



Knowledge, Attitude and Practices on Bed Net Usage among Communities in Cherangany Sub-County, Kitale, Kenya

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Abstract

BACKGROUND

Globally, vector-based malaria control programs, such as insecticide-treated nets (ITNs) play an essential role in reducing malaria infections. Despite evidence of their effectiveness when properly and consistently used, usage still lags. The study investigated knowledge, attitudes, and practices towards insecticide-treated nets utilisation among communities in Cherangany Sub County, Trans-Nzoia County.

METHODS

This cross-sectional study was conducted in the Charangany sub-county, and 326 respondents were recruited for the study. Quantitative data were collected by interviewer-administered questionnaires, and data were analysed using STATA version 15. Data were presented using frequencies and percentages. Linear correlations were used to determine associations between the dependent variable and independent variables, and Regression analysis was carried out to test whether the independent variables were predictors of net usage.

RESULTS

Academic achievement and educational resources showed a strong correlation with net usage ($r = 0.746$, $p < 0.01$). Knowledge, attitudes, and practices ($\beta = 0.41$, $p = 0.021$) and socio-economic factors ($\beta = 0.296$, $p = 0.010$) were also significant predictors. Individual characteristics had the strongest correlation ($r = 0.872$). Marital status and urban residence ($\beta = 0.372$, $p = 0.000$) were key predictors. Standardised results ranked knowledge ($\beta = 0.421$) highest, followed by education ($\beta = 0.308$) and socio-demographics ($\beta = 0.291$). These findings highlight education and socio-economic factors as critical for ITN adoption. Low-income households, lower education levels, and employment status were associated with lower bed net usage.

CONCLUSIONS

The study highlighted education and socioeconomic status as major influences on insecticide-treated net use. We also noted the important roles of individual factors like marital status and urban residence. These findings indicate that improving bed net utilisation may require both broad public education and targeted interventions for specific groups.

Keywords: Knowledge, Attitude and Practices, Insecticide-Treated Nets (ITNs), Communities and Spread of Malaria

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Introduction

Malaria remains a public health concern globally, with an estimated burden of 240 million cases in 2022, with the African region accounting for 95% of cases globally. Kenya is among the malaria-endemic countries with varying transmissions across the various ecological zones (1), these include: coastal endemic, such as Mombasa, Highland endemic in Trans-Nzoia, Uasin Gishu and Baringo. Kisumu, Homa Bay, and Busia fall in the lake endemic zone, while Northern Kenya is categorised as a seasonal risk (2).

Insecticide-treated nets (ITNs) are key in malaria reduction by protecting against mosquito bites; they also repel and kill mosquitoes, thus preventing the transmission of malaria parasites. It is worth noting that high coverage could help reduce the risk of individuals and communities getting malaria. In Kenya, malaria control efforts have been prioritised in collaboration with the Global Fund and the President's Initiative to provide and promote Insecticide-Treated Nets (ITNs), especially in high-risk areas. ITN ownership in Kenya has gradually been rising as a result of the mass distribution campaigns, but ownership varies across the ecological zones, with the highest percentage coverage (63%-78%) observed in the lake endemic region. In the coastal endemic zone, more than half of the population owns ITN (58%), while the low-risk and seasonal zones have lower coverage of less than 40% (3). Cherangany Sub County, which is malaria-endemic is situated in a region with a high incidence of malaria. The area's climate, characterised by warm temperatures and periodic rainfall, creates a conducive environment for mosquito breeding, making malaria a recurring health issue (4, 5). Despite their effectiveness, challenges remain, primarily related to community knowledge, attitudes, and practices (KAP) around bed net usage. Misconceptions, lack of knowledge, and inconsistent usage habits limit the potential

impact of bed nets, often reducing the success of these interventions (5).

Studies have shown that Knowledge, Attitudes, and Practices (KAP) are essential in determining the effective use of Insecticide-Treated Nets (ITNs) for malaria prevention. Knowledge of malaria transmission and prevention techniques enhances ITN adoption; individuals with greater awareness are more likely to understand the importance of ITNs and consistently use them (6). Furthermore, attitudes towards ITNs, influenced by cultural beliefs and perceived benefits, impact how communities accept and use these preventive tools. For example, in regions where there is a strong belief in alternative malaria prevention methods, ITN usage may be limited (7). Finally, practices around the consistent and correct usage of ITNs significantly determine their effectiveness. Previous studies have demonstrated that improper practices, such as irregular use or inadequate maintenance of ITNs, reduce their efficacy in malaria prevention. Therefore, addressing gaps in KAP through targeted educational campaigns is crucial for improving ITN usage and enhancing malaria prevention efforts (8).

Thoroughly assessing KAP related to bed net usage in Cherangany Sub-County will provide insights for improving malaria control strategies in communities. While studies have been conducted in Kenya, they have focused on net distribution and efficacy, but community-level perceptions and behaviours affecting ITN utilisation have not been extensively explored (9). Therefore, understanding local behavioural barriers can help develop targeted interventions that address misconceptions and improve adherence to bed net use guidelines. Consequently, we aimed to assess the knowledge, attitudes, and practices (KAP) regarding bed net usage in the Cherangany Sub-County community.

Materials and Methods

Study design

A cross-sectional research design was adopted for this study, and data were collected at a single point in time from a representative sample of the population, allowing for the capture of current opinions on the practices, perceptions, and understanding related to bed net use.

Study area

Cherangany Sub County, which is malaria-endemic, is situated in a region with a high incidence of malaria. The area's climate, characterised by warm temperatures and periodic rainfall, creates a conducive environment for mosquito breeding, making malaria a recurring health issue. Like many rural areas in Kenya, Cherangany faces limitations in healthcare resources.

Sample size and sampling

The study used Yamane's formula (10) to calculate the sample size of respondents within the Cherangany sub-county. The equation for the formula was as follows:

$$n = N / (1 + Ne^2)$$

$$1610 / (1 + 0.0025 * 1610)$$

n = 320 sample Size. This was rounded up to ensure proportionate distribution across the different groups.

N = is the entire population, n is the number of samples, and e is the tolerance for error.

We targeted 1610 individuals in Cherangany Sub-County, Trans Nzoia County, based on their roles in the community. Stratified sampling was used to ensure balanced representation across six key population categories.

For the target population in the NGO category, we selected field officers, project coordinators, and program staff actively implementing health and development programs in Cherangany (11). This group was chosen for their direct involvement in malaria prevention programs, health education and behavioural

change communication. Of 140 NGO members, 40 were purposively sampled based on proportionate distribution across the different organisations.

CHWs were selected from a pool of 180 active members estimated from the community health units affiliated with public health facilities across the seven wards of Cherangany, and 40 CHWs with at least one year of service were sampled proportionately. Only CHWs with at least one year of active service were considered to ensure relevant field experience.

Children aged 14-18 were sampled from secondary schools using simple random sampling from class registers after obtaining consent from school heads and guardians. A single secondary school was randomly selected from a list of all public secondary schools per ward. The secondary school children were chosen to understand their perspectives on bed net use.

We selected community members by a proportionate stratified sampling approach to select households from Cherangany Sub-County, which comprises seven administrative wards: Motosiet, Kaplamai, Chepsiro/Kiptoror, Sinyerere, Kwanza, Cherangany/Suwerwa, and Makutano. The wards were considered strata to ensure balanced geographic representation, resulting in a final target of 200 households. Each ward contributed approximately 28-29 households that were randomly selected. In the next stage, we selected 2-3 villages randomly, depending on the population density, using lists provided by CHWs and area chiefs. Here, we applied random sampling using a random number generator.

For instance, in Motosiet Ward, we sampled 29 households across three randomly selected Kapsara, Makilelat, and Kapolet villages and recruited the willing household head. This method was replicated across all wards, ensuring the final sample was both representative and robust.

Chiefs and sub-chiefs were selected based on their official administrative jurisdictions and were included as key informants to capture their policy-level perspectives due to the roles they play in mobilising the community.

This mixed and stratified approach allowed for representative, inclusive insights while covering all seven administrative wards in Cherangany.

Inclusion criteria

For the school children, they had to be in a public secondary school, aged between 14-18 years. For the community, Individuals aged 18 years and older were eligible; they had to be residents of Cherangany's Sub County to ensure that the data reflects the specific knowledge, attitudes, and practices within the local context, including cultural and environmental factors unique to the area. One representative from each household, preferably the primary caregiver, was included to ensure that the responses were from individuals who influence or are aware of bed net usage practices within the household. Additionally, only those willing to provide informed consent were recruited. Participating NGO members were selected based on whether their affiliations were directly involved in implementing health or community education, with preference given to those directly involved in malaria prevention programs and who had worked in the community for at least six months. They also had to be willing to participate in the study.

Exclusion criteria

Temporary residents of Cherangany, individuals with cognitive impairments, as well as those unwilling to sign the informed consent, were excluded from the study.

Data collection procedure

The data collection teams included two enumerators and a field supervisor per ward. All teams were trained for a day before the site visit. The training encompassed familiarising themselves with the study aim, a detailed review of the data collection tools, and the process of obtaining informed consent. The structured questionnaire, developed by the authors, was administered by the data collection team. The questionnaire consisted of five sections. The first two (A and B) sections captured the category of the respondents and their socio-demographic data. In the next two sections (C and D), the respondents were required to indicate their level of agreement to statements in a Likert scale format, ranging from Strongly Agreed (SA), Agreed (A), Undecided on a particular question (U), Disagreed (D), or Strongly Disagreed (SD). These statements were focused on the roles of knowledge, attitudes and practices in ITN usage.

The last section examined the opinions of the respondents on how variables such as age, sex, socio-economic status, literacy, marital status, and rural vs. urban residence influenced the use of ITNs. Similar to Section D, responses were rated using a 5-point Likert scale.

Table 1:
Sample Size Distribution

Estates Respondents	Target Population	Percentage	Sample Size
Chief	20	1.24%	4
Sub Chief	20	1.24%	4
Community Health Workers	180	11.18%	40
Children (Teens)	180	11.18%	40
Community Members	1000	62.11%	200
NGOs	140	8.70%	38
Total	1610	100	326

The consenting responders had enough time to complete the questionnaire. Between September 2022 and March 2023, the exercise was conducted.

The NGO participants were approached at their offices or project sites, and structured questionnaires were administered to capture their perspectives on malaria prevention. For the community health workers, questionnaires were administered during their routine meetings, and each consenting participant was interviewed in private at their linked public health facility. The selected pupils were interviewed in a supervised classroom setting after the school administration and guardians provided permission. The data collection team visited the selected households and administered questionnaires to the household heads or an available adult who consented to participate. Lastly, for the chiefs and sub-chiefs, the questionnaires were administered at their offices.

Validity

To ensure the interval validity of the questionnaires, a thorough literature review on the key constructs of knowledge, attitudes, and practices was conducted, along with expert review by the supervisors to ensure that the questions captured all the intended domains.

Ethical consideration

Permission to conduct the study was received for Mt. Kenya University institutional Scientific Ethics Review Committee approval, 1998 MKU/ISERC/1998. The study was licensed by the National Commission for Science, Technology and Innovation, NACOSTI/P/23/29896. Everyone who participated in the study was adequately informed about the study, and participation was voluntary. Permission was sought from guardians and teachers before requesting assent from the teenagers. For participants who could not read and write, the study was explained in their local language by either a member of the study or a community health worker and after verbal consent, a thumbprint was obtained in place of a signature. The questionnaires were anonymised, and all study documents were kept under controlled access to ensure privacy.

Data analysis

The data collected was entered into the Microsoft Excel computer application. The data was then checked for inconsistencies and cleaned then it was extracted and coded into Microsoft Excel before being analysed using Version 15 of STATA. Frequencies and percentages were employed for the analysis of descriptive statistics.

Table 2
Demographic Information

Variable		Frequency	Percentage
Gender	Male	100	36%
	Female	180	64%
	Total	280	100
Age	≤ 20 years	30	11%
	21-15 years	70	25%
	26-30 years	105	37%
	≥31 years	75	27%
	Total	280	100
Level of Education	Untrained	50	18%
	Diploma	110	39%
	Degree	82	29%
	Masters	38	14%
	Total	280	100

Linear correlations were used to determine associations between the dependent variable and the independent variables. Regression analysis was carried out to test whether the independent variables were predictors of ITN usage, and the statistical significance was set at $P < 0.05$.

Results

Sampled participants were 326; however, 280 questionnaires had complete data, and 46 questionnaires were excluded from the analysis due to incomplete data, leading to a response rate of 86%. From Table 2, most of the respondents were females at 64%. Respondents aged 20 years and below were the minority (11%) of the study sample; 21-25 years, 70(25%) indicated that young adults are well-represented. 26-30 years, 105 (37%), the largest age group in the study. Those above 31 years 75 (27%) were a notable proportion. Different age groups have varying patterns of bed net usage. Untrained respondents accounted for 50(18%) of the total responses.

Diploma holders were 110 (39%), Degree holders were 82(29%) respondents, while Master's holders were 38 respondents, making up 14% of the total.

Factors affecting ITN usage in Cherangany sub-county

The majority of the respondents, 43%, strongly agreed, and another 36% agreed that literacy influenced the likelihood of ITN usage. 45% of the respondents strongly agreed and 36% agreed that individuals from poorer backgrounds were unlikely to use ITN. Similarly, the majority 45% strongly agreed that socio-economic factors play pivotal roles in ITN usage, with wealthier demographics likely to use ITNs. Of note is that most respondents strongly agreed (43%) that demographic factors such as age and sex affected the use of ITNs. Additionally, 43% strongly agreed and 38% agreed that being knowledgeable about net usage promoted use; similarly, a positive attitude towards ITN promoted use.

Table 3

Factors Affecting ITN Usage

Factors Affecting INT's Usage	Strongly Agree (SA)	Agree (A)	Undecided(U)	Disagree(D)	Strongly Disagree (SD)	Total
Academic Achievement and Educational Resources						
Literate individuals are more likely to use ITNs	120(43%)	100(36%)	20(7%)	15(5%)	5(2%)	280
Socio-economic and Socio-demographic factors						
Socio-economic Background Influences ITN Usage	127(45%)	100(36%)	8(3%)	13(5%)	32(11%)	280
Socio-economic factors determine ITN usage	108(39%)	125(45%)	7(3%)	30(11%)	10(4%)	280
Demographics Affect ITN Usage	120(43%)	105(38%)	35(13%)	15(5%)	5(2%)	280
Individual Characteristics						
Married Individuals are more likely to use ITNs	112(40%)	115(41%)	13(5%)	30(11%)	10(4%)	280
Rural Vs Urban Residence Influence ITN Usage	108(39%)	125(45%)	7(3%)	30(11%)	10(4%)	280
Knowledge, Attitude and Practices influence ITN usage.						
Knowledge Influences ITN Usage	120(43%)	105(38%)	35(13%)	15(5%)	5(2%)	280
Attitudes Influence ITN Usage	115(41%)	110(39%)	20(7%)	25(9%)	10(4%)	280
Practices influence ITN usage	128(46%)	110(36%)	10(4%)	20(7%)	22(8%)	280

Nearly half of the respondents (46%) strongly agreed that practices around ITN influenced better usage. The majority felt that married people were more likely to use ITNs, and rural residents were unlikely to use ITNs. See Table 3.

A strong positive linear link between two variables is indicated by a correlation value of +1, whereas a strong negative linear association is suggested by a correlation coefficient of -1. On the other hand, the absence of a linear relationship between the two variables is indicated by a correlation value of zero. Table 4 displays the correlation study's findings.

The results imply that academic achievement and educational resources (X1) have a strong and favourable association. There is a statistically significant correlation coefficient of 0.746 ($p < 0.01$) between the two variables, supporting this claim. According to the study, there is a positive relationship between the effects of bed net usage among communities on the spread of malaria in Cherangany. There is no significant relationship between the knowledge, attitude and practices (X2) towards the effects of bed net usage among communities on the spread of malaria in Cherangany Sub County to be positively and significantly correlated, as indicated by the correlation coefficient of 0.794. This demonstrates that there is a 0.794-unit. There is no significant relationship between socio-economic and socio-demographic factors affecting the bed net usage among communities on the spread of malaria in Cherangany Sub County. There was a significant association ($r =$

0.872) between individual characteristics on bed net usage among communities on the spread of malaria in Cherangany Sub County.

Regression analysis

Y is a dependent variable.

$Y = 0.376 X_1 + 0.391 X_2 + 0.401 X_3 + 0.372 X_4$ is the fitted model.

$$Y = \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \epsilon$$

According to Table 5 below, academic achievement and educational resources were significant positive predictors of ITN usage ($\beta=0.391$, $P=0.038$), indicating that a unit increase in education led to an increased ITN usage by 39.1%, indicating that education is an important predictor of ITN usage.

Knowledge, attitudes and Practices were significant predictors of ITN usage, similarly with ($\beta=0.41$, $P=0.021$), underscoring the importance of educating communities on the importance of bed net usage in malaria prevention. Similarly, socio-economic and sociodemographic factors were positive predictors of ITN usage ($\beta=0.296$, $P=0.010$), highlighting that social and economic factors should be considered when planning ITN distribution. Finally, marital status and urban residence were the strongest predictors of ITN use ($\beta=0.372$, $P=0.000$). When standardised knowledge, attitude, and practices ($\beta=0.421$) had the strongest predictor, education was a moderate predictor ($\beta=0.308$) for usage, while individual factors and socio-demographics were predictors of net usage ($\beta=0.291$) and ($\beta=0.291$) respectively.

Table 4
Correlation between Study Variables

Variable	Y	(X1)	(X2)	(X3)	(X4)
Bed Net Usage in Cherangany (Y)	1				
Academic Achievement and Educational Resources (X1)	0.746***	1			
Knowledge, Attitude and Practices towards ITN Usage (X2)	0.794***	0.136	1		
Socio-economic and socio-demographic factors and ITN usage (X3)	0.872***	0.124	0.056	1	
Individual Characteristics and ITN Usage (X4)	0.612***	0.032	0.001	0.065	1

Note: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Discussion

We aimed to gain insights from different cadres of the community on ITN usage in the Cherangany subcounty. We observed that most of the study participants were females. The majority were aged between 26 and 30 years. In terms of occupation, the health workers formed the bulk of the study sample. Additionally, most of the study participants had attained tertiary levels of education, with the majority having a diploma, then a bachelor's degree, followed by a master's degree; very few study participants had not attended any education. The findings from this study highlight key factors that influence the use of Insecticide-treated bed nets.

In the current study, most participants felt that education did indeed increase the usage of ITN; similarly, we observed a strong positive correlation. Educational attainment is an important positive factor in ITN usage, in that literate individuals are likely to understand the importance of using nets in preventing as they are likely to understand the aetiology (12). The high correlation we observed could also be a result of health education, which has been shown to increase the uptake of ITN (13). This was consistent with Haile Selassie and colleagues,

who reported that ITN utilisation was consistently higher in educated compared to uneducated women over the years (14).

Socio-economic status was an important factor for ITN use, with individuals reporting more utilisation in individuals from higher socioeconomic classes. Compared to those from poorer backgrounds, since ITNs are offered free during campaigns, it is likely that families have to purchase additional bed nets, and the cost can be prohibitive. Thus, affordability and accessibility remain a burden to ITN use, as seen in a previous study (14).

Additionally, marital status and gender were important factors, with the married and females demonstrating a higher likelihood of utilising ITN. Similar trends were observed in Nigeria, females are more likely to consistently use ITNs regardless of socioeconomic status due to sensitisation and access to free ITNs in pregnancy, as ITNs are traditionally distributed to females, males may shy away from using them due to negative attitudes (15). Marital status was an important factor in ITN utilisation; married individuals, particularly women, may have better access to ITN as a result of shared financial responsibilities and spousal support in making healthcare decisions (16).

Table 5
Regression Analysis of Factors Associated with ITN Usage.

Model	Unstandardized Coefficients		Standardized Coefficients		
	Beta	Std. Error	Beta	t-stat	P-Value
Constant	0.376	0.286		1.315	0.002
X ₁	0.391	0.165	0.308	2.370	0.038
X ₂	0.401	0.154	0.421	2.600	0.021
X ₃	0.296	0.106	0.207	2.792	0.010
X ₄	0.372	0.162	0.291	2.300	0.000

X¹: Academic Achievement and Educational Resources

X²: Knowledge, Attitude and Practices towards ITN Usage

X³: Socio-economic and socio-demographic factors and ITN usage

X⁴: Individual Characteristics and ITN Usage

Knowledge, attitudes and practices were important predictors of ITN utilisation with a positive correlation ($r = 0.794$). Awareness of malaria aetiologies, prevention measures and the roles ITNs play in malaria prevention, combined with positive attitudes, promotes the use of ITNs. Konlan and colleagues noted that gaps in knowledge were a significant hindrance to ITN use in vulnerable populations (17). Misconceptions about ITNs hamper their use (18). This underscores the importance of health education campaigns and mass distribution to encourage the utilisation of ITNs (19).

In the current study, most of the participants felt that attitudes influenced ITN usage. Consequently, positive attitudes promote ITN usage while negative perceptions, such as discomfort, odour, and cultural and traditional beliefs, are barriers to malaria prevention (20). Most individuals in the current study either agreed or strongly agreed that practices associated with bed nets influenced their use. Indeed, proper and consistent use of ITNs is an effective method of malaria prevention; however, improper use and repurposing of ITNs remain a significant barrier. In cases where users reside in traditional houses, there is limited use as bed nets cannot be hung properly, more so in larger families. Additionally, smoke and soot discourage use. Similarly, ITNs are often repurposed or misused in fencing, used as sieves or for fencing. Misuse is often precipitated by poverty (8). Misuse underscores the importance of educating the masses during distribution campaigns.

The role of health workers and community health campaigns emerged as a critical factor in influencing ITN usage. With health professionals making up 43% of the respondents, their insights highlighted the importance of continuous education and support to sustain ITN utilisation. Community health workers, in particular, can bridge the gap between awareness and practice by engaging directly with

households to dispel myths and provide guidance on proper ITN maintenance and usage.

Study Limitations

The results may not be generalizable to other regions with different malaria transmission patterns or socioeconomic conditions, as this was a cross-sectional study. The non-response rate may also affect the generalizability of the findings. The majority of the study participants were educated, skewing the results, and this may not be generalised to all communities. Wealth and poverty were not defined in the study but relied on the community's understanding, such as limited access to education, health care, and housing, while wealth was interpreted as greater financial means.

Conclusion

Overall, the study suggests that education and socio-economic factors are the most important factors influencing the use of ITNs, indicating that programs that aim to increase ITN use should focus on educating people about the importance of ITNs and making them more accessible to everyone, regardless of their socio-economic status. Individual characteristics had the strongest correlation with ITN use, suggesting that there are other factors, beyond education and socio-economic status that influence ITN use. Marital status and urban residence were key predictors of ITN use, suggesting that programs that target specific groups of people, such as married couples or people living in urban areas, may be more effective.

Recommendations

Based on the findings, we recommended that knowledge-based campaigns be strengthened to enhance the community's understanding of the importance of bed net usage. Health education programs should have focused on the benefits of Insecticide-Treated Nets (ITNs) in preventing malaria, particularly among vulnerable groups such as children and pregnant women. Additionally, promoting positive attitudes toward

the use of ITNs was deemed essential. We encourage Public health programs to engage community leaders and influencers to advocate for bed net usage, as their endorsement could have shifted negative attitudes and normalised protective practices.

We recommend implementing regular follow-ups and training to ensure that communities not only own but also correctly use and maintain the nets. Strategies like routine household visits and demonstrations were recommended to reinforce these practices. Furthermore, providing affordable or free ITNs, particularly in low-income areas, would improve accessibility and encourage consistent usage.

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