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Research Article

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Community's Knowledge, Attitudes and Practices towards Malaria Vector Control Methods in Ruhango district, Rwanda

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Abstract

Background: *Malaria occurs mostly in poor tropical and subtropical areas of the world and still a leading cause of illness and death. This study aimed to explore the community knowledge, attitudes and practices towards malaria vector control methods in Rwanda.*

Methods: *This research was conducted under community-based cross-sectional study. Study was conducted in Ruhango district, located in South province of Rwanda. A number of 385 participants were selected using a two-stage randomized cluster sampling procedure and subjected to a tested structured questionnaire for data collection. The data were coded and entered using Kobo Collect Toolbox, and transferred to SPSS for statistical analysis.*

Results: *More than a half of respondents were females (57.7%), married (69.4%), had attended school (89.4%) and 89.6% were farmers. The overall knowledge score showed that 41.0% had low knowledge about malaria vector control methods. Overall, 33.8% of the respondents had positive attitudes towards MVCM. The overall practice score indicated 24.7% of respondents had good on MVCM. People with high level of knowledge towards malaria vector control methods were less likely to have good practices on malaria vector control methods than people with medium and low level of knowledge towards MVCM (OR=0.04; 95%CI: [0.005-0.30]; p<0.001) and that people with positive attitudes were 1.97 times more likely having good practices than people with neutral and negative attitudes towards malaria vector control methods (OR=1.97; 95%CI: [1.08-3.59]; p<0.001).*

Conclusion*: Malaria vector control campaigns accompanied with education for behavioural change should be considered to ensure householders' participation and cooperation in the Integrated Vector Management (IVM) programme. Moreover, continuous evaluation and monitoring of IVM as well as conducting more surveys on KAP are recommended to improve malaria control measures and to identify indicators for effective, successful, and sustainable malaria elimination programme.*

Keywords: Malaria, Mosquito, Indoor Residual Spraying, KAP Study

Introduction

Despite being a preventable and curable disease, malaria remains a major public health problem with a huge economic burden [1]. Nearly 85% of global malaria deaths in 2018 were concentrated in 20 countries in the WHO African Region and India [2]. The African region accounting for more than 90% cases and 93% of all deaths occurred in Africa World Health Organization (WHO) region. Various studies have shown that improving community knowledge, attitudes and practices (KAP) can play an effective role in preventing and controlling malaria [3]. Previous studies have demonstrated that directly engaging of community plays an important role in improving the acceptability and effectiveness of programmes aimed at reducing the transmission of malaria. Failure to consider the beliefs and perceptions of the community regarding

aspects of the planned programmes may lead to negative attitudes or practices and contribute to failure to achieve the intended goals [4].

Despite significant improvement in prevention and control for the past decades, malaria remains a significant public health concern in Rwanda with an increase in malaria prevalence rising to 7.2% among children less than five years of age compared with 2.2% in the DHS 2014-2015 [5].

But at the time being, Rwanda accounts only 3% in total malaria cases in the world [2]. Therefore, among different reasons identified as risk factors to the increase of malaria cases in Rwanda were inconsistent vector control activities, increased rice cultivation, an increase in the total number of patients seeking healthcare in health facilities, increased number of health facilities reporting into the system, improved availability of rapid diagnostic tests and encouraging patients to seek care at fully stocked health facilities, low universal ITNs coverage with 43% coverage of one ITN for every two people, vector resistance to pyrethroid insecticides, increased rainfall, and agricultural environmental modification [6].

The major intervention strategies that are applied in Rwanda to combat malaria include early diagnosis and prompt treatment, selective vector control that involves use of indoor residual spraying (IRS), ITNs and environmental management. However, all these efforts are not based on active participation and knowhow of the local community. Hence, an integrated effort that actively involves the local communities with their full knowledge is essential to enhance the disease controlling program in malaria endemic regions in Rwanda. This study assessed knowledge, attitude and practices towards malaria among local community in Ruhango District, Southern province of Rwanda.

Methods

This research was a community-based cross-sectional study. The choice of this type of the study was motivated by the fact that the data were collected in the community and at one point of time. This study used quantitative approach to assess the community's KAP towards malaria vector control methods. .

Target Population

The target population for this study was 10,352 households distributed into seven (7) cells and 63 villages in Byimana sector where this study has been undertaken.

Sample Design

The sample size was being calculated by using Yamane's formula. This formula is used when the researcher has a finite population and if the population size is known [7].

The formula thus used is the following $n = \frac{N}{1+N(e)2}$

Where: n = corrected sample size, N = population size, and e = margin of error equals to 5% or 0.05 at 95% confidence interval. Hence, $n = \frac{10,352}{1+(10,352(0.05)^2)} = 385.11 \sim 385\ households$

With the total households of 10,352, at 95% confidence interval of 5% of margin error, the sample size for this study was found to be 385 households to be investigated.

Sampling Technique

The two stages sampling techniques were used. In the first stage, cluster sampling technique was used. Clusters were selected from the sampling frame, which consisted of the list of households from which the sample was selected. A total of clusters with probability proportional to size was selected from the Enumeration areas (EAs) as defined with the Rwanda Population and Housing Census [8].

In the second stage, systematic sampling technique was used. This technique involved systematic selection of households. A household listing operation has been undertaken in all selected EAs during the main data collection. Household to survey was chosen at regular intervals (for example, every 5th, 10th, etc.) from the sampling frame. Ideally, households to be included in the survey were then randomly selected from a list of households in the study area.

Data Collection Methods

A structured questionnaire containing close-ended, open-ended and likert scale questions was used to collect primary data from the respondents. Note that the structured questionnaire was translated in Kinyarwanda to facilitate the CHWs. They were also pre-tested to 10 heads of households in Bweramana sector of Ruhango District to ensure that it maintained its original meaning after translation and responded to the study objectives. Some adjustments in the questionnaire have been made after the pilot study.

Data Analysis Procedure

KAP survey responses were coded then digitally, entered using Kobo Collect Toolbox and exported to Microsoft Office Excel for data cleaning and to SPSS for analyses. Variables analyzed included socio-demographic characteristics, malaria vector control methods-related knowledge, attitudes and practices. Socio-demographic characteristics were reported using descriptive statistics such as frequencies and percentages and continuous variables reported as means, standard deviations.

An overall knowledge score was calculated by adding up the total scores for each respondent. Respondents answered also to a number of statements to help to get their attitudes towards malaria vector control methods using a 5-point Likert's scale ranging from strongly agree (1) to strongly disagree (5). There were 16 questions related to the respondents' attitudes towards malaria vector control methods. The overall attitude was determined for each respondent by adding up the scores across the 16 attitudes' questions. Respondents were classified in three categories: negative, neutral and positive attitude.

An overall practices score was determined for each respondent by adding up the scores across the 12 malaria vector control practices' questions. To assess the relationship between the dependent and the independent variables, a logistic regression model has been used to calculate odds ratio and the corresponding 95% confidence interval. A two-tailed p-value of less than or equal to 0.05 has been used in order to state the statistical significance or not.

Ethical Consideration

Ethical clearance and the introduction letter from the Mount Kenya University Rwanda have been presented to the Ruhango District Authorities to obtain permission to carry out the study according to the required rules and regulations of district administration. Informed consent was signed by the respondent before preceding the interview to ensure that they first agree to be in the study out of their own independent choice. Confidentiality was taken into considerations by assigning codes to the questionnaires. Respondents benefited from this survey because they were expressed their views towards vector control activities in their communities. There were no risks of providing information in this study because the findings will be only used for academic purpose and will be maintained in confidentiality.

Results

Socio-Demographic Characteristics of the Respondents

This section contains the respondent's gender, age group, marital status, and school attendance, level of education completed, religion, occupation, family size, health insurance ownership, and type of health insurance owned, social category [Ubudehe Category] and the respondent's income per month.

Table 1: Socio-Demographic Characteristics of the Respondents

Variable	Items	Frequency (n)	Percent (%)
Gender	Male	163	42.3
	Female	222	57.7
Age group	18 - 49 years	245	63.6
	More than 49 years	140	36.4
Marital status	Single	47	12.2
	Married	267	69.4
	Separated	5	1.3
	Divorced	19	4.9
	Widowed	20	5.2
	Refused	27	7.0
School attendance	Yes	344	89.4
	No	41	10.6
Level of education completed	No formal education	41	10.6
	Incomplete primary school	77	20.0
	Complete primary school	213	55.3
	Incomplete secondary school	36	9.4
	Complete secondary school	17	4.4
	Postsecondary and above	1	0.3
Religion	Catholic	266	69.1
	Protestant	61	15.8
	Adventist	45	11.7
	Muslim	3	0.8
	No religion	10	2.6
Occupation	Government employee	4	1.0
	Student	8	2.1
	Retired	4	1.0
	Farmer	345	89.6
	Self-employed	11	2.9
	Unemployed	13	3.4
Family size	1-3 people	114	29.6
	4-6 people	237	61.6
	6-10 people	34	8.8

Health insurance ownership	Yes	365	94.8
	No	20	5.2
Type of health insurance owned	Mutuelle de la santé	353	91.7
	RAMA	8	2.1
	MMI	1	0.3
	Do not know	23	6.0
Social category [Ubudehe category]	Category 1	32	8.3
	Category 2	227	59.0
Income per month	Category 3	73	19.0
	Category 4	1	0.3
	No	52	13.5
	Less than RWF 30,000	299	77.7
	RWF 30,000-60,000	15	3.9
	More than RWF 60,000	2	0.5
	Do not know	69	17.9

As presented in table 1, a total of 385 respondents participated in this study. More than a half were females (57.7%); aged between 15-49 years dominated the study (63.6%); married (69.4%); attended schools (89.4%), the head of households surveyed (55.3%), Catholics (69.1%), farmers (89.6%). The average family size was 4.39 individuals and ranged from 1 to 10 people.

The research revealed that the majority of respondents (91.7%) were subscribed to the Community Health Insurance, for social categories, it has been found that more than half of the participants (59%) lay in the second category, about 77.7% of head of households had an income per month less than Rwf 30,000.

Knowledge Towards Malaria Vector Control Methods

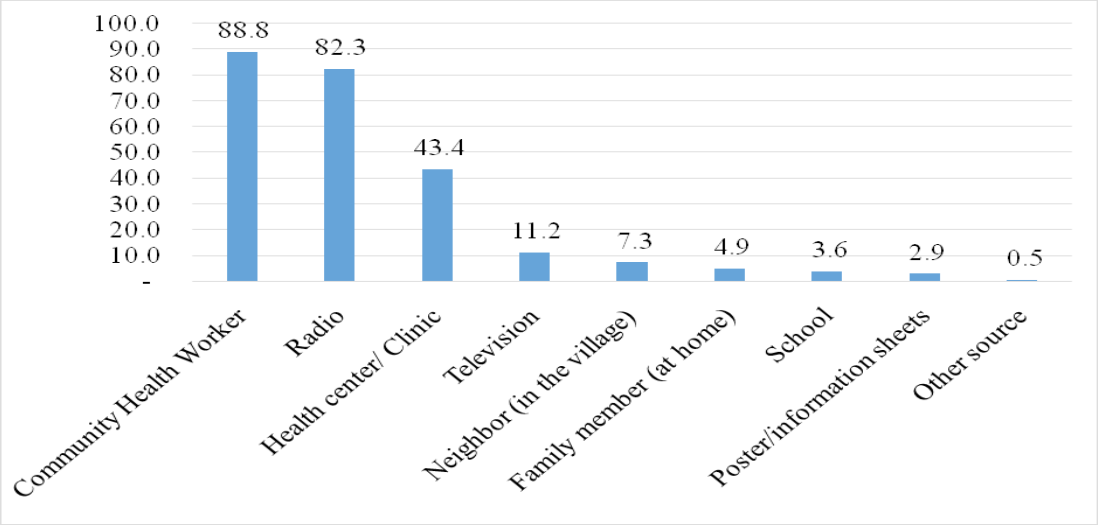

Figure 1: Sources of Information about Malaria Vector Control Methods

Source: Primary data, 2020

Community health workers and radio were reported to be the main sources of households' information about malaria vector control methods respectively with 88.8% and 82.3%.

Table 2: Knowledge about Malaria Infection

Variable	Frequency (n)	Percent (%)
Causes of malaria		
Mosquito bites	380	98.7
Getting soaked with rain	81	21.0
Drinking contaminated water	29	7.5
Cold or changing weather	28	7.3
Eating contaminated food	13	3.4
Close contact with malaria patient	8	2.1
Mosquito breeding places		-
Still water	381	99.0
Rice fields	126	32.7
Forest pools	116	30.1
Rivers	82	21.3
Rubbish	52	13.5
Do not know	12	3.1
Malaria prevention		-
Sleep under mosquito net	371	96.4
Cut grass around the house	289	75.1
Remove stagnant water	249	64.7
Spray house with insecticide	168	43.6
Use mosquito repellent	119	30.9
Avoid mosquito bites	100	26.0
Put mosquito screens on the windows	65	16.9
Use mosquito coils	63	16.4
Take preventive medication	19	4.9
Do not get soaked with rain	10	2.6
Do not drink dirty water	9	2.3
Do not eat bad food	4	1.0
Do not know	1	0.3

Findings in table 2 indicate that the majority of the respondents (98.7%) knew about malaria as a disease, and knew that malaria is transmitted through a mosquito bite and level of knowledge was significantly associated with the level of education. Stagnant water or still water considered by the majority of the respondents (99%) as breeding place of mosquitoes; although rice fields, forest pools, rivers and rubbish also were mentioned as mosquito breeding places. Unfortunately, statistical analysis did not reveal a significant association between knowledge of mosquito breeding places and educational level of head of household. Most of the participants reported sleeping under mosquito nets (96.4%), cutting grasses around the house (75.1%) and removing stagnant water (64.7%) as the main preventive measures against malaria transmission.

Table 3: Respondent's Knowledge about Malaria Vector Control Interventions

Variable	Frequency (n)	Percent (%)
Knowledge of IRS		
Yes	383	99.5
No	2	0.5
How does spraying walls with insecticides (IRS) prevent malaria for those people living in the household?		
Kills mosquitoes that land on the walls	263	68.3
Prevents mosquitoes from resting on the walls	242	62.8
Don't know	36	9.3
Cleans the wall	12	3.1
How do treated mosquito nets prevent malaria for those who sleep under them?		
Prevent mosquito from biting	352	91.4
Kills mosquitoes that land on them	136	35.3
Keeps people warm	2	0.5
Don't know	15	3.9
How does a spatial repellent prevent malaria for those people living in the home?		
Kills mosquitoes that land on them	213	55.3
Prevent mosquitoes from entering the home	166	43.1
Don't know	54	14.03

The study's results presented in table 3 shows that most of the respondents (99.5%) had ever heard of indoor residual spraying (IRS). Out of those who had heard of IRS, the majority reported that IRS would be beneficial in malaria prevention. Moreover, findings in table 3 indicate that more than half of head of households (68.3%) reported that IRS prevents malaria by killing mosquitoes that land on sprayed walls, while 62.8% reported that IRS prevents malaria by preventing mosquitoes from resting on sprayed walls.

When asked about who has sprayed their households, the majority of respondents (99.5%) stated that the Government of Rwanda through RBC has sprayed their households in the last 12 months and all costs related to IRS campaigns were covered by the same institution and has been conducted. When asked how treated mosquito nets prevent malaria infection, 91.4% of head of households responded that mosquito nets preventing mosquitoes from biting those under the mosquito net.

With the choice of multiple responses, 35.3% responded that mosquito nets prevent malaria by killing mosquitoes that land on them whereas 3.9% do not know the importance of treated

mosquito nets in the prevention of malaria for those who sleep under mosquito nets.

Concerning spatial repellent product such as mosquito coils, respondents replied that spatial repellents could prevent malaria infection by killing mosquitoes that land on the walls (55.3%) or preventing mosquitoes from entering the house (43.1%). About 14.03% of the respondents revealed not to know how spatial repellents prevented malaria infection.

Overall Knowledge Score

Table 4: Level of Knowledge Towards Malaria Vector Control Methods

Level	Frequency (n)	Percent (%)
High (Score: ≥ 10.5)	33	8.6
Medium (Score: 7.5 – 10.4)	194	50.4
Low (Score < 7.5)	158	41.0
Total	**385**	**100**
Minimum: 6.00	**Mean**:7.91	
Maximum: 12.00	**SD**:1.52	

Findings in table 4 show that there were 8.6% of respondents with a high knowledge about malaria vector control methods, 50.4% of them had medium knowledge, while 41.0% had low knowledge about malaria vector control methods.

Attitudes towards malaria vector control methods

Table 5: Respondents' Views about Malaria Vector Control Methods

Variables	n (%)				
	Strongly agree	Agree	Not sure	Disagree	Strongly disagree
Vector control methods are effective in controlling malaria	141 (36.6)	210 (54.5)	24 (6.2)	3 (0.8)	-
Having my house sprayed is very inconveniency	2 (0.5)	3 (0.8)	7 (1.8)	272 (70.6)	90 (23.4)
Chemicals used in IRS are totally safe	131 (34)	228 (59.2)	8 (2.1)	7 (1.8)	1 (0.3)
If my house is sprayed, no need for other methods	12 (3.1)	22 (5.7)	3 (0.8)	265 (68.8)	73 (19)
Sleeping under mosquito net alone does not give the guarantee of malaria prevention	78 (20.3)	203 (52.7)	3 (0.8)	80 (20.8)	13 (3.4)
Mosquito net makes me feel hot when I sleep	19 (4.9)	115 (29.9)	1 (0.3)	203 (52.7)	39 (10.1)
Mosquito net hinders men when doing sexual activities	-	1 (0.3)	23 (6)	241 (62.6)	116 (30.1)
Mosquito net causes skin rashes and poses breathing allergies	3 (0.8)	22 (5.7)	12 (3.1)	281 (73)	62 (16.1)
Mosquito net is good in agriculture especially for kitchen garden	3 (0.8)	14 (3.6)	5 (1.3)	226 (58.7)	136 (35.3)
I do not like the colour of my mosquito net	8 (2.1)	50 (13)	3 (0.8)	294 (76.4)	28 (7.3)
The quality of the mosquito net(size, shape and softness) is good	51 (13.2)	274 (71.2)	4 (1)	51 (13.2)	4 (1)
If the mosquito net I own was not given to me for free, I would not buy it	18 (4.7)	73 (19)	1 (0.3)	250 (64.9)	42 (10.9)
I prefer the mosquito net because it is free	18 (4.7)	83 (21.6)	-	245 (63.6)	37 (9.6)
Elimination of larval breeding sources is a waste of time and very complicated	6 (1.6)	10 (2.6)	-	296 (76.9)	70 (18.2)

Restricting and checking availability of potential breeding sources should be conducted regularly	145 (37.7)	223 (57.9)	-	12 (3.1)	3 (0.8)
You are the one of the important people in preventing malaria Transmission	125 (32.5)	253 (65.7)	4 (1)	3 (0.8)	-

In table 5, heads of households were asked questions related to their perceptions or attitudes towards malaria vector control methods; 54.5% and 36.6% respectively agreed and strongly agreed that malaria vector control methods are effective in controlling malaria infections.

Most participants (70.6%) disagreed while 23.4% strongly disagreed that having their house sprayed is very inconveniency. The findings as showed in table 5 revealed that 34% and 59.2% of the respondents were respectively strongly agreed and agreed with the view that chemical products or insecticides used in IRS are totally safe. When the respondents were asked that there is no need for using other vector control methods if their house is sprayed, 68.8% and 19% were respectively disagreed and strongly disagreed.

A total of 73% of respondents reported that sleeping under mosquito nets alone does not give the guarantee of malaria prevention. This gives the picture that the participants do not ignore other malaria vector control methods. More than half of the respondents did not agree (52.7%) and strongly disagree (10.1%) that mosquito net makes someone feel hot when slept. Almost all respondents (92.6%) responded denied that mosquito net does not hinder men when doing sexual activities.

Also, a total of 89.1% disagreed with the statement that mosquito net causes skin rashes and poses breathing allergies. It has also found that 94% in total were not agreed that mosquito net is for agriculture especially for kitchen garden. When asked the heads of households about their mosquito nets, 76.4% replied they liked the colour and 71.2% liked the quality of the mosquito net (size, shape and softness). In addition to that, 64.9% and 10.9% of the respondents respectively disagreed and strongly disagreed with the statement that they would not buy the mosquito net if it was not given for free. Seventy-three percent (73%) reported they did not prefer the mosquito net because it is free.

About more than three-quarters (76.9%) of the respondents did not agree with the statement that elimination of larval breeding sources is a waste of time and very complicated. Also, a total of 95.6% of the heads of households agreed with the statement that restricting and checking availability of potential breeding sources should be conducted regularly. And finally, the majority of respondents (98.2%) were agreed that heads of households are the ones of the important people in preventing malaria transmission.

Overall Attitude Score

Table 7: Distribution of Respondents' Attitudes Towards MVCM

Level	Frequency (n)	Percent (%)
Positive (Score: ≥ 52)	130	33.8
Neutral (Score: 37 - 51.9)	218	56.6
Negative (Score <37)	37	9.6
Total	385	100
Minimum: 32.00	Mean:50.19	
Maximum: 63.00	SD:4.20	

The findings presented in figure 4.8, the researcher notices that 33.8% of the respondents have positive attitudes towards malaria vector control methods while 56.6% and 9.6% respectively presented neutral and negative attitudes towards malaria vector control methods.

Practices towards malaria vector control methods

Table 8: Respondents' Answers on Practices Related to Malaria Vector Methods

		Frequency (n)	Percent (%)
1.Do you think malaria disease can be prevented?	Yes	385	100
2.Does your household have any mosquito net?	Yes	381	99
	No	4	1
3.Where did you get the mosquito net?	Mass distribution	317	82.3
	Health facility	64	16.7
4.Who sleeps under the mosquito nets?	All family members	380	98.8
	Father and mother	3	0.8
	Children under 5 years	2	0.4
5.Have you hanged the mosquito net?	Yes	378	98.1
	No	7	1.9
6.Did you sleep under the mosquito net during the last night?	Yes	375	97.4
	No	10	2.6
7.How often do you wash your mosquito nets?	Once in a month	223	57.9
	Once in a six month	130	33.9
	Not washing	14	3.6
	Not applicable	14	3.6
8.If you wash your mosquito nets, do you use detergents when washing them?	Yes	371	96.4
	Not applicable	14	3.6
9.IRS conducted in the past 12 months	Yes	381	99
	No	4	1
10.Who sprayed your household?	Government	383	99.5
	Not applicable	2	0.5
11.How many times do you clean your household surroundings?	Regularly	270	70.1
	Sometimes	110	28.6
	Never	5	1.3

Findings in table 8 show that the majority of the respondents (100%) fully confirmed that malaria disease can be prevented. Participants preferred these vector control methods of protection because they are better at stopping mosquito bites and destroying mosquito breeding places, mosquito nets are getting for free during mass distributions (82.3%), almost all households (99%) owned mosquito nets on the average of 2.64 mosquito nets per households and mosquito nets are easy to use: 98.8% reported all

family members usually slept under mosquito nets, 98.1% ensured they have hanged their mosquito nets while 97.4% revealed being slept under the mosquito net during the last night preceded the day of survey. Only one (1) people reported not being slept under the mosquito net during the last night preceded the day of survey because it was too hoot in the house.

Asked how often do they wash their mosquito nets, 57.9% washed it once in a month, 33.9% said once in six months, 3.6% never washing their mosquito nets, 1% did it once in a year while only 3.6% said that it is not applicable. The majority of respondents (96.4%) who owned a mosquito net admitted that they are using some form of detergents in washing their mosquito nets. Lastly, the respondents showed good practices of malaria vector control methods' application because it has found that 70.1% were regularly cleaning their household surroundings, 28.6% did it sometimes while only 1.3% reported never cleaning household surroundings.

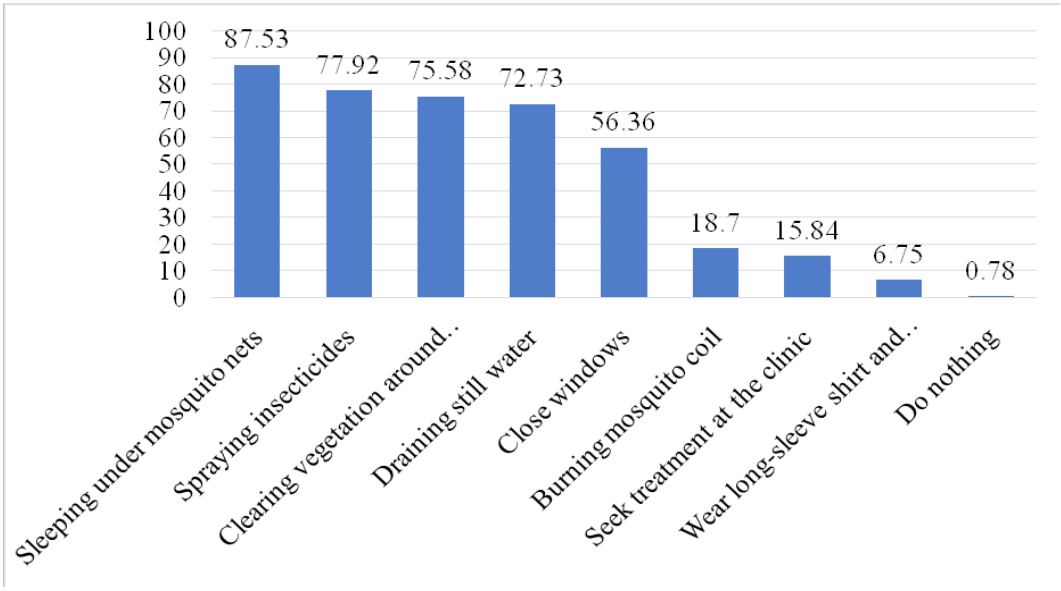

Figure 2: Protection Measures Currently Used to Prevent Malaria in Byimana Sector

The figure 2 illustrates that sleeping under a mosquito net (87.5%), spraying insecticides (77.9%), clearing vegetation around the house (75.5%), draining still water (72.7%,) and close windows (56.3%) are the most commonly reported means of protection against malaria infection. These results coincided with what the researcher has observed at the field during data collection period.

Overall Practices Score

Table 10: Distribution of Malaria Vector Control Practices Amongst Respondents

Level	Frequency (n)	Percent (%)
Good (Score: ≥ 16)	95	24.7
Fair (Score: 12 - 15.9)	290	75.3
Poor (Score < 12)	0	0
Total	385	100
Minimum: 12.00	Mean: 13.65	
Maximum: 19.00	SD: 1.95	

The practices' section comprised twelve questions related to malaria vector control methods and were marked for each respondent. If a respondent provided a correct response, he/she was given a score of two points. If he/she provided a false response, he/she was marked by zero. An overall practice score was determined for each respondent by adding up the scores across the 12 malaria vector control practices' questions. The total score was 24 marks. So, there were 24.7% of respondents with "good practices" (scored ≥ 16 out 24 marks) and 75.3% of them had "fair practices" (scored between 12 and 15.9 marks out of 24 marks). None amongst the participants has been found with poor practices towards malaria vector methods.

Factors associated with practices towards malaria vector control methods

Table 13: Socio-Demographic Characteristics and Respondents' Practices Towards Malaria Vector Control Methods

Variable	Item	Practices towards MVCM		p	95% CI	OR
Gender	Male	30(18.5)	132(81.5)	0.016*	0.33-0.89	0.54
	Female	65(29.3)	157(70.7)			
Age group	18-49 years	64(26.1)	181(73.9)	0.384	0.76-2.03	1.24
	More than 49 years	31(32.6)	109(77.9)			
School attendance	Yes	80(2.3.)	264(76.7)	0.05	0.96-3.76	1.90
	No	15(36.6)	26(63.4)			
Level of education completed	No formal education	-	-	0.28	-	-
	Incomplete primary	20(26)	57(74)			
	Complete primary	48(22.5)	165(77.5)			
	Incomplete secondary	9(25)	27(75)			
	Completed secondary	2(11.8)	15(88.2)			
	Postsecondary &above	1(100)	-			
Marital status	Single	13(27.7)	34(72.3)	0.001*	0.32-2.58	0.90
	Married	60(22.5)	207(77.5)			
	Separated	3(60)	2(40)			
	Divorced	-	-			
	Widowed	5(25)	15(75)			
	Refused	8(29.6)	19(70.4)			
Occupation	Government employee	1(25)	3(75)	0.69	0.08-15.03	1.11
	Student	4(50)	4(50)			
	Retired	1(25)	3(75)			
	Farmer	84(24.3)	261(75.7)			
	Self-employed	2(18.2)	9(81.8)			
	Unemployed	3(23.1)	10(76.9)			
Family size	1-3 people	114(100)	-	0.001*	2.67-7.34	3.1
	4-6 people	38(16)	199(84)			
	6-10 people	-	34(100)			
CBHI ownership	Yes	92(25.2)	273(74.8)	0.354	0.15-1.95	0.55
	No	3(15.8)	16(84.2)			
Type of health insurance owned	Mutuelle de santé	90(25.5)	263(74.5)	0.87	-	-
	RAMA	2(25)	6(75)			
	Other (MMI)	-	1(100)			
	Do not know	-	1(100)			

Social category	1st Category	9(28.1)	23(71.9)	0.001*	0.21-1.87	0.64
	2nd Category	52(22.9)	175(77.1)			
	3rd Category	17(23.3)	56(76.7)			
	4th Category	-	1(100)			
	No	11(37.9)	18(62.1)			
Income per month	<Rwf30,000	70(23.4)	229(76.6)	0.27	0.36-1.15	0.65
	Rwf 30,000-60,000	2(13.3)	13(86.7)			
	More than Rwf 60,000	1(50)	1(50)			
	Do not know	22(31.9)	47(68.1)			
Religion	Catholic	61(22.9)	205(77.1)	0.001*	1.21-15.11	1.78
	Protestant	21(34.4)	40(65.6)			
	Adventist	10(22.2)	35(77.8)			
	Muslim	-	3(100)			
	No religion	1(14.3)	6(85.7)			

Source: Primary data, 2020

We found that males were less likely to have good practices towards MVCM than females (OR=0.57; 95%CI:[0.33-0.89]; p=0.016), singles were less likely to have good practices towards MVCM than other people (OR=0.90; 95%CI:[0.32-2.58]; p<0.001),households with less ≤ 3 people were 3.1 times more likely to have good practices towards MVCM than households with more than 3 people in the house (OR=3.1; 95%CI:[2.67-7.34]; p<0.001), households in the first social category have been found to be less likely to have good practices towards MVCM than households in the other social categories (OR=0.64; 95%CI:[0.21-1.87]; p<0.001), and Catholics had 1.78 times more likely to have poor practices towards MVCM than other religions(OR=1.78; 95%CI:[1.21-15.11]; p<0.001).

Table 14: Knowledge, Attitudes and Practices Towards MVCM

Variable	Level	Practices towards MVCM		p	95% CI	OR
		Good	Poor			
Knowledge towards MVCM	High	1(3)	32(97)	0.001*	0.005-0.30	0.04
	Medium	25(12.9)	169(87.1)			
	Low	69(43.7)	89(56.3)			
Attitudes towards MVCM	Positive	74(23.3)	243(76.7)	0.010*	1.08-3.59	1.97
	Neutral	-	12(100)			
	Negative	21(37.5)	35(62.5)			

We observed that people with high level of knowledge towards MVCM have been found to be less likely to have good practices about malaria vector control methods than people with medium and low level of knowledge towards MVCM (OR=0.04; 95%CI: [0.005-0.30]; p<0.001) and people with positive attitudes were 1.97 times more likely having good practices than people with neutral and negative attitudes towards malaria vector control methods (OR=1.97; 95%CI: [1.08-3.59]; p<0.001).

Discussion

Findings from this study indicate that most study participants had good knowledge of malaria disease, transmission routes and prevention strategies. High awareness of people about malaria transmission, symptoms and prevention has been also reported from other malaria endemic countries including Malaysia, Saudi Arabia, Swaziland, Ethiopia, Ghana and Tanzania [9-11]. Similar findings have also been found from other malaria-endemic areas in the southeast of Iran [12-14].

Results of this study shown that majority of the participants knew stagnated water as a breeding place of malaria vectors. This finding is consistent with findings in other studies in Iran which revealed high knowledge of people about mosquitoes breeding places [15]. Awareness of mosquitoes breeding site could influence parameters

which are involved in the vector control including the selection of residential areas and use of preventive methods aiming to decrease mosquito population density.

In this study, spraying house with insecticide (IRS) has been reported by only 43.6% of the respondents as one of the prevention measures used in Byimana sector. This low rate may be explained by the fact that Ruhango district has been included in the districts concerned by IRS for the first time last year in 2019.

Attitudes related to malaria disease and interventions among study population surveyed were positive at 33.8% against 9.6% and 56.6% with respectively negative and neutral attitudes towards malaria vector control methods. This study found that most of the respondents (92.9%) recognized that vector control methods are effective in controlling malaria. This attitude is favourable to the implementation of malaria vector control interventions.

These findings are somehow similar with those found in a study conducted in rural northwest of Tanzania where 73.5% of the respondents acknowledged the benefits of vector control practices in the reduction of mosquito abundance, but only 17% related this with protection of the family against malaria [16]. Similar observations have been reported in Mexico. 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 and malaria control based on indoor house spraying heavily depends on this acceptance [17].

On the practical side, the findings in this study showed that respondents were good practicing malaria vector control methods at 24.7.5% against 75.3% who showed fair practices towards malaria vector control methods. This might be related by the community awareness conducted regularly by CHWs in this study area. This has been discovered in other studies in Nigeria and Ethiopia, where the study population saw environmental management as an efficacious mosquitos control strategy [18, 19].

The overall improvement in access to malaria and vector control practices has also been documented in a study conducted in Abashege area, Guraege zone, south central Ethiopia where access to at least one LLINs per household reached up to 98.7% [20]. These results are consistent with ours where the researcher found that 99% of respondents owned LLINs on the average of 2.64 mosquito nets per households.

Conclusion

People's knowledge of malaria prevention and control methods has significantly improved following the implementation of IVM in Rwanda. Low socio-economic status of the community is one of the main limitations to sustainable malaria elimination. This factor, along with community attitudes and practices, ultimately influence community participation in malaria elimination despite high knowledge of malaria vector control methods. Misconceptions about malaria prevention measures are critical to identify in endemic communities in order to facilitate successful disease and vector control.

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