

Evaluating Knowledge and Attitude Towards Insecticide-Treated Mosquito Nets: Implications for Malaria Prevention among Pregnant Women in Endemic Regions

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Abstract Background: Malaria remains as significant public health challenge in Rwanda, particularly affecting pregnant women and their unborn children. Insecticide-treated mosquito nets (ITNs) are critical preventive measure against malaria. This study aimed to assess the knowledge and attitudes of pregnant women towards ITN usage. **Methods:** A Cross-Sectional study was conducted among pregnant women attending Rwamagana Health Center. A structured questionnaire collected data on demographics, knowledge of malaria transmission and prevention with ITNs and attitudes towards ITN use. **Results:** The study found that 58.7% of respondents were aged 21-30, with 82.55 being married. Education attainment varied, with 42.9% having completed primary education, while secondary and bachelor's degree were held by 33.3% and 15.9%, respectively. 76.2% reported awareness of ITNs and 96.06% reporting regular use. However, 42.8% reported no additional preventive actions against mosquito bites despite recognizing the necessity of ITNs. A significant relationship ($p=0.031$) was found between education levels and ITN usage. **Conclusion:** While ownership of ITNs among pregnant women in Rwanda is relatively high, consistent usage is hindered by financial constraints, availability issues, and net conditions. Targeted intervention is needed to address these challenges, promote awareness, and ensure ITNs accessibility. Such efforts are essential in fostering a supportive environment for ITN utilization, which is vital for reducing malaria's impact on maternal and child health in Rwanda.

Keywords: Malaria, Insecticide-Treated Nets, Pregnancy, Knowledge, Attitude, Rwanda

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1. Introduction

Plasmodium species are the primary causative agents of malaria, which ranks as one of the leading causes of infectious disease-related deaths globally. The transmission of malaria is facilitated by female Anopheles mosquitoes, which carry the Plasmodium parasites. The World Health Organization (WHO) has reported an estimated 219 million malaria cases and 66,000 deaths in recent years, highlighting the severity of this public health issue [1]. Furthermore, around 3.2 billion people across 97 countries are at risk of contracting malaria, with 1.2 billion classified as being at high risk [2]. In the United States, between 1,500 and 2,000 malaria cases are reported each year, predominantly among immigrants and travelers from endemic regions such as South Asia and Sub-Saharan Africa [3].

Notably, Africa accounts for approximately 94% of global malaria cases and 96% of malaria-related deaths [4]. The impact of malaria on communities, particularly in Africa, is profound. It threatens the lives of millions of individuals [5]. Despite the availability of effective treatments, an estimated 25 million pregnant women contract malaria annually, with the disease contributing to a significant percentage of maternal deaths in several African countries [1]. In North Sudan, around 75% of the population is at risk, with malaria diagnoses accounting for about 30% of hospitalizations and 16% of hospital mortality [6]. Similarly, in Kenya, approximately 70% of the population is at risk, particularly vulnerable groups such as pregnant women and children under five [7].

In Rwanda, malaria poses a significant risk to approximately 1.8 million children under five and about 443,000 pregnant women at risk each year [8]. High-endemic areas for malaria have been identified in 19 of Rwanda's 30 districts, predominantly in the eastern and

southern provinces, where over half of all reported cases occur [9]. Despite the availability of insecticide-treated nets (ITNs), only about 43% of households possess enough nets to adequately protect all members, leading to sharing among family members [10]. Awareness and utilization of ITNs are crucial for malaria prevention, particularly among pregnant women, as evidenced by studies indicating that knowledge and attitudes significantly influence ITN use [11].

In summary, malaria remains a critical public challenge, particularly in sub-Saharan Africa, where its prevalence and associated mortality rates are alarmingly high. The effective use of preventive measures, such as ITNs, is essential to mitigate the disease's impact, especially among vulnerable populations like pregnant women and young children.

2. Materials and Methods

Description of study locations and Research Design

The study was conducted at Rwamagana Health Center, in the Rwamagana District of Rwanda. An area known for its malaria-endemic status, making it suitable for this research. A cross sectional descriptive study design with quantitative approach was employed to evaluate knowledge and attitudes towards insecticide-treated mosquito nets (ITNs) among pregnant women attending the health center.

Study Population and Sample Size

The target population for this study consisted of pregnant women attending antenatal care at Rwamagana Health Center. A total 63 participants, all aged 18 years and older, were recruited based on specific criteria. The sample size was determined by estimated prevalence of ITN usage among pregnant women in Rwanda, ensuring it was sufficient to yield statistically significant results. The focus on this population aimed to gather essential data reflecting the experiences and challenges faced by pregnant women in accessing and utilizing ITNs, which are crucial for malaria prevention.

Data Collection Instrument and Methods

The study utilized a self-administered questionnaire to collect data on malaria and insecticide-treated mosquito nets (ITNs), focusing on demographics, knowledge of malaria, attitudes towards ITN usage, and net preferences. To ensure accessibility, the questionnaire was translated into Kinyarwanda. Formal permission was obtained from expert at UCSI university, enhancing the study's credibility and ethical standards. The validity and reliability of the questionnaire were confirmed through a thorough review by faculty from the University of Rwanda's College of Medicine and Health Sciences. A pilot study with ten pregnant women showed a Cronbach's alpha coefficient above 0.7, indicating good internal consistency. Ethical approval was granted by The Institution Review Board at the University of Rwanda, and participants were informed of their rights, including the right to withdraw from the study at any time. Participants aged 18 and older provided informed consent, and completing the questionnaire took approximately 20 to 30 minutes. Data collection occurred over three weeks, in alignment with health center's schedule.

Data Analysis

The collected data were entered, coded, and analyzed using the Statistical Package for Social Sciences (SPSS), Version 21. Chi-square tests ($p < 0.05$) were utilized to examine relationships between demographic variables and knowledge/attitude scores related to ITN usage. The study acknowledged certain limitations, including the potential for self-report biases due to the reliance on participants' responses regarding their knowledge and practices related to ITN use. Additionally, the cross-sectional design of the study imposes constraints on making causal inferences regarding changes in knowledge and attitudes over time.

3. Results

Table 1. Demographic characteristics of the study participants

Respondents(n=63)	Sub-Categories	frequency	Percentages (%)
Age	[11-20]	8	12.7
	[21-30]	37	58.7
	[31-40]	17	27.0
	>40	1	1.6
Marital status	Yes	52	82.5
	No	11	17.5
Level of education	Primary	27	42.9
	Secondary	21	33.3
	Bachelor	10	15.9
	Illiterate	3	4.8
	Missing data	2	3.2

A total of 63 valid respondents highlighted the socio-demographic areas. The majority of respondents (58.7%) were aged between 21 and 30 years. Most of which were married women 82.5% only 17.5% reported being unmarried. With reference to respondents' education attainment, the majority 42.9% had completed primary education, while secondary and bachelor education was completed by 33.3% and 15.9% respectively, with very few being illiterate (4.8%). (Table 1)

The results indicate that a significant majority of respondents (96.07%) sleep under ITNs every night, and a large portion (76.2%) has heard information about insecticide-treated nets (ITNs). The primary sources of information include mass media (38.1%), relatives and friends (27%), and health facilities (17.5%). Awareness of ITNs is high, with 84.1% acknowledging their existence, suggesting effective public health efforts to combat malaria through ITN utilization in the study population. (Table 2)

The data collected from 63 respondents provides valuable insights into their attitudes and behaviors regarding the use of insecticide-treated nets (ITNs) for malaria prevention.

A significant portion of respondents (52.4%) indicated that the availability of ITNs does not affect their usage. This suggests that barriers to usage may extend beyond mere access, possibly involving factors such as awareness, personal beliefs about effectiveness, or cultural practices.

An overwhelming majority (95.2%) believe that ITNs are necessary in their homes, reflecting a strong recognition

of their role in preventing malaria. This high level of perceived necessity presents an opportunity for public health campaigns to further promote the usage of ITNs.

Most respondents (60.3%) suggested that health centers should be responsible for providing ITNs to ensure their use among pregnant women, emphasizing the importance of accessible healthcare services in promoting preventive measures. A concerning 42.8% of respondents reported

taking no action to prevent mosquito bites, which may indicate a lack of awareness or resources for implementing additional preventive measures. The response indicating that "all the above" actions should be taken to prevent malaria transmission received substantial support from 42.9% of participants, suggesting that a community-oriented approach could enhance malaria prevention efforts by integrating multiple strategies (Table 3).

Table 2. Level of knowledge and awareness and other information vis-a-vis ITNs utilization

Variables	Categories	Frequency	Percentage (%)
Sleeping under the net every night(n=63)	YES	49	96.07
	NO	14	3.93
Heard information towards insecticide treated net(n=63)	YES	48	76.2
	NO	15	13.8
Source of the information on awareness of an insecticide treated mosquito net (ITN) (n=63)	Health facility	11	17.5
	Relatives and friends	17	27.0
	Mass media	24	38.1
	Do not remember	8	12.6
Awareness of an insecticide treated mosquito net (ITN)	Yes	53	84.1
	NO	10	15.9
Source of the information on mosquito net	Gift from my friend	4	6.3
	Purchased from the nearby shop	6	9.5
	Provided by health center	42	66.7
	Given free by NGO dealing with malaria control	2	3.2
	Not applicable (if no net)	9	14.3

Table 3. Attitude towards the use of ITNs

Variables	Categories	Frequency	Percentages (%)
How ITNs Availability affect its usage at your home? (n=63)	Greatly affected	21	33.3
	Affected	9	14.3
	Do not affected	33	52.4
Do you think insecticide treated net is necessary at home? (n=63)	Yes	60	95.2
	No	3	4.8
If yes in question above, what can be done to ensure every pregnant woman uses the net? (n=63)	Health center to provide	38	60.3
	Village to provide	8	12.7
	Government to provide	17	27
Apart from using the net, what action do you personally take to prevent yourself from mosquito bite or contact? (n=63)	Using mosquito repellents	19	30.2
	Wearing long sleeved clothing at dawn and after sunset	17	27.0
	No action taken	27	42.8
What activities can your home carry out to prevent malaria transmission? (n=63)	Ensure all the bed in all rooms have ITNs	7	11.1
	Indoor spraying for mosquitoes	3	4.8
	Window screening for mosquitoes	14	22.2
	Clearing bushes around the house that serve as mosquito breeding sites	12	19.0
	All the above	27	42.9

Table 4. Relationship Between Demographic Data and Attitude Towards the use of ITNs

<i>Do you sleep under mosquito net to protect yourself from mosquito bites?</i>					
Education Level	YES Count	YES Percentage (%)	NO Count	NO Percentage (%)	P-Value
Primary	21	77.8%	6	22.2%	0.031
Secondary	19	90.5%	2	9.5%	
Bachelor	10	100.0%	0	0.0%	
Illiterate	1	33.3%	2	66.7%	
Age Group					0.151
1-20	7	87.5%	1	12.5%	
21-30	30	81.1%	7	18.9%	
31-40	15	88.2%	2	11.8%	
41 and above	0	0.0%	1	100.0%	

The P-value of 0.031 indicates a statistically significant relationship between education level and the likelihood of sleeping under a mosquito net. As education level increases, the percentage of individuals sleeping under a mosquito net also increases, with all respondents holding a bachelor's degree reporting usage (100%). In contrast, illiterate individuals demonstrated a significantly lower usage rate at only 33.3%, suggesting that lack of education may hinder awareness or access to preventive measures. The majority of respondents in younger age groups (ages 1-30) reported using mosquito nets, with usage rates ranging from 81.1% to 88.2%. However, the chi-square test yielded a P-value of 0.151, indicating that there is no statistically significant evidence to conclude that variations in net usage are influenced by age. (Table 4).

4. Discussion

The findings of this study provide critical insights into the knowledge and attitudes of pregnant women in Rwanda regarding the use of insecticide-treated nets (ITNs) as a preventive measure against malaria. The results indicated a high level of awareness and owner of ITNs among participants, with 76% acknowledging their existence and 96.06% reporting regular use. This aligns with previous research that highlights the importance of awareness in promoting ITNs usage particularly in malaria-endemic regions [6,7]. However, despite this awareness significant portion of respondents (42.8%) reported taking no preventive actions against mosquito bites, suggesting barriers that extend beyond mere knowledge and ownership [2,9]. The study also reveals a statistically significant relationship between education level and ITN usage, with higher education correlating with increased likelihood of using ITNs ($p=0.031$). This finding is consistent with other studies that emphasize the role of education in health behavior and decision-making, particularly among women [11] and [7]. Educated women are often more autonyms in health-related decisions, which can lead to improved health behaviors for themselves and their families [11]. This underscores the need for targeted educational interventions to enhance the understanding and effective use of ITNs among less educated population.

Moreover, the results indicate that while the majority of respondents recognize the necessity of ITNs for malaria prevention (95.2%), there are still significant barriers to consistent usage. Factors such as financial constraints availability, and the condition of the nets were cited as

impediments to effective utilization [12] and [13]. This reflects a broader trend observed in various studies where ownership doesn't always translate into usage, particularly in high malaria transmission areas [9]. Addressing these barriers through community engagement and support from health workers is essential for fostering a supportive environment for ITN utilization [3] and [8]. The study advocates for comprehensive preventive strategies that include not only the distribution of ITNs but also community education and involvement. Engaging community leaders and health workers can enhance the effectiveness of malaria prevention efforts by promoting a multi-faceted approach that includes ITN usage, indoor spraying, and other preventive measures [6,10]. This holistic strategy is vital for reducing malaria's impact on maternal and child health in Rwanda, particularly given the high susceptibility of pregnant women and young children to malaria [8,12].

In conclusion, while the study highlights positive trends in knowledge and ownership of ITNs among pregnant women in Rwanda, it also reveals critical gaps in consistent usage and the need for targeted interventions. Addressing the barriers to effective ITN utilization through education, community engagement, and improved access will be essential in fight against malaria in this vulnerable population.

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