20].

Bed nets are among the most recognized methods of personal protections against mosquitoes and many studies have reported the benefits of ITNs [21, 22]. The majority

TABLE 6: Reported respondent's health seeking behavior against malaria by educations (%).

Variable	Level of education				
	None	Primary	Secondary	Tertiary qualification	Others
Action taken when having malaria					
Allopathic	12.6	4.9	2.7	0	0
Homeopathic	38.8	44.6	51.3	25	50
Traditional healer	0	0.98	0	0	0
Hospital/Dispensaries	43.7	46.6	43.6	75	50
Others*	4.9	2.9	2.6	0	0
χ^2			Not significant		
N	103	204	39	4	6

*Others: self treatment, no treatment, buy antimalaria at drug stores.

mentioned the use of insecticidal bed nets (ITNs) in our study, and most of them reported to sleep under bed nets a night before the survey. Similar results have been reported from Mexico, Ghana, Tanzania, and Bangladesh [10, 12, 23]. Most of the households reported ITN ownership and the majority reported that everyone in the household was sleeping under a bed net. This was an encouraging observation and can be used by malaria control programme to increase the number of ITNs in this community but this will not imply use of it. The main reason of sleeping under bed nets was protections from mosquito bites. The use of ITNs in Tanzania has increased markedly over the past few years. Statistics of 2001–2005 from the National Malaria Control Programme reported that the proportion of households with at least a mosquito net has increased from 14% to 58%, while the proportion of households with at least an ITN has increased from 14% to 25% [2]. Following a mass campaign to distribute free ITNs to mothers of under five, pregnant women and introduction of voucher scheme to pregnant women, these statistics have changed [24]. Affordability to purchase a net was the most common barrier in owning a net. This finding is similar to a previous report from Eastern Tanzania [10]. The majority of respondents reported to retreat their bed nets with insecticides “NGAO” after 2-3 months and the main sources of “NGAO” was indicated to be the retail shops. Net washing is an important determinant of the effectiveness of ITNs, targeted efforts have to be made to sensitize the community on washing their nets after specified period of time. The cost of “NGAO” was mentioned to be the main reason for not re-treating bed nets.

Conversely, about half of respondents reported to have heard of IRS program and the main sources of information on IRS were radio programs and government campaign. Most of the respondents accepted their house to be sprayed during the spraying campaign. This attitude is favorable to implementation of IRS for malaria vector control.

The respondents recognized the benefits of IRS in the reduction of mosquito abundance (73.5%), but only 17% related this with protection of the family against malaria. Similar observations have been reported in Mexico [23]. Acceptability of the spraying, in terms of house-spraying coverage, is sufficient to prevent human-vector contact and to control malaria in the study area. Malaria control based

on indoor house spraying heavily depends on this acceptance [23]. The causes of refusal of accepting IRS were bad smell of the insecticides, poisoning of domestic animals, poisoning of children, and the insecticides may cause infertility to family members. The responses corroborate another report from Mexico [25]. A study in Zimbabwe concluded that there is a significant relationship between people's knowledge of the causes of malaria and preventive measures taken against it, and that a household's level of understanding of the purpose of an insecticides spraying program is directly correlated with their compliance with having their house sprayed [3].

In this study, the majority of respondents reported to have heard of the combination therapy, artemether+lumefantrine (ALU) for treatment of malaria. Health facilities were the main sources of information about ALU. This has also been reported from Nigeria [26]. Surprisingly, only 35% of the respondents reported to have used ALU for malaria treatment. Probably, the ongoing campaign by the Ministry of Health and Social Welfare to sensitize the community to use ALU to treat malaria in children may have resulted into adults to use other antimalarials. In a study by Ajayi et al. [26] conducted in Nigeria, most of the respondents reported that ALU was the best treatment for malaria in children. Artemisinin combination therapy (ACT) with ALU is currently the first line treatment policy in Tanzania. ALU is an efficacious drug combination that also has the capacity to reduce malaria transmission to mosquitoes. Some of the respondents still mentioned local herbs as the first treatment for malaria at home. This was similar with previous studies in Nigeria and Ghana [20, 26]. The perceived side effects of ALU by respondents were headache and dizziness, nausea, anorexia and abdominal pain, and arthragia or myalgia. Although this finding is similar to reports of earlier studies which reported mild adverse effect during clinical trials [27, 28] and among patients prescribed ALU [29], but these observations cannot be used to draw conclusion on the safety of ALU.

On the other hand, when respondents were asked about their personal opinion on ALU, the majority believed that the drug was good for malaria treatment and the best drug in treating children. A similar finding was reported by Ajayi et al. [26] in Nigeria. However, other respondents complained that the fully dose of ALU has many tablets, the drug had

severe side effects, the drug do not cure malaria, and high cost of the drug in retail shops.

5. Conclusions

The findings of this study indicate that rural communities in northwestern Tanzania have high knowledge on malaria transmission, symptoms, and preventive measures. However, low education was detected as a major drawback for effective control, and intervention measures and information campaigns should focus on this high risk group. There is also a need for district health departments to improve availability of information about malaria through rural dispensaries and primary health centers.

The use of bed nets is widespread which makes its intensive use viable for malaria control. The high community acceptance of IRS is an advantage for the program to introduce IRS for effective malaria vector control. Health education is needed to convince some members of the community to use Artemether Lumefantrine combination therapy for effective malaria treatment.

There is a need for future studies to evaluate effectiveness of IRS on malaria vectors, prevalence, and the community perception on IRS after spraying exercise. Lastly, collaborations between the public and private sector on malaria control are encouraged because both the community and business benefit from the control activities.

Competing Interests

The authors declare that they have no competing interests.

Authors' Contributions

H. D. Mazigo conceptualized and designed the study, analyzed data, drafted the manuscript, and made final revisions. M. Zinga, E. J. Kkweka, and L. L. Mnyone did sample calculations and designed the study. E. Obasy, W. Mauka, and P. Manyiri organized the field activities, data collections and helped in the revision of the manuscript. J. Heukelbach analyzed data, drafted the manuscript, and made final revisions. All authors read and approved the final version of the manuscript.

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