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Factors Associated with Non-Use of Mosquito Nets for Prevention and Control of Malaria among Rural Communities in Nyagatare District, Rwanda

Ngabire Nkunda Philippe*, Onesmus Marete and Rosemary Okova

Public Health Department, School of Health Science and Nursing, Mount Kenya University, Kigali, Rwanda

***Corresponding Author:** Ngabire Nkunda Philippe, Public Health Department, School of Health Science and Nursing, Mount Kenya University, Kigali, Rwanda.

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Abstract

Malaria is one of the top causes of death and illness in subtropical and tropical region. Taking into consideration the contribution of bed nets use and factors correlated to their non-utilization at community level for prevention and control of malaria is critical to planning and assessing intervention campaigns. Rwanda was expecting Malaria pre-elimination phase in 2017 and the community has to play an important role by using mosquito nets to achieve this Malaria pre-elimination phase. However, the use of mosquito nets differs among families, and such differences of usage can reduce its positive effect. The general objective of this study was to investigate factors related to non-use of mosquito nets for preventing and controlling malaria among communities in the rural area of Nyagatare District-Rwanda. The findings of the study may contribute to design policies and procedures based on what the members of the community needs. A study was conducted among household's sample selected randomly from 2 rural sectors with high burden of malaria in 2016 - 2017 (Rukomo sector and Tabagwe sector) through questionnaires. Data we reanalyzed using SPSS Version 21. Descriptive statistics (mean, standard deviation, percentages, and rage) as well as inferential statistics (correlation, chi-square) between characters were considered. The research findings have shown that 57.8% of Households are headed by female, 98.5% of respondents are above 20 years of age, 74.3% with primary education level, 97.1%of respondents are not employed and 64.1% are married. With regard to sleeping space, 72.3% of respondents used to sleep on floor. This study has shown that the prevalence of ITN use is 57%. In Rwanda, there is a need to maintain universal ITN coverage and ensure that all ITNs are used effectively. It may be useful therefore to educate the population about appropriate sleeping space (bed). It is recommended to conduct a study on local environmental and socio-cultural factors influencing ITN use in Rwanda, so that proper cost effective measures can be taken to improve use.

Keywords: *Malaria; Non-Use of Nets Treated; Insecticide Treated Bed Nets; Household*

Introduction

Malaria is one of the top causes of mortality and morbidity in subtropical and tropical region.

A report from WHO conducted in 2014 have shown that 216 million malaria cases were reported all over the world, while in 2010 Malaria cases reported were 237 million, compared to 211 million cases which occurred in 2015. The high prevalence of malaria in 2016 was reported in the WHO African Region (representing 90% of all malaria cases in 2016), 7% in the WHO South-East. Asia Region, 2% in the

WHO Eastern Mediterranean Region. In 2016, among 91 countries which reported high burden of malaria, 15 of them are in sub-Saharan Africa, 80% of the global malaria burden carried by India [1].

Based on the people at risk of getting malaria between 2010 and 2014, it have been reported that the incidence of malaria have declined by 18% worldwide, from 76 to 63 cases per 1000 people at risk. The largest decline (48%) was recorded in Asia, 22% in America and 20% in the Africa. Even if there have been an important decrease between 2010 and 2014, it was reported that there have been an increase in case incidence between 2014 and 2016 in some countries (America, Asia and Africa). Among all malaria cases reported in 2016, *Plasmodium falciparum* parasite is more prevalent with 99% of cases in sub-Sahara Africa [2].

In the WHO Region of the America, *P. vivax* is predominant and represent 64% of malaria cases, but it is more than 30% in Asia, while it is 40% in the Eastern Mediterranean regions [3]. Malaria burden estimation methods will be reviewed by WHO for sub-Saharan Africa in 2018 [1].

In sub-Saharan Africa, countries have increased the coverage of bed nets to fight malaria, but records on the utilization of those mosquito nets and causes of their non-utilization are rare.

It have been shown that the utilization of bed nets can be increased by proper information, education and communication about mosquito nets usage [4].

Correct usage of ITNs can contribute up to 90% of malaria decrease and 44% of all-cause of death in children under five. Premature births and anaemia in pregnancy can be prevented by using ITNs [2].

Worldwide, 85% of nets were given freely during campaigns [5]. The study conducted in Ethiopia in 2016 showed that the possession of ITNs is 72.6%. Among these who have ITNs, only 80 % utilized them the previous night of the survey [2]. According to PMI report of 2014, the overall ITN coverage in Rwanda for 2013 was 83% and 74% for under five years children [6].

The distribution of Bed nets in Rwanda started in 2003, but there is few information on their utilization and causes of their non-use. Many studies have focused on ITN use among children and pregnant women and it have been reported that 81% of HHs have at least an ITN. According to the 2013 Rwanda Malaria Indicators Survey, 83% of HHs possesses one bed net [7].

Materials and Methods

The methodology used for the development of this research is quantitative descriptive cross-sectional, method was used and it was a household study which was conducted using questionnaires completed by the interviewers based on the respondent answers. This study method helped to administrate the appropriate questions to the right target groups and to collect unbiased data and gather target results in which to Factors associated with non-use of Mosquito nets for Prevention and Control of Malaria among rural communities in Nyagatare District, Rwanda, draw conclusion and make important decisions for preventing and controlling malaria.

Results

The findings are presented using figures, tables and based on study objectives and it contains: demographic and social characteristics of the rural communities of Nyagatare District which were described in figure 1 and the prevalence of ITN use and factors associated with non-ITN use among rural communities in Nyagatare District.

Prevalence of ITN use among rural communities in Nyagatare district

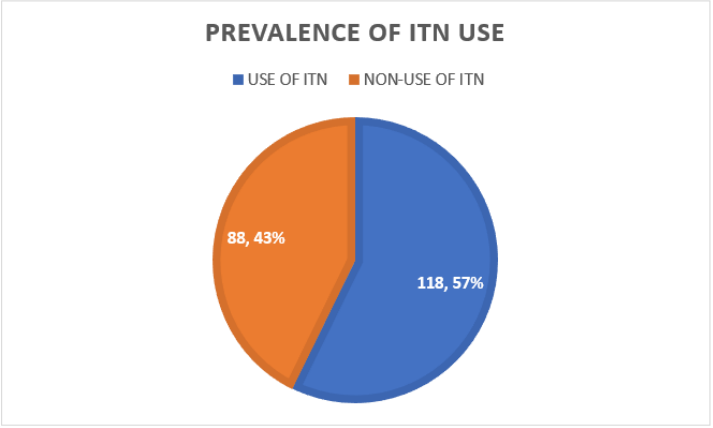

Figure 1: Prevalence of ITN use.

Figure 1 above indicates that among 206 respondents, the prevalence of ITN use was 57%.Contrary to this study, a study conducted in Rwanda in 2015 have shown that the prevalence of ITN use was 83.3% [8], which is higher compared to the prevalence shown by this study findings. According to other literatures, a study conducted in Zambia in 2014 demonstrated that the prevalence of ITN use in rural area of Zambia was 52% [9], compared to a study conducted in Kenya which revealed that the use of ITN was 59% [10,11] which is similar to the prevalence shown by a study conducted in Mozambique showing that the ITN use is at 58.6% [12]. These two studies are similar to this research conducted in Nyagatare.

Factors associated with ITN non-use among Nyagatare rural communities

Factors associated with ITN non-use were determined at bivariate analysis using chi-square test then factors found to be significant at bivariate analysis were passed to multivariate logistic regression to adjust for possible confounders.

Table 1 above, indicates that at bivariate analysis, only sleeping space type was significantly related to non-use of ITN (p-value: < 0.001) while the rest of socio-demographic characteristic did not show significant association with non-use of ITN. Contrary to this study, other previous studies shown that woman education and age have an impact on ITN utilization [3]. A study conducted in Cameroun have shown that the use of ITN in individuals who had received no formal education was 52.3% while that in individuals who had attained primary education was 39.1% while that in individuals who had attained secondary education was 40.8%, while that in those who had attained higher education was 32.8%. Thus it shows a statistically major difference in ITN according to individuals level of education in the use of ITNs [13].

Variable	Use of ITNN (%)	Non use of ITNN (%)	P-Value
Gender of HoH			0.367
Female	65 (55.1)	54 (61.4)	
Male	53 (44.9)	34 (38.6)	
Age of HoH			0.098
< 20	0 (0)	2 (2.3%)	
> 20	118 (100)	85 (97.7)	
Education level			0.468
Primary	84 (71.2)	69 (78.4)	
Post primary	16 (13.6)	10 (11.4)	
Secondary or high	18 (15.3)	9 (10.2)	
Occupation			0.190
Not employed or agricultural	113 (95.8)	87 (98.9)	
Employed	5 (4.2)	1 (1.1)	
Marital status			0.096
Single	32 (27.1)	14 (15.9)	
Married	74 (62.7)	58 (65.9)	
Divorced	9 (7.6)	9 (10.2)	
Widowed	3 (2.5)	7 (8.0)	
Sleeping space			
Bed	45 (38.1)	12 (13.6)	< 0.001
Floor	73 (61.9)	76 (86.4)	
Number of HH member			0.630
< 5	55 (46.6)	44 (50)	
> 5	73 (53.4)	44 (50)	
Number of used room for sleeping			0.630
< 2	67 (56.8)	47 (43.4)	
> 2	51 (43.2)	41 (46.6)	

Table 1: *Factors associated with ITN non-use among Nyagatare rural communities (bivariate analysis).*

Table 2 above explains respondent's knowledge on ITNs use and its importance. 84.1% (176/206) of the respondents said that they sleep under ITNs to prevent malaria. This table shows also factors that are reasons of not supporting ITN use, treating ITN, regular ITN treatment and reason of not owning ITN were considerably linked with non-use of ITN and their p-values were 0.013, < 0.001, < 0.001, < 0.001 and < 0.001 respectively. The rest of factors did not show significant association with non-use of ITN. Factors founded at bivariate analysis were filtered for multivariate analysis to adjust for potential confounders.

Variable	Use of ITN (%)	Non-use of ITN (%)	P-value
Heard about ITN			
Yes	113 (95.8)	84 (95.5)	0.915
No	4 (4.5)	4 (4.5)	
Source of ITN info			
Friend	9 (7.6)	3 (3.4)	0.153
HF	81 (68.6)	53 (60.2)	
Radio	28 (23.7)	30 (34.1)	
TV	0 (0)	1 (1.1)	
Other	0 (0)	1 (1.1)	
Reason of sleeping under ITN			
Prevent malaria	95 (80.5)	65 (73.9)	0.061
Get sound sleep	6 (5.1)	1 (1.1)	
Avoid mosquito bite	17 (14.4)	22 (25)	
Supporting use ITN			
Yes	115 (97.5)	84 (95.5)	0.432
No	3 (2.5)	4 (4.5)	
Reason of not supporting ITN use			
Malaria is not serious problem	7 (5.9)	3 (3.4)	0.013
Net is expensive to buy	61 (51.7)	65 (73.9)	
No need to use net	1 (0.8)	1 (1.1)	
Other	49 (41.5)	19 (21.6)	
Is net treated			
Yes	80 (67.8)	13 (14.8)	< 0.001
No	20 (16.9)	50 (71.4)	
Do not know	18 (15.3)	25 (28.4)	
Regular treated			
Yes	62 (52.5)	15 (17)	< 0.001
No	56 (47.5)	73 (83)	
If no, why?			0.850
Cannot afford	51 (43.2)	39 (44.3)	
No need	25 (21.2)	22 (25.0)	
Dangerous used chemical	1 (0.8)	1 (1.1)	
Other	41 (34.7)	26 (29.5)	
Way you acquired your ITN			0.507
Bought	25 (21.2)	19 (21.6)	
Given by MoH	93 (78.8)	68 (77.3)	
Donated by NGOs	0 (0)	1 (1.1)	
ITN prevent Malaria			0.734
Agree	101 (85.6)	74 (84.1)	
Disagree	14 (11.9)	10 (11.4)	
Undecided	3 (2.5)	4 (4.5)	

Table 2: *Knowledge, utilization and non-utilization of ITNs related factors in prevention and control of malaria, bivariate analysis.*

A study conducted by Domina Isingizwe in Rwanda have shown that participants had knowledge on signs, symptoms and prevention of malaria. This is similar to what founded a study conducted in Tanzania where 85.2% of people interviewed were knowledgeable about malaria (Spjeldnaes., *et al*. 2014).

A similar study conducted in Botswana have shown that many of respondents were knowledgeable about malaria signs and symptoms (88.7%), they are also aware of preventive where measures (98.6%) and malaria transmission (95.8%). These findings are similar to the ones of a study conducted in Colombia respondents have shown a high knowledge about malaria transmission, symptoms and prevention [8]. A study conducted by Zuradanin Ghana revealed that people have different reasons of not using ITNs, according to them. 70% of respondents in Zuradan's study said that they use ITNs to avoid mosquito bites, while 22% said that they use it to prevent malaria and 4% reported that they use it just to have sound sleep [14].

Variable	95%CI Lower	95%CI Upper	AOR	P-Value
Sleeping space				
Bed	0.119	0.748	0.298	0.010
Floor	Reference			
Reason of not supporting ITN use				
Malaria is not serious problem	0.096	3.523	0.582	0.582
Net is expensive to buy	0.849	6.016	2.260	0.102
No need to use net	0.799	0.020	32.245	0.905
Other	Reference			
Is net treated				
Yes	0.068	0.531	0.190	0.002
No	1.133	7.682	2.950	0.027
Do not know	Reference			
Regular treated				
Yes	0.178	1.145	0.451	0.094
No	Reference			
Reason of not owning ITN				
No money	0.062	3.936	0.494	0.506
Expensive	0.282	11.557	1.804	0.533
Unavailable	1.138	52.627	7.738	0.036
Other	Reference			

Table 3: *Multivariate analysis, factors associated with ITN non-use.*

Table 3 above indicates multivariate analysis for factors filtered from bivariate analysis with p-value less 0.05 and at this stage, respondents who used to sleep on bed were 70% more likely to use bed net compared to those who slept on floor and 81% more likely to use net if they were treated compared to respondents who do not if their ITN was treated or not while those with non-treated ITN were about 3 times to not use ITN compared to those who do not know (AOR: 2.950, 95%CI: 1.133 - 7.682, P-value: 0.027). With regard to reason of not owning ITN, respondents who said that ITN were not available were about 8 times of not owning ITN compared to those with other reasons. The rest of factors didn't show significant association with non-use of ITN. According to Baume., *et al*. in their study conducted in Ethiopia, the multivariate analysis founded that the regional state was a major factors associated with ITN utilization. Households living in more urbanized area were less likely having ITNs compared to these living in peri-urban area or rural [15]. Contrary to this study conducted in Ethiopia, a study conducted in Nyagatare shown that respondents who used to sleep on bed were 70% more likely to use bed net compared to those who slept on floor and 81% more likely to use net if they were treated compared to respondents who do not know if ITN was treated or not while those with non-treated ITN were about 3 times to not use ITN compared to those who do not know (AOR: 2.950, 95%CI: 1.133 - 7.682, P-value: 0.027).

Discussion

This study aimed to determine factors associated with non-use of ITNs, highly malaria endemic area in Rwanda and to show the prevalence of mosquito net use in these communities.According to Global Malaria Strategy, the increase of ITN coverage in Sub-Saharan Africa is due to the increase in funding's support to fight malaria. But, the possession of ITN will have less influence on the issue until owners use them properly [16]. Even if there are many studies which documented on ownership of ITN, same in Rwanda, only few of them talked about utilization of it among rural communities. These conducted in Rwanda on ITN use have focused on specific age groups (Children, pregnant women, women of reproductive age, etc). This section offers the discussion on the findings from analysis of data collected from 206 respondents in rural communities of Nyagatare District. This section also illustrates the relevance of these findings and relation with other studies carried out.

This study shows thatthe majority of households were represented by female (57.8%) and the majority of respondents were above 20 years of age (98.5%) with primary education level (74.3%). Majority of respondents were not employed or in agricultural occupation (97.1%) and married (64.1%). With regard to sleeping space, majority of respondents used to sleep on floor (72.3%) with more than 5 household members (51.9%) in a house of less than 2 rooms (55.3%). These socio-demographic characteristics are similar to these from a study conducted in 2015 in Rwanda by Asingizwe., *et al*. on practices for elimination of malaria in rural communities of Rwanda where, in their study, the many of respondents where female (70%), married (65%), 52% had no formal education and majority of families had more than 3 household members [8].

Findings from this study illustrated that the prevalence of ITN use among rural communities of Nyagatare District is 57%. This no utilization gap (43%) is greater than the expected prevalence of mosquito net use and it may be the main cause of malaria burden in Nyagatare District.

The prevalence of ITN use among rural communities from this study is less than the prevalence from the study conducted in Rwanda in 2015 by Asingizwe., *et al*. Where 83.3% of the respondents indicated they always use ITNs, while 24% of household members never use it [8]. A similar study conducted in Zambia in 2014 have shown that the prevalence of ITN use in rural area in Zambia was 52% [9]. A study conducted in Kenya have shown that 95 % of households surveyed owned at least one net, but only 59% of them use it the prior night of the survey [10,11].

In this research, the sleeping space type was significantly linked to non-use of ITN (p-value: < 0.001) while the rest of socio-demographic characteristic did not show significant association with non-use of ITN.Our study have shown that respondents who used to sleep on bed were 70% more likely to use bed net compared to those who slept on floor. A similar study did in 2016 on associated factors with ITN non-use among Rwandan children have revealed that ITNs non-use is not related to the number of under five years children residing in the family, available rooms, the mother occupation, the children age, the children sex and the children birth weight as the p > 0.05 [17].

Contrary to this study, other previous studies shown that woman's age and education influence ITN utilization. These studies indicated that educated women (primary education) use ITN compared to those with no education [3].

A similar study done in Cameroun revealed that the use of ITN in individuals who had received no formal education was 52.3% while that in individuals who had attained primary education was 39.1% while that in individuals who had attained secondary education was 40.8%, while that in those who had attained higher education was 32.8%. Therefore, there is a statistically significant difference in ITN use according to the level of education and is higher among high educated individuals [13].

A study conducted in Uganda on ITNs use in Kibaale District, revealed that some cultural factors affect the sleeping arrangements and this may make children to be vulnerable of malaria (some slept in the sitting room when there are visitors: 25%, others slept on floor in children's rooms where they cannot hang the nets in the sitting room where there are no supportive mechanisms for net hanging) [18]. This finding is the same as the one shown by Alaii., *et al*. in Western Kenya, where it have been shown that as visitors come and go, this affects sleeping arrangements [18].

Summary of findings

Socio-demographic characteristics of rural communities of Nyagatare district

Overall (n = 206), the majority of household were represented by female and the majority of respondents were above 20 years of age with primary education level. The Majority of respondents were not employed or in agricultural occupation and married. With regard to sleeping space, majority of respondents used to sleep on floor with more than 5 household members in a house of less than 2 rooms.

Prevalence of mosquito net use among rural communities of Nyagatare district

In this study, overall 206 respondents, it have been shown that the prevalence of ITN use is 57%.

Factors associated with nonuse of mosquito nets for malaria prevention and control

Findings showed that the sleeping space type and treatment of ITN were significantly associated with non-use of ITN (p-value: < 0.001) while the rest of factors did not show significant association with non-use of ITN.

Conclusion

We investigated the nonuse of mosquito nets associated factors in the rural communities of Nyagatare District. It was intended to determine any gap between having ITN and using it as well as determine any factors associated with ITN nonuse, so that ITN use could be improved. In Rwanda, there is a need to maintain universal ITN coverage and ensure that all ITNs are used effectively. The main reported reason for not sleeping under an ITN in rural communities of Nyagatare District was that the majority of respondents sleep on floor where it is not easy to hang the net. Other reason was that their old bed nets are not retreated, mosquito nets are not available, even if many of

them reported that they have financial issues to buy new bed nets to replace olds one. This finding of a gap between having ITN and using it is consistent with findings in other studies elsewhere [13]. It may be useful therefore to educate the population about appropriate sleeping space (bed) and reassure them that even if a bed net is old, if it doesn't have holes, it can protect from mosquito bites and prevent from malaria disease [19-30].

Recommendations

To the ministry of health

We recommend conducting a study on local environmental and socio-cultural factors influencing ITN use in Rwanda, so that proper cost effective measures can be taken to improve use.

To Nyagatare district and district health facilities

Efforts to improve the use of bed nets by educational messages must address socio-cultural, economic and other determinants of behavior.

Suggestions for Further Study

Health care workers, NGOs and local leaders should put more focus on sensitization about the benefit of using mosquito nets in rural areas of Rwanda. This would help to achieve the malaria pre-elimination phase which was expected by Rwandan government in year 2017. We recommend further studies on change in sleeping habits, mechanical barriers of bed nets in mosquito bites prevention, etc. The researcher suggests also that this study can be extended in the whole country, as there is no country image on factors associated with nonuse of ITNs.

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