ORIGINAL ARTICLE

Malaria and Its Prevention: Socio-acceptability in the Application of Insecticides-treated Bed Nets Among Household Heads in the Rural Village Community of Mazabuka, Zambia

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ABSTRACT

Introduction: Malaria poses immerse public health challenges in the world as it is still causing significant morbidity and mortality especially in endemic regions such as Zambia. One of the effective tools in preventing malaria is the application of insecticide-treated bed nets (ITNs). This study aims to explored the socio-acceptability of malaria and ITNs among rural village community of Mazabuka, Zambia. **Methods:** A semi-structured questionnaire was administered to 177 respondents via two different approached methods; focus group discussions and one-to-one interviews to assess the level of KAP of the respondents about malaria and ITNs. **Results:** Most of the respondents (98.7%) possessed ITNs that were provided free of charge by the Ministry of Health Zambia. Overall, the knowledge and attitude of respondents on malaria and ITNs were at moderate levels of 68.1% and 71.8%, respectively. In contrast, the level of practice was poor with only 36.2% of positive response. Although 92.1% of the respondents answered correctly on the association between malaria and mosquito bites, myths and misconceptions were still common as some of them still attributed malaria to drinking dirty waters (32.8%), bad weather (15.8%), witchcraft (3.4%), and bathing dirty water (19.8%). The practice was significantly associated with knowledge (p=0.003), but not attitude (p=0.230). Logistic regression analysis revealed that respondents with high knowledge level and tertiary education were more likely to use ITNs correctly (OR=2.957; OR=21.739, respectively). **Conclusion:** The present study showed that the knowledge gaps were remained among the villagers as misconceptions and their believe of myths were still exist.
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Keywords: Insecticide-treated bed nets, Socio-acceptability, Malaria, Rural Zambia

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INTRODUCTION

Malaria remains one of the leading causes of morbidity and mortality in tropical and sub-tropical countries despite decades of disease control efforts (1). Every year, malaria continues to claim millions of lives (2) with the World Health Organization (WHO) in 2020reporting the presence of malaria in as many as 85 endemic countries worldwide with an estimated 241 million malaria cases (3). Globally, it led to 627,000 deaths in 2020 which about 12% upsurge compared to 558,000 deaths in 2019 (3). In 2017, 61% of the victims of malaria infection being young African children (4). Furthermore, tifteen countries in Sub-Saharan Africa account for up to 95% of the global burden of malaria (3). The progress to reduce the global malaria cases is not significant as malaria cases continue to rise in the twenty-nine countries with the highest disease burden worldwide, especially on the African continent. Six of these countries (Nigeria, the Democratic Republic of the Congo, Mozambique, Uganda, Angola, and Burkana Faso) were responsible for about half of all the malaria cases worldwide (3,). In Zambia, almost eight million malaria cases in 2020, increasing from four million in 2015. The malaria death declined from 2389 cases in 2019 to 1972 cases in 2020 (3, 5). Despite some decrease in the malaria death cases since 2015, it remains a challenge to continuously reduce the malaria cases in Zambia. The efforts are hindered by inadequate health infrastructure, limited financial and human resources, as well as poorly planned and executed malaria control programs on the African continent (6). However, the renewal of interest in scaling up the implementation of effective interventions throughout Africa has generated new hopes (7) and ambitions to eliminate malaria transmission in countries that have shown significant case reduction (8).

To date, the malaria vaccine program has been launched in Kenya, Ghana, and Malawi. The vaccine, known as 'RTS, S/AS01', is suitable for children from 6 months to 2 years old. Completion of four doses showed a significantly reduced malaria infection rate in children (4). Apart from vaccination, insecticide-treated bed nets (ITNs) and indoor residual spraying (IRS) are the cornerstones of vector-targeted interventions that have been proven effective and applied in a wide range of settings (9). Coupled with effective case management, ITNs and IRS have yielded a marked reduction in cases in many southern African countries (6). The Ministry of Health (MOH) Zambia, through the National Malaria Control Programme (NMCP), has outlined an aggressive approach aiming at reducing malaria and malaria-related burden through massive scale-up of proven control interventions. In the pursuit to achieve the ultimate "Malaria-Free Zambia" goal, Integrated Vector Management (IVM) was implemented in 2006. One of the efforts under IVM was the massive distribution of ITNs. Nevertheless, malaria remains one of the leading causes of morbidity and mortality in Zambia (10). Worse still, the country is facing a resurgence of the disease, together with neighboring Rwanda and Sao Tome and Principe (11). However, unlike Zambia, the latter two countries showed a reduction in the following year (3). Therefore, it is postulated that the local community perception of malaria plays a major role in ensuring better understanding, uptake, and sustainability of malaria control strategies. Thus, the study on the knowledge, attitude, and practice (KAP) in the community towards malaria control interventions is vital to identify any gaps at the community level so that any weaknesses of the control interventions can be addressed promptly (12).

A few studies have been conducted in determining the KAP of malaria control in various parts of Zambia (13, 20, 25). However, this study focused on the communities in the rural areas of Southern Zambia. This cross-sectional study aimed to assess the social acceptability of malaria and the use of ITNs among respondents in the Cheeba village of Mazabuka, Zambia. It also aimed to determine the relationship between the socio-demographic characteristics of respondents and their KAP level of malaria and its prevention. The predictors of proper net usage among study respondents were also investigated.

MATERIALS AND METHODS

Study Area

Zambia is a landlocked country situated in the southern part of sub-Saharan Africa with a population of about 13 million people. The transmission of malaria in Zambia is high with a seasonal pattern with peaks during the rainy season from November to April (14). Malaria-related morbidity and mortality have been increasing in Zambia since 2010. To date, the cornerstones of malaria control in Zambia IRS using dichlorodiphenyltrichloroethane (DDT) and ITNs, supported by effective case management (14).

Mazabuka is one of the 73 districts in the country and is located in the Southern part (3). The study was conducted between August and December 2011 in the village of Cheeba in Mazabuka (Figure 1). The site was selected based on the recommendation of the Mazabuka District Health Management. Cheeba is located about 120 km away from the central business district of Mazabuka. It is also 15 km off the main road. The village area consists of households grouped into 3 sub-villages, i.e. Cheeba, Chitingizya, and Soda. Each sub-village is headed by a traditional leader known as the "Village Headman". Cheeba has a history of high malaria incidences and the traditional leaders were agreeable to participating in the study. There is also a Rural Health Centre (RHC) manned by a qualified nurse within its vicinity.

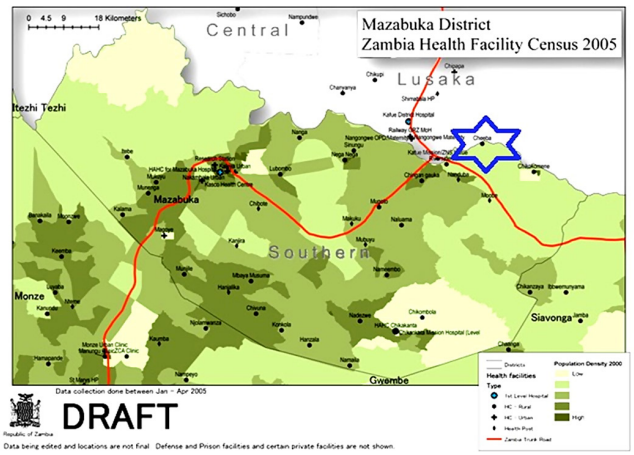

Figure 1: Map of Mazabuka district with the star indicating the village of Cheeba

Study Design and Population

This cross-sectional survey employed a universal sampling method. All respondents or in their absence; a representative aged 18 years and above were interviewed. The minimum sample size for this research derived using Cochrain's formula (15) was 173. A total sample of 177 respondents was recruited.

Ethical considerations

Ethical approval was obtained from the Research Ethics committee at Universiti Putra Malaysia, Eres Converge Research Ethics Committee in Zambia, and the MOH Zambia. A detailed explanation was given to the respondents before enlisting them. Both verbal and written consent was obtained. The responses were kept confidential and anonymous.

Data Collection

Semi-structured questionnaires containing questions gathered from previous studies on KAPs and modified to suit the objectives of this research were developed. The content of questionnaires was validated with cross-reference and verification was made from the experts

in the field. Reliability of the questionnaires was done by administering the questionnaires to a group of respondents in a different village. The Cronbach's alpha for each section in the questionnaire was within the acceptable limit (> 0.7). The questionnaires were pre-tested and standardized to be administered by trained field workers. The administration of the questionnaire was monitored daily for quality control and follow-ups were made in the following day if any issues arose. The first part of the questionnaire captured demographic characteristics, the second part included questions on knowledge of malaria (transmission, signs, symptoms, and vector biting times), the third part examined the attitude of ITN usage while the last part assessed the practice of the respondents.

Three focus group discussions (FGDs) were performed consisting of 9, 10 and 7 respondents (16) in each of the sub villages. The respondents comprised of respondents that have been selected carefully by the health centre nurse and the headman. The FGDs were conducted to consolidate the semi-structured questionnaire and also allow the respondents to share the information as well as maximizing the benefits of group dynamics. Apart from that, the purpose of conducting FGDs were clearly explained in the respondent's sheet information as well. The respondents were further informed that the discussions would be recorded for assisting the researcher to recall of what have been discussed. After getting the consensus from the respondents, the group members were assigned with the numbers which were written on the blank paper and tagged onto their shirts. This is to ensure the anonymity of the respondents is applied throughout the discussion. The recordings were translated from the local dialects to English languages.

Apart from FGDs, one to one interview also has been conducted. The interview was conducted using the preferred dialects of respondents. Respondents were informed to be freely asked any questions related to the study and their participation in this study is based on the voluntary basis. Data was collected by administering a semi-structured questionnaires on one-to-one interviews involving the respondents.

Data analysis

The data were analyzed using Statistical Package for Social Sciences (SPSS) version 19.0 (SPSS Inc., Chicago, IL, USA). Descriptive analysis was used to determine the sociodemographic factors and the KAP level of respondents on malaria control and prevention. The association between selected categorical variables (KAP and socio-demographic characteristics) was determined using the Chi-square test. Statistical significance was set at p-value of < 0.05 with 95% confidence interval (CI). Variables showing significant associations were included in the logistic regression analysis.

The digital records of FGDs containing local dialects (Tonga, Nyanja, Bemba and Lozi) were directly transcribed into English language and later were coded based on the research objectives (17,18). The translated texts were read by researchers repeatedly prior to the development of relevant and precise themes. Next, the data were coded based on the thematic analysis by organizing the data into the relevant themes and behavioral patterns. The similarities and contradicts viewpoints were identified. Data in each of the themes were retrieved, assembled and viewed to achieve the significant interpretation in accordance to the study objectives.

RESULTS

Socio-demographic characteristics of the study population

A total of 177 respondents were involved in this study. The participation of male and female respondents was almost equal (males: 51.4%, females: 48.6%) with a range of age between 18 and 61 years (mean age of 37.0 + 14.0). Half of the respondents (52.5%) had attained basic education and only 4.5% attended tertiary schools. Most respondents were either unemployed (51.0%) or housewives (42.0%). The mean person per household was 5.19 (SD=2.45). A high proportion of houses (72.5%) were made of muddy brick walls with either iron sheets (56.5%) or grass roofs (43.5%). Furthermore, most houses were small, measuring only 3.0 x 3.0 meters and about 2.5 meters high. The primary water source in the village was from self-dug shallow wells (62.7%). Meanwhile, pit latrines (88.7%) were the only type of toilet available. A small percentage of the houses did not have any proper toilet (11.3%). Almost all households (98.9%) used bed nets in their homes, thus giving rise to a high prevalence of net possession among the village households. In addition, the majority of respondents suffered from malaria before (97.2%). Only five respondents (2.8%) claimed to not have contracted malaria before. In the year 2011, almost 152 (85.9%) of respondents had contracted malaria at least once and only 25 of them (14.1%) did not contract malaria (Table I).

Knowledge of Malaria

The mean percentage score for malaria knowledge was 68.1% (SD=26.64), indicating a moderate knowledge level. Nine of out ten of the respondents (92.1%) correctly associated the disease with mosquito bites. However, certain of them still associated malaria disease with other causes such as human transmission (92.1%), bad weather/sun (83.6%), bathing in dirty water (79.1%), witchcraft (96.0%), and the consumption of dirty water (66.7%). The most frequently mentioned signs and symptoms of malaria in order of frequency were fever (82.5%), body pains and weakness (82.5%), headache (79%), loss of appetite (58.8%), nausea and vomiting (57.2%) as well as chills and rigors (49.2%). The main source of information concerning malaria originated

Table I: Socio-demographic characteristics of respondents in the village of Cheeba, Mazabuka District, Zambia

Characteristic	n	%
Gender		
Male	91	51.4
Female	86	48.6
Age		
18 – 30	75	42.4
31 – 43	49	27.7
44 – 56	28	15.8
57 +	25	14.1
Number of persons in household		
1 – 5	85	48.0
5 – 8	67	37.9
9+	25	14.1
Marital status		
Single	25	14.1
Married	130	73.4
Divorced	12	6.8
Widowed	10	5.6
Highest level of education completed		
Illiterate	29	16.4
Primary	33	18.6
Basic	93	52.5
High School	14	7.9
Tertiary	8	4.5
Occupation of respondents		
Not employed	51	28.8
Self-employed	32	18.1
Housewife	45	25.4
Employed	40	22.6
School going	9	5.1
Family Income (Zambian Kwacha)		
245,000 – 490,000	141	79.7
491,000 – 980,000	27	15.2
>980,000	9	5.1
Housing structure		
Roofing		
Iron sheets/asbestos	100	56.5
Thatched roof	77	43.5
Walls		
Concrete	42	23.7
Muddy bricks	133	75.2
Others	2	1.1
Water source		
Piped	3	1.7
Borehole	44	24.9
Well	111	62.7
River	19	10.7
Toilet type		
Pit latrine	157	88.7
Others	20	11.3
Drainage		
Good	2	1.1
Poor	175	98.9
Ever had malaria?		
Yes	172	97.2
No	5	2.8
How many times did you suffer from malaria in 2011		
0	25	14.1
1	56	31.6
2	64	36.2
3	24	13.6
>3	8	4.5
Do you have mosquito nets in your home?		
Yes	175	98.9
No	2	1.1

from the health facilities although a few mentioned that it was from their friends. Most of them were aware that malaria-transmitting vectors bite at night (74.0%). Surprisingly, they also mentioned that the vectors would bite throughout the day (88.1%). A few of them mentioned it could be transmitted due to vector-bite in the late evening (40.7%) or early morning (29.9%). Most of them claimed that they have heard of ITNs (99.4%) although 19.2% of them did not know the difference between ITNs and ordinary bed nets. Apart from that, their knowledge regarding the possibility of malaria prevention was high (91.5%) among respondents. Only 5.6% claimed that malaria could not be prevented while 2.8% did not know whether it can be prevented or not. It was notable that the respondents would prefer to share the bed nets with other family members (95.5%) rather than put prioritize their children (72.3%) or pregnant women (29.9%) if there was an issue of inadequate bed nets (Table II).

Respondents' attitude towards malaria and ITNs

The mean score for the attitude of respondents was 71.8% (SD=34.59). Descriptive analysis showed that the majority of respondents had positive attitudes towards malaria as a disease and its prevention, particularly the usage of ITNs (Table 3). For instance, all respondents (100%) stated that they were concerned about contracting malaria and 97.7% asserted that malaria is a serious disease. As high as 85.9% of them would seek treatment within 24 hours if they fell sick. Moreover, 70.6% were willing to purchase a bed net if they could not receive it for free (Table III).

Respondents' practice regarding malaria prevention and treatment-seeking patterns

The practice items consisted of ten statements that examined good and unacceptable practices of malaria prevention among the respondents. The mean percentage score for the practice was 36.9% (SD=32.2). In other words, the practices of malaria prevention using ITNs were rather low. Moreover, their practice scores were much lower than the scores of knowledge and attitude. However, most of the respondents (97.7%) had used ITNs before. Almost half of them (49.2%) claimed that they just slept under a bed net the night before the survey. On the contrary, when a physical check was conducted, only less than half of households (37.9%) had at least a bed net hanging in their homes. The bed nets in the rest of the households were either still unopened in the package or stored somewhere else in the house.

In addition, the respondents claimed that they were prompt in treatment-seeking as 85.9% responded that they would seek treatment for malaria within 24 hours of symptom onset. Only 14.1% would wait and observe the condition. However, they did not state the exact period of waiting. It is important to point out that 4% of

Table II: Respondents' knowledge of malaria and its prevention

Statements	Correct responses n (%)	Incorrect responses n (%)	Do not know n (%)
Malaria is transmitted by			
Mosquito bites	163 (92.1)	13 (7.3)	1 (.6)
Drinking dirty water	118 (66.7)	58 (32.8)	1 (.6)
Bad weather/sun	148(83.6)	28 (15.8)	1 (.6)
Human to human	163 (92.1)	7 (4.0)	7 (4.0)
Witchcraft	17 (96.0)	6 (3.4)	1 (1.6)
Bathing in dirty water	140 (79.1)	38 (19.8)	2 (1.1)
Malaria signs and symptoms			
Fever	146 (82.5)	29 (16.4)	2 (1.1)
Chills/rigors	87 (49.2)	88 (49.7)	2 (1.1)
Body pains/weakness	146 (82.5)	31 (17.5)	0 (0)
Headache	141 (79.1)	35 (19.8)	1 (.6)
Nausea and or vomiting	102(57.6)	72 (40.7)	1 (.6)
Loss of appetite	104 (58.8)	72 (40.7)	1 (.6)
Cough	22 (12.4)	155 (87.6)	0 (0)
Abdominal discomfort	69 (39.0)	108 (61.0)	0 (0)
What times do mosquitoes transmit malaria bite?			
Early morning	53 (29.9)	124 (70.1)	0 (0)
Late evening	72 (40.7)	105 (59.3)	0 (0)
At night	131 (74.0)	46 (26.0)	0 (0)
Throughout the day	156 (88.1)	21 (11.9)	0 (0)
Is it possible to avoid getting malaria?	162 (91.5)	10 (5.6)	5 (2.8)
Have you heard of ITNs?	176 (99.4)	1 (1.6)	0 (0)
Is there any difference between ITNs and ordinary bed nets?	102 (57.6)	41 (23.2)	34(19.2)
If you have fewer nets than the number required, who must be given priority to use them?			
Children	129 (72.3)	48 (27.1)	1 (.6)
Husband and wife	160 (90.4)	16 (9.0)	1 (.6)
Visitors	160 (90.4)	16 (9.0)	1 (.6)
Pregnant women	53 (29.9)	123 (69.5)	1 (.6)
All share	169 (95.5)	7 (4.0)	1 (.6)

Table III: Respondents' attitude towards malaria and ITNs

Statements	Agree n (%)	Disagree n (%)	Uncertain n (%)
I use mosquito nets to prevent malaria	172 (97.2)	2 (1.1)	3 (1.7)
I use mosquito nets to avoid mosquito bite	176 (99.4)	0 (0)	1 (.6)
In your opinion, do you feel you would like to learn more about malaria and ITNs	135 (76.3)	40 (22.6)	2 (1.1)
When you feel sick, how soon would you seek for treatment?			
Immediately (within 24 hours)	152 (85.9)	25 (14.1)	0 (0)
Wait and observe condition	25 (14.1)	150 (84.8)	2 (1.1)
Wait till condition gets worse	7 (4.0)	167 (94.4)	3 (1.7)
Wait till household head comes	3 (1.7)	171 (96.6)	3 (1.7)
In your opinion, do you believe that;			
ITNs are easy to use	163 (92.1)	13 (7.3)	1 (.6)
ITNs are best tools to prevent further occurrence of malaria	166 (93.8)	6 (3.4)	5 (2.8)
It is totally the responsibility of Health authorities to implement malaria prevention and control measures?	80 (45.2)	89 (50.3)	8 (4.5)
Malaria is a serious disease?	173 (97.7)	2 (1.1)	2 (1.1)
Malaria can kill if left untreated?	166 (94.4)	0 (0)	9 (5.1)
You are concerned about getting malaria?	177 (100)	0 (0)	0 (0)
You cannot afford to buy mosquito net if you were not given one freely?	45 (25.4)	125 (70.6)	7 (4.0)
In your opinion, who do you feel should take lead in mosquito control?			
The Community	147 (83)	26 (14.6)	4 (2.3)
The Government	163 (92)	8 (4.5)	6 (3.4)
House owners	154 (84)	21 (12.9)	2 (1.1)
Myself	156 (88.2)	18 (10.2)	3 (1.7)
The Solid Waste Company	143 (80.8)	14 (7.9)	20 (11.3)

those who preferred to wait until the condition worsened before seeking treatment were males. Their reason was simply because they wanted to be certain that it was a serious illness.

On a separate note, 8.5% of respondents stated that they would also consult traditional healers and 24.9% of them would consume traditional herbs. Half of the respondents (51.4%) ascertained that they would also buy drugs that were available over the counter from the drug stores. Most of them claimed that they used mosquito nets to prevent malaria (98.9%). Other preventive measures mentioned by the respondents were keeping the house clean (60.5%), eliminating the mosquito breeding sites (40.7%), and using insecticides or spray (13.0%) (Table IV).

Table IV: Respondents' practices of malaria and ITNs

Statements	Yes n (%)	No n (%)
Have you ever used a mosquito-net?	173 (97.7)	4 (2.3)
Apart from going to the clinic and hospital, where else do you go to get treated for malaria?		
I buy drugs on my own from pharmacy	91 (51.4%)	86 (48.6)
Traditional healers	15 (8.5)	162 (91.5)
Use herbal medicines (If yes, please specify)	44 (24.9)	133 (75.1)
How do you and your family prevent malaria?		
We use mosquito nets	175 (98.9)	2 (1.1)
We Keep the house/ surroundings clean	107 (60.5)	70 (39.5)
We eliminate the mosquito breeding sites	72 (40.7)	105 (59.3)
We use of insecticide/ spraying	23 (13.0)	154 (87,0)
We fumigate by smoke/ Fogging	13 (7.3)	164 (92.7)
We use anti-malaria drugs	2 (1.1)	175 (98.9)
We use medicinal plants. If Yes, name.	8 (4.5)	169 (95.5)
How many people sleep under ITNs in your home?		
Everyone	87 (49.2)	90 (50.8)
Some	23 (13.0)	154 (87)
None	4 (2.3)	173 (97.7)
Frequency of bed net use		
I sleep under ITNs every night	95 (53.7)	82 (46.3)
I occasionally sleep under ITNs	81 (45.8)	96 (54.2)
I do not sleep under ITNs at all	2 (1.1)	175 (98.9)
Did you sleep under ITN last night?	87 (49.2)	90 (50.8)
Net hanging? (Physical check)	67 (37.7)	110 (62.3)
Which Season of the year do you use mosquito nets?		
Warm and Wet season	156 (53.7)	21 (11.9)
Cool and Dry season	92 (52.0)	85 (48.0)
Hot and dry season	136 (76.8)	41 (23.2)
Do you retreat the nets?	69 (39.0)	108 (61.0)
When you are outdoors for gatherings like funerals between dusk and dawn, what measures do you take to prevent mosquito bites?		
Insect repellents	6 (3.4)	171 (96.6)
Wearing long-sleeved clothes	23 (13.0)	154 (87.0)
Burn cow-dung	2 (1.1)	175 (98.9)
Fire/smoke	46 (26.0)	131 (74.0)
No measures	103 (58.2)	74 (41.8)

Association between KAPs and socio-demographic characteristics

Chi-square analysis showed a significant association between the knowledge level of malaria and income (p=0.021), tertiary education level (p=0.007), and self-employed status (p=0.004). Respondents with high-income levels were associated with a good knowledge of malaria compared to those with low-income levels (88.9% vs. 49.4%; prevalence ratio (PR) = 8.193, 95% CI = 1.003-66.953). The association of knowledge level and other variables are shown in Table V.

No significant association was detected between the attitude and socio-demographic factors. As for the practice scores, there was a significant association between preventive practice and the age group of 18 to 30 years (p = 0.003), age group of 57 to 71, and school attendance (p = 0.003) (Table V).

Relationship between socio-demographic characteristics and KAP with the consistency of net usage among respondents

The analysis revealed a significant association between the use of ITN and several sociodemographic characteristics, i.e. gender (p=0.0001), age group of 18-30 (p=0.001), age group of 31 to 43 (p=0.023), level of education (basic [p=0.016], high school [p=0.014], and tertiary[p=0.025]), as well as employment status (self-employed [p=0.004], housewives [p=0.0001], and school-going [p=0.011]) (Table VI). In terms of the relationship between KAP and consistency of net usage, three variables that showed significant association were high knowledge [p=0.0001], positive attitude [p=0.0002], and excellent practice [p=0.0001] (Table VI).

Further analysis with logistic regression was performed to identify the effect of significant sociodemographic characteristics and KAPs on the likelihood of consistent usage of bed nets among the respondents. Those with higher knowledge scores were more likely to use the ITN correctly [OR 2.957, (95% CI = 1.436-6.091, p-value = 0.003)]. As for education background, tertiary education was a significant predictor of proper usage of bed nets [OR= 21.739, (95% CI 1.799- 25.000, p-value = 0.012)] (Table VI).

DISCUSSION

Knowledge, attitude, practices of malaria and its prevention with ITNs among respondents

ITNs are an integral component of the Roll Back Malaria (RBM) global strategy plan and an essential means to attain the malaria-related Millennium Development Goal 6 (MDG 6) (19). This study was conducted to provide vital information on the KAP of malaria and its prevention in Zambia, a country that aims to achieve malaria elimination. The study focused on a community in an area with almost universal coverage of ITNs. The study findings demonstrated that the majority of community members had an excellent knowledge of malaria that was mainly acquired from the health facilities and very little knowledge was gained from malaria community meetings. All except five (2.8%) of the respondents had a history of malaria illness, thus possibly indicating the holo-endemicity of disease in the area. Another possible reason could be misdiagnosis as febrile illnesses are often assumed as malaria.

In this study, nine out of ten respondents correctly associated malaria transmission with constant exposure to the vector, i.e. mosquito bites. The finding was comparable with Shimaponda-Mataa et al. (2017) (20) in which 89.6% of respondents showed a high knowledge in terms of mosquito being a vector of malaria. Our respondents demonstrated better knowledge levels of malaria transmission than studies done in Ethiopia (21),

Table V: Association between respondent's knowledge, attitude, practice, and their socio-demographic characteristics

Variables	Knowledge level n (%)		Total n (%)	P value (Pearson Chi Square)	Prevalence ratio (95% C.I)
	Good	Poor			
Gender					
Male	41 (45.1)	50 (54.9)	91 (51.4)	0.082	1.694 (0.934-3.071)
Female	50 (58.1)	36 (41.9)	86 (48.6)		
Age groups					
18-30	44 (58.7)	31 (41.3)	75 (42.4)	0.098	1.661 (0.909-3.034)
Non 18-30	47 (46.1)	55 (53.9)	102 (57.6)		
Level of education					
Primary	13 (39.4)	20 (66.6)	33 (18.6)	0.126	0.550 (0.254-1.190)
Non Primary	78 (54.2)	66 (45.8)	144 (81.4)		
Basic	50 (53.8)	43 (46.2)	93 (52.5)	0.510	1.220 (0.675-2.202)
Non Basic	41 (23.2)	43 (51.2)	84 (47.5)		
High school	4 (7.2)	10 (71.4)	14 (7.9)	0.075	0.349 (0.105-1.160)
Non high school	87 (49.2)	76 (46.6)	163 (92.1)		
Tertiary	8 (100.0)	0 (0)	8 (4.5)	**0.007***	0.491 (0.421-0.573)
Non tertiary	83 (49.1)	86 (50.9)	169 (95.5)		
Illiterate	16 (55.2)	13 (48.8)	29 (16.4)	0.658	1.198 (0.538-2.665)
Non illiterate	75 (50.7)	73 (49.3)	148 (83.6)		
Employment status					
Unemployed	29 (56.9)	22 (43.1)	51 (28.8)	0.356	1.361 (0.707-2.620)
Not unemployed	62 (49.2)	64 (50.8)	126 (71.2)		
Self-employed	9 (28.1)	23 (71.9)	32 (18.1)	**0.004***	0.301 (0.130- 0.695)
Non self-employed	82 (56.6)	63 (43.4)	145 (81.9)		
Income					
High income	8 (88.9)	1 (11.1)	9 (5.1)	**0.021***	8.193 (1.003-66.953)
Low income	83 (49.4)	85 (50.6)	168 (94.9)		
	Attitude level				
	High	**Low**			
Gender					
Male	81 (89.0)	10 (11.0)	91 (51.4)	0.217	2.000 (0.655-6.110)
Female	81 (48.6)	5 (5.6)	86 (48.6)		
Age groups					
18-30	68 (90.7)	7 (9.3)	75 (42.4)	0.725	0.827 (0.286-2.389)
Non 18-30	94 (92.2)	8 (7.8)	102 (57.6)		
31-43	46 (93.9)	3 (6.1)	49 (27.7)	0.487	1.586 (0.428-5.881)
Non 31-43	116 (90.6)	12 (9.4)	128 (72.3)		
44-56	25 (89.3)	3 (10.7)	28 (15.8)	0.643	0.730 (0.192-2.774)
Non 44-56	137 (91.9)	12 (8.1)	149 (84.2)		
57-71	23 (92.0)	2 (8.0)	25 (14.1)	0.927	1.076 (0.228-5.081)
Non 57-91	139 (91.4)	13 (8.6)	152 (85.9)		
Level of education					
Primary	28 (84.8)	5 (15.2)	33 (18.6)	0.127	0.418 (0.133-1.317)
Non Primary	134 (93.1)	10 (6.9)	144 (81.4)		
Basic	85 (91,4)	8 (8.6)	93 (52.5)	0.949	0.418 (0.335-2.789)
Non Basic	77 (91.7)	7 (8.3)	84 (47.5)		
High school	13 (92.9)	1 (7.1)	14 (7.9)	0.852	1.221 (0.149-10.039)
Non high school	149 (91.4)	14 (8.6)	163 (92.1)		
Tertiary	8 (7.3)	0 (0)	8 (4.5)	0.375	0.911 (0.869-0.955)
Non tertiary	154 (91.1)	15 (8.9)	169 (95.5)		
Housewives	40 (88.9)	5 (11.1)	45 (25.4)	0.462	0.656 (0.212-2.033)
Non housewives	122 (92.4)	10 (7.6)	132 (74.6)		
School going	9 (100.0)	0 (0)	9 (5.1)	1.000	0.911 (0.869-0.955)
Non school going	153 (91.1)	15 (8.9)	168 (94.9)		
Household income					
Low Income	128 (90.8)	13 (9.2)	141 (79.7)	0.739	0.579 (0.125-2.691)
High income	34 (94.4)	2 (5.6)	36 (20.3)		
	Practice level				
	High	**Low**			
Gender					
Male	13 (14.3)	78 (85.7)	91 (51.4)	0.177	1.701 (0.782-3.702)
Female	19 (22.1)	67 (77.9)	86 (48.6)		
Age groups					
18-30	21 (28.0)	54 (72.0)	75 (42.4)	**0.003***	3.217 (1.441-7.185)
Non 18-30	11 (10.8)	91 (51.4)	102 (57.6)		
31-43	5 (10.2)	44 (89.8)	49 (27.7)	0.092	0.425 (0.154-1.176)
Non 31-43	27 (21.1)	101 (78.9)	128 (72.3)		
44-56	5 (17.9)	23 (82.1)	28 (15.8)	0.973	0.982 (0.343-2.816)
Non 44-56	27 (18.1)	122 (81.9)	149 (84.2)		
57-71	1 (4.0)	24 (96.0)	25 (14.1)	**0.048***	0.163 (0.021-1.249)
Non 57-91	31 (20.4)	121 (79.6)	152 (85.9)		
Illiterate	5 (17.2)	24 (82.8)	29 (16.4)	0.898	0.934 (0.327-2.668)
Non illiterate	27 (18.2)	121 (81.8)	148 (83.6)		
Employment status					
School-going	5 (55.6)	4 (44.4)	9 (5.1)	**0.003***	6.528 (1.648-25.889)
Non School-going	27 (16.1)	141 (83.9)	168 (94.9)		

*P < .05; **P < .001; ***P < .0001

Table VI: Relationship between socio-demographic characteristics and KAP with the consistency of net usage among respondents

Variables	Consistent use	Non-consistent use	N (%)	P value	Prevalence ratio (95% C.I)
Gender					
Male	23 (25.3)	68 (74.7)	91 (51.4)	**0.0001*** **	3.097
Female	44 (51.2)	42 (48.8)			(1.643-5.840)
Age groups					
18-30	39 (52.0)	36 (48.0)	75 (42.4)	**0.001****	2.863
Non 18-30	28 (27.5)	74 (72.5)	102 (57.6)		(1.528-5.365)
31-43	12 (24.5)	37 (75.5)	49 (27.7)	**0.023***	0.430
Non 31-43	55 (43.0)	73 (57.0)	128 (72.8)		(0.206-0.902)
Level of education	9 (27.3)	24 (72.7)	33 (18.6)	0.165	0.556
Primary	58 (40.3)	86 (59.7)	144 (81.4)		(.241-1.282)
Non Primary					
Basic	43 (46.2)	50 (53.8)	93 (52.5)	**0.016***	2.150
Non Basic	24 (28.6)	60 (71.4)	84 (47.5)		(1.151-4.016)
High school	1 (7.1)	13 (92.9)	14 (7.9)	**0.014***	0.113
Non high school	66 (40.5)	97 (59.5)	163 (92.1)		(0.014-0.885)
Tertiary	0 (0)	8 (4.5)	8 (4.5)	**0.025*[a]**	0.604
Non tertiary	67 (39.6)	102 (60.4)	169 (95.5)		(0.534-0.682)
Employment status					
Self-employed	5 (25.6)	27 (84.4)	32 (18.1)	**0.004***	0.248
Non self-employed	62 (42.8)	83 (57.2)	145 (81.9)		(0.090-0.680)
Formally employed	9 (22.5)	31 (77.5)	40 (22.6)	0.230	0.395
Non formally employed	58 (42.8)	79 (57.7)	137 (77.4)		(0.175-0.894)
Housewives	27 (60.0)	18 (40.0)	45 (25.4)	**0.0001*****	3.450
Non housewives	40 (30.3)	92 (52.0)	132 (74.6)		(1.709-6.965)
School-going	7 (77.8)	2 (22.2)	9 (5.1)	**0.011***	6.300
Non-school going	60 (94.9)	108 (64.3)	168 (94.9)		(1.268-31.293)
Knowledge scores					
High	50 (54.9)	41 (45.1)	91 (51.4)	**0.0001***[b]**	4.950
Low	17 (19.8)	69 (80.2)	86(48.6)		(2.527-9.697)
Attitude scores					
Positive	0 (0)	15 (100.0)	15 (8.5)	**0.002****	1.705
Negative	67 (41.4)	14 (58.6)	162 (91.5)		(1.498-1.941)
Practice scores					
Excellent	27 (84.4)	5 (15.6)	32 (18.1)	**0.0001*****	14.175
Poor	40 (27.6)	105 (72.4)	145 (81.9)		(5.104-9.364)

Significant by Chi-square test at *P <0.05; **P <0.001; ***P <0.0001; [a,b]Significant by logistic regression for tertiary education (AOR 21.739; 95% CI=1.799-25.000; p=0.012) and high knowledge (AOR 2.957; 95% CI= 1.436-6.091; p= 0.003).

India (22), Côte d'Ivoire (23). Again, these variations could be partly attributed to the holo-endemicity of the disease in the studied areas.

Apart from that, the high levels of knowledge towards the mode of transmission could be a result of the proximity to the health facility and the ongoing "scaling-up for impact" campaigns in Zambia during the study period. These results are parallel to study findings from Swaziland and Tanzania in which most respondents who had heard of malaria correctly associated the disease with mosquito transmission (24). Despite a high level of knowledge on malaria transmission, myths and misconceptions still prevailed. Similarly, Jumbam et al. (2020) (25) highlighted that many caregivers still lacked an understanding of how malaria can be transmitted. To some extent, this could explain why a substantial number of people with bed nets were still not using them properly (26). Moreover, unequal distribution of the bed nets and other issues related to the maintenance and replacement of nets could also explain the lack of proper net usage (27–29). Moreover, other studies suggested alternative ways to enhance the information delivery to the community, especially among those with low health literacy. For example, personal advice on hanging up ITNs can be provided to the community members. With customized health education that emphasizes knowledge gaps, it is hoped that the behaviors of the community towards malaria prevention can be improved (30,31).

It is interesting to note that only 19% of the respondents were aware that malaria transmission by mosquitoes occurs in the late evening and early morning. Thus, it highlighted the need for continuous sensitization of malaria campaigns among the surveyed community. These efforts are vital towards the reduction of malaria cases as reported in one of the studies done in Ethiopia (21). The commitment from the facility-based and community-based health workers who deliver the malaria prevention education play a fundamental role in improving the coverage of ITNs usage among the community (13). Most of the respondents sought treatment at the healthcare facility within 24 hours of the onset of symptoms, a higher rate than in Abuja (24). However, a few of the respondents were still believed to treat their family using traditional herbs. Some of the traditional herbs believed to confer anti-malarial properties including Mululwe (Cassia abbreviata), Milk thistle (Silybum marianum), and Aloe vera. The name of Mululwe plant is known to be used by Ila-speaking people which means 'bitter' and it represents as a characteristic of its taste (36). The root of Mululwe (Cassia abbreviata) has been used as a traditional medicine in the coastal region of Kenya for malaria treatment. A study reported that the root extract of this plant consists of flavan active compound which has a potential to be an anti-plasmodial agent (37). Meanwhile, the Milk thistle (Silybum marianum) is commonly recognized as hepatoprotective drug. Silymarin, which isolated from the plant's seed is a polyphenolic flavonoid has an anti-plasmodial mechanism by inhibiting the formation of peroxidase molecules due to heme detoxification. It also could induces the apoptosis by accumulating the caspase-3 level in the parasite cells (38, 39). Furthermore, all respondents expressed concerns about contracting malaria infection and the majority of them believed ITNs to be the best tools to prevent further occurrence of malaria in the community. However, their concern was not reflected in their ultimate practice in terms of net ownership because only 25.4% of them are willing to purchase a net if not provided by the health authority.

In general, the average practice score of malaria

and prevention using ITNs was much lower than the knowledge and attitude scores. There was a discrepancy between the reported use of ITN for the night before the survey and the actual deplored nets observed during the home visit, thus showing the possibility of informer bias in an attempt to impress the researcher. During the home visit, most of the ITNs were still in the original sealed packages, thus representing the non-utilization of ITNs. Another possible reason for non-usage was the build-up structure of the housing unit as most of the local houses were small and constructed with muddy bricks (31). Therefore, it is quite unfortunate that the high bed net coverage (98.9%) and the 2.7 persons per net ratio in the community did not translate into consistent net use. If the vision of a "Malaria-free Zambia" is to be accomplished, more attempts should be taken to promote the benefits of effective vector control and to highlight the importance for the community members to actively participate in community health promotion activities.

Association between KAPs and socio-demographic characteristics

Respondents with tertiary education levels showed a significantly higher knowledge of malaria and prevention using ITNs. Individuals with a higher level of education may broaden the knowledge related to the transmission, prevention, and treatment of malaria. This study echoed other studies and showed that malaria knowledge is strongly associated with preventive practices of malaria in sub-Saharan Africa (13,24). Apart from that, self-employed respondents also had a significant association with a higher knowledge level. Higher-income earners were also significantly more knowledgeable than the middle- and low-income earners, possibly due to the access to a broader source of information that can enhance their knowledge levels.

However, there was no significant association between socio-demographic factors and attitude. Only 25.4% of the respondents expressed their willingness to purchase bed nets if they are not provided for free. In the past, free net distribution by the government was a common practice, thus not many people were inclined to purchase the bed nets. Another more plausible reason might be the low-income status of most of the households, thus bed nets were not treated as a priority. Nevertheless, this study showed that most respondents preferred to use bed nets as the main choice of malaria prevention measures. It could be due to the successful health promotion by the MOH 'scale-up for impact' campaign that aimed towards universal ITN coverage.

Lastly, the practice of respondents' was significantly associated with their knowledge of malaria and prevention using ITNs. In other words, excellent knowledge can potentially yield excellent practice. Age was significantly associated with the practice, thus indicating that more experience or encounters with malaria over the lifetime can cast an influence on the compliance to the available prevention tools available. Unlike previous studies that reported an association between the level of education and the consistency of bed net use, such practice was not associated with the level of education in this study (23).

Consistency of bed net use

Lastly, this study also identified age, education, and employment status to be significantly associated with the consistency of ITNs use. Previous studies also demonstrated that formal education was associated with the correct use of ITNs (21,33). Additionally, our study also identified several challenges linked to ITN utilization, including excessive heat and suffocation due to the structure and limited space of the houses. On a similar note, a study in Kenya reported the sleeping arrangements could be one of the challenges that hampered compliance to ITNs usage among the community (34). To overcome this, the campaign to promote net hang-up is highly recommended to improve the utilization of ITNs in the community (35). Once in place, ITNs will be more likely to be used.

CONCLUSION

The majority of the study respondents had a moderate knowledge of malaria transmission, its signs and symptoms, and how it can be prevented. However, there is a need to improve their knowledge of vector biting times, thus, they can apply the necessary personal preventive measures and avoid unnecessary exposure at a certain time to halt the vector biting habits. This study also revealed that it is insufficient to just know about malaria unless the knowledge is translated into the right attitudes and preventive practices. Furthermore, it can also be concluded that increased ITN ownership does not automatically translate into increased utilization. Therefore, malaria control programs should focus on identifying and addressing any gaps in the KAPs of community members to achieve the target of malaria elimination. Despite of massive malaria control programs have been initiated in certain parts of Zambia, the number of malaria prevalence in Zambia was upsurged between 2010 and 2015, and currently between 2019 to 2021. Therefore, only by community consolidation in applying the best prevention practices, malaria control and the universal use of ITNs can be achieved.

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