



## Determinants of Ownership and Utilization of Insecticide-Treated Bed Nets for Malaria Control in the Kanifing Municipality, the Gambia

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### Abstract

**Background:** Malaria remains a major cause of mortality and morbidity in the world, and particularly in sub-Saharan Africa. Despite big increases in the supply of mosquito nets, especially of LLINs in Africa, the number available is still far below what is needed in almost all countries. Household surveys showed that the coverage of all interventions is lower than the 80% target set by the World Health Assembly. The aim of this research was to investigate magnitude and associated factors determining ownership and utilization of bed nets to control malaria in the Kanifing Municipality.

**Methods:** A community based cross sectional study design using multi-stage sampling method. Both quantitative and qualitative approaches were instituted using interviewed structured questionnaires. Both univariate and bivariate analysis were used in analyzing the data. The binary logistic regression model with significance level set at 5% was used to determine predictors of bed net utilization. Data entry and analysis were conducted using SPSS version 24.

**Results:** The prevalence of current utilization of ITNs were 235 (61.5%) while in terms of ownership, 298 (78.0%) were found to own/have mosquito nets in their households. The significant predictors of ITN utilization includes the size of the family in the household, 0.855 (95% CI: 0.798 – 0.916); having mosquito nets in the households, 11.806 (95% CI: 5.513 – 25.279); having nets in the sleeping spaces, 1.732 (95% CI: 1.443 – 2.078) and reporting that bed net can reduce the incidence of malaria were 3.902 (95% CI: 1.215 – 12.531).

**Conclusion:** Despite free distribution of LLINs during mass campaigns and routine government health facilities distribution, the ownership was moderately high and utilization remains low. Thus, there is a need to refocus on people's choice of bed nets including the textural properties in order to increase the utilization of ITN to effectively and efficiently control malaria in the municipality. Furthermore, the distribution centers and bed nets choices of individuals as in conical and soft texture should be increased during routine and mass LLIN campaigns.

**Keywords:** Malaria; Insecticide Treated Nets; Ownership and Utilization

### Abbreviations

ACT: Artemisinin-based Combination Therapies; EAs: Enumerated Areas; GBOS: Gambia Bureau of Statistics; HMIS: Health Management Information System; IPTp: Intermittent Preventive Therapy; IRS: Indoor Residual Spray; ITNs: Insecticide Treated Nets; KM: Kanifing Municipality; LLINs: Long Lasting Insecticide Treated Nets;

MICS: Multiple Indicator Cluster Survey; NMCP: National Malaria Control Programme; RBM: Roll Back Malaria; RDT: Rapid Diagnostic Tests; SMC: Seasonal Malaria Chemotherapy; SPSS: Statistical Package for Social Sciences; UNICEF: United Nation International Children Fund; WHO: World Health Organization.

## Introduction

Malaria is an entirely preventable and treatable mosquito-borne illness. In 2015, 95 countries and territories had ongoing malaria transmission and an estimated 3.2 billion people – nearly half the world's population – were at risk of malaria. Malaria is a major public health problem in tropical and subtropical regions of the world [1].

During the last decade, malaria control and prevention efforts in the Gambia have been accelerated with increased availability of resources aimed at reducing the disease burden. As part of efforts to improve program performance, the Ministry of Health and Social Welfare in collaboration with Roll Back Malaria partners conducted a Malaria Program Review (MPR) between 2011 and 2012. The results of the MPR highlighted strengths, weaknesses, opportunities and threats as well as challenges to malaria prevention and control (MICS 2015).

Following the recommendations of the MPR, the 2008-2015 National Malaria Strategic Plans was revised and updated. Currently, the new strategic plan is aligned with Roll Back Malaria targets. The vision of 2014 -2020 malaria policy is "A Malaria-Free Gambia" and aims to achieve pre elimination slide positivity rate of  $\leq 5\%$  by 2020. The strategic plan places emphasis on universal coverage for key malaria interventions and seeks to consolidate the gains already achieved. Therefore, it will provide basis for a common ground for co-ordination, implementation and monitoring and evaluation of malaria control activities (MICS 2015).

In the Gambia, malaria continues to remain a leading cause of morbidity and mortality among children under the age of five years (GBoS, 2007). However, recent studies have indicated that malaria cases and admissions in government health facilities are on the decline. Findings between 2003 and 2007 from four health facilities with complete slide examination records show a decrease in the proportions of malaria-positive slides by 82%, 85%, 73%, and 50% respectively. In two hospitals the proportions of deaths attributed to malaria fell by 100% and 90%. Since 2004, mean haemoglobin concentrations for all-cause admissions increased by 12 g/L, and mean age of paediatric malaria admissions increased from 3 to 9. (Ceesay, *et al.* 2008). In spite of the decline recorded in cases reporting to health facilities, malaria remains a major killer disease especially among infants and children under five years of age.

A combination of tools and methods are now used to combat malaria in The Gambia and they include long-lasting Insecticidal Nets, (LLIN); Artemisinin-based Combination Therapy (ACT), supported by Indoor Residual Spraying of insecticide (IRS) and Intermittent Preventive Treatment in pregnancy (IPTp) (Nyan, *et al.* 2009).

Despite big increases in the supply of mosquito nets, especially of LLINs in Africa, the number available is still far below what is needed in almost all countries (WHO, 2008). Household surveys and data from The Gambia National Malaria Control Programme (NMCP) showed that the coverage of all interventions is lower than the 80% target set by the World Health Assembly. LLIN usage in the general population is low, given that the average rural household size is approximately 8 only 60% of rural households have at least one LLIN (Nyan, *et al.* 2009); less than 50% of children under 5 years of age sleep under LLINs (Nyan, *et al.* 2009; GBoS, 2007); 32% of children with fever were treated with ACT (Nyan, *et al.* 2009); and 50% of women used IPT in pregnancy (Nyan, *et al.* 2009).

The Gambia has made considerable progress in the fight against malaria. The overall malaria parasite prevalence in the country is only 0.2 compared to 4 in 2011 indicating a significant decline of more than 90 in all the health regions of the country. WHO and Roll Back Malaria partners have identified the Gambia as one of seven countries in West African sub-region for accelerated progress towards malaria elimination (NMCP 2017).

The Gambia has a long history of bed net usage. In fact, bed nets usage is seen as part of Gambian tradition, especially in rural areas. Between 2000 and 2009, LLIN distribution targeted the most vulnerable groups; Children under 5 years, pregnant women and the differentially able persons. In 2010, the universal coverage strategy was adopted (MICS 2015).

In 2014, the first nationwide mass LLINs distribution was conducted during which Over 700,000 Nets were distributed. In 2017, the second LLIN distribution campaign was conducted and 911,183 LLINs were delivered.

Household surveys and data from The Gambia National Malaria Control Programme (NMCP) showed that the coverage of all interventions is lower than the 80% target set by the World Health Assembly. Due to these fact children in the kanifing municipality are

not benefitting from other interventions such as the seasonal malaria chemotherapy SMC found in other parts of the country. This makes children under five in KM more prone to malaria episodes considering the geographical pattern and socio-demographic factors in the municipality.

Identification of awareness gaps, monitoring of behavioral changes on malaria disease recognition and use of preventive and control measures such as the use of ITNs are a priority area for the Government of The Gambia with a special emphasis on increasing coverage and use of ITNs under national malaria guidelines. Few studies assessed the ownership and use of ITNs by households of under-five children. The research describes magnitude and predictors of ownerships and utilization of ITNs among these vulnerable groups in the selected households in kanifing Municipality.

### Objective of the study

The objective of the study is as follows

1. To determine the magnitude of ITNs utilization among households with under-five children in KM.
2. To assess the ownership of ITNs among households of under-five children in KM.
3. To determine the socio-demographic and proximate factors associated with the utilization of ITNs among households with under-five children in KM.

### Research questions

The research attempted to answer the following questions

1. What is the ITNs utilization prevalence across the selected sites in KMC?
2. What are the ownership and utilization pattern of ITNs across the selected households of under-five children in KMC?
3. What socio-demographic and proximate factors are associated with ITN utilization among households with under-five children in KM?

### Research hypothesis

- **Null Hypothesis  $H_0$ :** There are no statistical differences between utilization and ownership of ITNs with socio-demographic and proximate factors except by chance alone.
- **Alternate Hypothesis  $H_A$ :** There are statistical differences between utilization and ownership of ITNs with socio-demographic and proximate factors which is not attributed to chance alone.

## Material and Methods

### Background information of the study site

The Kanifing Municipality stretches from old Jeswang to Bakoteh and from Bakau to Abuko. It has a total population of 812,395 with an under five populations of 62,658. The most common occupation among women is business and gardening, and the most common among men are formal employment.

### Study design

A community based cross-sectional study design was employed in this study. Both quantitative and qualitative data was generated and collected using structured questionnaire as it allows meaningful comparison of responses across participants.

### Study population

The study targeted households in the selected EAs (Enumeration Areas) as per Districts within KM, The Gambia.

### Inclusion and exclusion criteria

#### Inclusion criteria

Households with at least an under-five child among the selected clusters in a selected EA in KM and of any ethnic group or nationality, present during the time of the study and have consented to participate in the study.

#### Exclusion criteria

Those household heads that are unwilling to participate in the study, or do not have any under-five children at the time of the study.

### Sample size estimation and sampling technique

By using a fisher's formula for the estimation of a single proportion [2]:

$$n = \frac{p(1-p) \times Z_{\alpha}^2}{d^2} \times 2$$

Where

- $Z^2$  the standard normal deviate, which is 1.96 for the 95% confidence limit
- $p$  is proportion in the target population estimated to have a particular characteristic.  $P = 0.5$  (because of the approximation of households of under-five children properly utilizing ITNs in the area is unknown),
- $d^2$  is a degree of accuracy desired which was set at 5% (0.05) and
- contingency for non-response rate of 10%,

Therefore, an estimated minimum sample size of 424 study participants was expected to be enrolled in the study. However as result of limited resources mobilized for the study, a total of 382 participants were recruited for the study.

### Sampling selection technique

A multi-stage sampling approach was used to obtain the estimated sample size of 424 households for the study.

- **Stage 1: Selection of Districts:** At stage one, a total of five districts were randomly selected using the 2016 Microsoft Excel randomization function (a random number which greater 0 and less than 1. The function returns new a new number each time a spreadsheet recalculates).
- **Stage 2: Selection of Enumeration Areas (EAs):** For each of the five selected districts at stage one, a total of 4 EAs (taken from GBoS) were randomly selected using 2016 Microsoft Excel randomization function in order to have a total of 20 EAs for the study.
- **Stage 3: Selection of Households:** At the level of each EA, was further demarcated in to three clusters. Out of which, one cluster was randomly selected and all the eligible households was recruited for the study.
- **Stage 4: selection of respondent:** At the level of selected household, the number of legible respondents was determined by asking for a caregiver of under-five child in the household who were recruited for the study.

### Data collection instruments

#### Structured questionnaire

Data was collected using a pretested structured questionnaire prepared in English and was translated into the three major local languages of KM (Mandinka, Wolof and Fula). The questionnaire included variables related to socio-demographic characteristics, number of household members, net possession, net utilization, and so forth. Pretest was carried out on 5% of the households that were not literally participants in the actual research work. Necessary modifications were made thereafter. Each filled questionnaire was re-checked just after the administration of the tool to correct wrong responses with a view to assess appropriateness, comprehensiveness of the questions, any ambiguities and inaccuracies. The research work was supervised by one of the Lecturer at the Department of Public and Environmental health.

The public health students in the BSc program at the department of Public and Environmental Health were used to administer the questionnaire through house-to-house visits. Information

were primarily collected from the heads of the households (father or mother) or from an adult household member in case this was not possible.

### Data processing and analysis

Data was checked for completeness and consistency. The data was entered at once by some trained students research assistants. Coded data was entered, cleaned, and analyzed using SPSS version 20.0 for Windows (SPSS, Chicago, IL, USA). Descriptive summaries (frequencies and proportions) and univariate analysis were computed. Multivariable logistic regression analysis was used to determine ITN ownership and utilization as the main outcome variables.

Adjusted odds ratios (AOR) and their corresponding 95% confidence intervals (CI) was used to examine the strength of association. The p values of less or equal to 0.05 were considered statistically significant.

### Ethical consideration

Written or verbal consent was obtained from individual respondents of the study. However, the researchers are committed to the development of knowledge in this particular area and are committed to conduct the research with honesty and integrity.

## Results and Discussion

### Socio-demographic characteristics of caregivers of children under-five in Kanifing Municipality

Table 1 shows the summary of the socio-demographic characteristics of respondents in Kanifing Municipality. Majority of respondents as caregivers were females 89.0% whiles male respondents were 11.0%. The mean age of the participants in the study was 39.98 years with standard deviation of  $\pm 10.91$ . When the mean age of male and female caregivers were compared using the independent sample t-test, there was a statistically significant differences at significant level 0.05. Majority of the respondents were between the age group of 35-44 which accounted for 244 (63.9%) and followed by 25-34 age group for 73 (19.1%).

In terms of Ethnicity, the larger proportion of the respondents was Mandinkas 128 (33.5%) while the least were the Manjagos 6 (1.6%). The numbers of respondents who are working were 185 (48.4%) and majority of the caregivers with at least a primary education level accounted for 62.6% of the overall study subjects. A total of 223 (58.4%) has an estimated monthly income of less than D2000. Business formed the major occupation of these respon-

dents which accounted for 108 (28.3%). However, 268 (70.2%) of the respondents were Married (monogamy), 75 (19.6%) were never married, while 17 (4.5%) were reported to be in polygamous marriage type.

Variables	Frequency (n)	Percent (%)
Sex of the respondents		
Male	42	11.0
Female	340	89.0
Age of respondents		
25 - 34	73	19.1
35 - 44	244	63.9
45 - 54	45	11.8
55 and above	20	5.2
Mean (SD): 33.98(±10.91)		
Family size per household		
1 - 10	312	81.7
11 - 20	58	15.2
21 - 30	12	3.1
Mean (SD): 7.94(±4.93)		
Attended school		
Yes	239	62.6
No	143	37.4
Ethnicity		
Mandinka	128	33.5
Fula	75	19.6
Wollof	61	16.0
Jola	53	13.9
Serere	24	6.3
Serahuleh	21	5.5
Others	14	3.7
Manjago	6	1.6
Currently working		
Yes	185	48.4
No	197	51.6
Educational level		
Never attended school	143	37.4
Primary	74	19.4
Secondary	118	30.9

Tertiary	37	9.7
Vocational	10	2.6
Religion		
Muslim	358	93.7
Christian	22	5.8
Others	2	0.5
Occupational status		
Others (Students, not working, etc.)	133	34.8
Business	108	28.3
Household role	52	13.6
Farmer	39	10.2
Civil Servant	24	6.3
Private sector employee	20	5.2
Carpentry/Mechanic/ Welding	4	1.0
Driver	2	0.5
Average monthly income		
Less than D2000	223	58.4
D2001 - D3000	85	22.3
D3001 - D4000	26	6.8
D4001 - D5000	26	6.8
More than D5000	22	5.8
Nationality		
Gambian	328	85.9
Guinea Conakry	25	6.5
Senegalese	20	5.2
Nigerian	4	1.0
Sierra Leonean	2	0.5
Other African	1	0.3
Ghanaian	1	0.3
Non African	1	0.3
Marital status		
Married (monogamy)	268	70.2
Never married	75	19.6
Divorced/Separated	20	5.2
Married (polygamy)	17	4.5
Widowed	2	0.5

**Table 1:** Socio-demographic characteristics of the respondents in Kanifing Municipality, 2018.

**Magnitude of ITN ownership and preference among caregivers in the Kanifing Municipality**

As shown in table 2, 298 (78.0%) possessed bed nets in their households at the time of the study. Furthermore, 321 (84.0%) of the respondents preferred using the conical/round type of bed nets while as small as 25 (6.5%) have no specific preference between the available choices. With regards to the net texture, the greater proportion 335 (87.7%) of respondents preferred the soft texture whereas only 26 (6.8%) reported to have no texture preference. Slightly more than half of the respondents 211 (55.2%) slept under bed net even without having their nets of choice. Almost more than half of the households interviewed, 196 (51.3%) had 0-2 bed nets at the time of the study. The mean number of bed nets possessed by each household was 3.30 and standard deviation is ±3.58.

The mean number of sleeping spaces among respondents was 2.51 and standard deviation of ±2.81, with the highest record of 0-2 accounted for 245 (64.1%) of total respondents. Furthermore, a total of 314 (82.2%) of respondents never used bed nets outside their sleeping spaces. Sources of bed nets acquisition differ from different respondents but majority got theirs from either government health facility 147 (39.7%) or mass LLIN campaign 179 (48.4%). Respondents trek 1.65km on average to acquire bed nets with a standard deviation of ±2.67. Most respondents travel between 0-2km which stands at 315 (82.5%) in order acquire bed nets. From the total number of respondents, only 80 (20.9%) have reasons for not acquiring bed nets.

Variables	Frequency	Percent
Mosquito nets in household		
Yes	298	78.0
No	84	22.0
Net preference by type/shape		
Conical/round	321	84.0
Rectangular	36	9.4
Any of the two	25	6.5
Net preference by texture		
Soft	335	87.7
Hard	21	5.5
Any of the two	26	6.8
Sleeping under net without preference		
Yes	171	44.8
No	211	55.2
Number of bed nets in household		
0 - 2	196	51.3

3 - 4	95	24.9
5 and above	91	23.8
Mean (SD): 3.30(±3.58)		
Number of bed nets in use		
0 - 2	241	63.1
3 - 4	88	23.0
5 and above	53	13.9
Mean (SD): 2.59(±2.94)		
Number of sleeping places in household		
0 - 2	128	33.5
3 - 4	149	39.0
5 and above	105	27.5
Mean (SD): 3.93(±2.82)		
Number of nets in sleeping places		
0 - 2	245	64.1
3 - 4	87	22.8
5 and above	50	13.1
Mean (SD): 2.51(±2.81)		
Using net when sitting outside		
Yes	68	17.8
No	314	82.2
Source of mosquito net*		
Mass campaign	179	48.4
Govt. Health Facilities/Posts	147	39.7
Mobile/Outreach clinic	45	12.2
Shops/Market vendors	28	7.6
Friends/Relative/Neighbors	19	5.1
Others	17	4.6
NOG/Private Outreach	10	2.7
NGOs/Private Clinics	9	2.4
Traditional healers	2	0.5
Distance from health center (km)		
0 - 2.00	315	82.5
2.01 - 4.00	33	8.6
4.01 and above	34	8.9
Mean (SD): 1.65(±2.67)		
Are there factors preventing from acquiring nets		
Yes	80	20.9
No	302	79.1
*Multiple responses		

**Table 2:** Magnitude of ITN ownership and preference among the respondents in Kanifing Municipality, 2018.

**Utilization of ITNs and incidence of malaria among households of under-fives in the Kanifing Municipality**

The study revealed that 235 (61.5%) of the respondents used bed nets when sleeping as shown in Table 3. A total of 183 (47.9%) respondents reported malaria episodes in their households. Half of the respondents did not record any malaria episode in the household, and only 8 (2.1%) of the respondents had no idea whether a single malaria episode was reported in their household. From a total number of 179 who contracted the disease, 92 (51.4%) slept under a treated bed nets while 87 (48.6%) did not sleep under a treated bed net before contracting malaria. Majority of the respondents, 333 (87.2%) believed that bed nets can help in reducing the incidence of malaria in Kanifing Municipality. Only 18 (4.7%) of respondents believed that other interventions can reduce the incidence of malaria in the Kanifing Municipality.

Variables	Frequency	Percent
Current use of treated bed net		
Yes	235	61.5
No	147	38.5
Malaria episode this season		
Yes	183	47.9
No	191	50.0
Don't know	8	2.1
Slept under bed net before contracting diseases (n=179)		
Yes	92	51.4
No	87	48.6
Bed net can reduce the incidence of malaria		
Yes	333	87.2
No	31	8.1
Other intervention	18	4.7
*Multiple responses		

**Table 3:** Utilization of ITN and cases of malaria among the household of under five children in Kanifing Municipality, 2018.

**Socio-demographic factors associated with ITN Utilization among the household of under five children in Kanifing Municipality**

Table 4 shows the association between socio-demographic factors and utilization of ITNs among the respondents as per household in the study. Majority of the users were found among Mandinkas, Fulas, Jolas, Sarahulehs, Manjagoes, Serere and those in the other categories while Wollofs were found to record the lowest in the utilization of ITNs at the time of the study. The Fisher's exact test results revealed that these difference were statistically significant (p=0.022).

Socio-demographic factors	Current use of ITNs		Test Statistics	p-value
	Yes 235 (61.5)	No 147 (38.5)		
	n (%)	n (%)		
Sex of the respondents				
Male	24 (57.1)	18 (42.9)	$\chi^2$	0.537
Female	211 (62.1)	129 (37.9)		
Family size per household				
1 - 10	5 (50.0)	5 (50.0)	$\chi^2$	0.105
11 - 20	36 (51.4)	34 (48.6)		
21 - 30	194 (64.2)	108 (35.8)		
Attended school				
Yes	139 (58.2)	100 (41.8)	$\chi^2$	0.081
No	96 (67.1)	47 (32.9)		
Ethnicity				
Mandinka	86 (67.2)	42 (32.8)	†	0.022*
Wollof	24 (39.3)	37 (60.7)		
Fula	48 (64.0)	27 (36.0)		
Jola	35 (66.0)	18 (34.0)		
Serahuleh	13 (61.9)	8 (38.1)		
Manjago	5 (83.3)	1 (16.7)		
Serere	15 (62.5)	9 (37.5)		
Others	9 (64.3)	5 (35.7)		
Currently working				
Yes	119 (64.3)	66 (35.7)	$\chi^2$	0.275
No	116 (58.9)	81 (41.1)		
Educational level				
Never attended school	97 (67.8)	46 (32.2)	†	0.056
Primary	47 (63.5)	27 (36.5)		
Secondary	66 (55.9)	52 (44.1)		
Tertiary	17 (45.9)	20 (54.1)		
Vocational	8 (80.0)	2 (20.0)		
Religion				
Muslim	224 (62.6)	134 (37.4)	†	0.097
Christian	11 (50.0)	11 (50.0)		
Others	0 (0.0)	2 (100.0)		
Occupational status				
Farmer	21 (53.8)	18 (46.2)	†	0.291
Household role	35 (67.3)	17 (32.7)		
Civil Servant	11 (45.8)	13 (54.2)		
Private sector employee	10 (50.0)	10 (50.0)		
Business	73 (67.6)	35 (32.4)		

Driver	2 (100.0)	0 (0.0)		
Carpentry/Mechanic/ Welding	3 (75.0)	1 (25.0)		
Others (Students, Not working, etc)	80 (60.2)	53 (39.8)		
Average monthly income				
Less than D2000	143 (64.1)	80 (35.9)	$\chi^2$	0.739
D2001 - D3000	51 (60.0)	34 (40.0)		
D3001 - D4000	15 (57.7)	11 (42.3)		
D4001 - D5000	14 (53.8)	12 (46.2)		
More than D5000	12 (54.5)	10 (45.5)		
Nationality				
Gambian	208 (63.4)	120 (36.6)	†	0.234
Senegalese	8 (40.0)	12 (60.0)		
Guinea Conakry	14 (56.0)	11 (44.0)		
Nigerian	2 (50.0)	2 (50.0)		
Nigerian	1 (100.0)	0 (100.0)		
Sierra Leonean	1 (50.0)	1 (50.0)		
Ghanian	1 (100.0)	0 (0.0)		
Other African	0 (0.0)	1 (100.0)		
Marital status				
Married (monogamy)	166 (61.9)	102 (38.1)	†	0.200
Never married	49 (65.3)	26 (34.7)		
Married (polygamy)	6 (35.3)	11 (64.7)		
Divorced/Separated	13 (65.0)	7 (35.0)		
Widowed	1 (50.0)	1 (50.0)		
*Statistical significance at p<0.05				
†Fisher's exact test				
$\chi^2$ Chi-square test				

**Table 4:** Socio-demographic factors associated with ITN Utilization among the household of under five children in Kanifing Municipality, 2018.

However, other socio-demographic factors were found to be non-statistically significant with the utilization of ITNs and includes the following: sex of the respondent, family size per household, attended school, currently working status, educational level, religion, occupational status, average monthly income, nationality and marital status.

**Proximate factors associated with ITN Utilization among the household of under five children in Kanifing Municipality**

As shown in Table 5, the major proximate factors that were found to be statistically significant were as follows: the availability of mosquito nets in the household ( $\chi^2=101.473$ ,  $df=1$ ,  $p<0.001$ ), number of bed nets in the household ( $\chi^2=36.242$ ,  $df=2$ ,  $p<0.001$ ), number of bed nets in use ( $\chi^2=46.454$ ,  $df=2$ ,  $p<0.001$ ), number of bed nets in sleeping places ( $\chi^2=45.510$ ,  $df=2$ ,  $p<0.001$ ), use of nets when sitting outside ( $\chi^2=19.754$ ,  $df=1$ ,  $p<0.001$ ), opinion on the presence of factors preventing from acquiring nets ( $\chi^2=17.560$ ,  $df=1$ ,  $p<0.001$ ) and sleeping under bed nets before contracting diseases ( $\chi^2=38.991$ ,  $df=1$ ,  $p<0.001$ ).

Proximate factors	Current use of ITNs		Test Statistics	p-value
	Yes 235 (61.5) n (%)	No 147 (38.5) n (%)		
Mosquito nets in household				
Yes	223 (74.8)	75 (25.2)	$\chi^2$	<0.001*
No	12 (14.3)	72 (85.7)		
Net preference by type/shape				
Conical/round	195 (60.7)	126 (39.3)	$\chi^2$	0.121
Rectangular	20 (55.6)	16 (44.4)		
Any of the two	20 (80.0)	5 (20.0)		
Net preference by texture				
Soft	209 (62.4)	126 (37.6)	$\chi^2$	0.457
Hard	13 (61.9)	8 (38.1)		
Any of the two	13 (50.0)	13 (50.0)		
Sleeping under net without preference				
Yes	105 (61.4)	66 (38.6)	$\chi^2$	0.967



No	130 (61.6)	81 (38.4)		
Number of bednet in household				
0 - 2	92 (46.9)	104 (53.1)	$\chi^2$	<0.001*
3 - 4	72 (75.8)	23 (36.6)		
5 and above	71 (78.0)	20 (22.0)		
Number of bednet in use				
0 - 2	117 (48.5)	124 (51.5)	$\chi^2$	<0.001*
3 - 4	73 (83.0)	15 (17.0)		
5 and above	45 (84.9)	8 (15.1)		
Number of sleeping places in household				
0 - 2	75 (58.6)	53 (41.4)	$\chi^2$	0.675
3 - 4	95 (63.8)	54 (36.2)		
5 and above	65 (61.9)	40 (38.1)		
Number of nets in sleeping places				
0 - 2	120 (49.0)	125 (51.0)	$\chi^2$	<0.001*
3 - 4	72 (82.8)	15 (17.2)		
5 and above	43 (86.0)	7 (14.0)		
Using net when sitting outside				
Yes	58 (85.3)	10 (14.7)	$\chi^2$	<0.001*
No	177 (56.4)	137 (43.6)		
Source of mosquito net*				
Govt. Hlth Facilities/ Posts	97 (66.0)	50 (34.0)	†	0.362
Mobile/Out-reach clinic	26 (57.8)	19 (42.2)		
NGOs/Private Clinics	6 (66.7)	3 (33.3)		
NGO/Private Outreach	6 (60.0)	4 (40.0)		
Friends/Relative/Neighbors	13 (68.4)	6 (31.6)		
Shops/Market vendors	22 (78.6)	6 (21.4)		
Traditional healers	1 (50.0)	1 (50.0)		
Mass campaign	122 (68.2)	57 (31.8)		
Others	7 (41.2)	10 (58.8)		

Distance from health Centre (km)				
0 - 2.00	195 (61.9)	120 (38.1)	$\chi^2$	0.485
2.01 - 4.00	22 (66.7)	11 (33.3)		
4.01 and above	18 (52.9)	16 (47.1)		
Are there factors preventing from acquiring nets				
Yes	33 (41.3)	47 (58.8)	$\chi^2$	<0.001*
No	202 (66.9)	100 (33.1)		
Malaria episode this season				
Yes	110 (60.1)	73 (39.9)	†	0.321
No	118 (61.8)	73 (38.2)		
Don't know	7 (87.5)	1 (12.5)		
Outcome of the treatment (n=183)				
Treated & Discharged	60.7)	64 (39.3)	†	0.517
Hospitalized	11 (57.9)	8 (42.1)		
Died	0 (0.0)	1 (100.0)		
Slept under bednet before contracting diseases (n=179)				
Yes	75 (81.5)	17 (18.5)	$\chi^2$	<0.001*
No	31 (35.6)	56 (64.4)		
Bednet can reduce the incidence of malaria				
Yes	212 (63.7)	121 (36.3)	$\chi^2$	0.054
No	16 (51.6)	15 (48.4)		
Other intervention	7 (38.9)	11 (61.1)		
*Statistical significance at p<0.05				
†Fisher's exact test				
$\chi^2$ Chi-square test				

**Table 5:** Proximate factors associated with ITN Utilization among the household of under five children in Kanifing Municipality, 2018.

On the contrary, some of the proximate factors there were not found to be statistically significant with the utilization of ITNs include the following: Net preference by type/shape (p=0.121), net preference by texture (p=0.457), sleeping under net without preference (p=0.967), number of sleeping places in the household (p=0.675), source of mosquito nets (p=0.362), distance from health center (p=0.485), episode of malaria in this season (p=0.321), treatment outcome (p=0.517) and reduction of the incidence of malaria by use of bed nets (p=0.054).

**Final Binary Logistic regression analysis for current utilization of ITNs by socio-demographic and proximate factors among the household of under five children in Kanifing Municipality, 2018**

The variables in the model explained 35.0% to 47.5% of the variation observed in the current utilization of ITNs among the respondents as shown in Table 6. The model was statistically useful (Omnibus Tests of model coefficient = 164.378.86, p<0.001).

With a unit increase in the size of the family in a given household of the respondents were 0.855 (95% CI: 0.798 – 0.916) times less likely to utilized ITNs among the respondents.

The respondents who were having mosquito nets in their households were 11.806 (95% CI: 5.513 – 25.279) times more likely to utilized ITNs compared to those who were not having mosquito

nets in their households. The households who were having nets in their sleeping spaces were 1.732 (95% CI: 1.443 – 2.078) times as likely to utilized ITNs compared to those who were not having nets in their sleeping spaces across the respondents in the study.

The study respondents who reported that bed net can reduce the incidence of malaria were 3.902 (95% CI: 1.215 – 12.531) times more likely to utilized ITNs compared to those who reported other interventions beside bed net as a mean of reducing the incidence of malaria.

In this study we examined the determinants of ownership and utilization of treated bed nets among households in the kanifing municipality. Socio-demographic and proximate factors were used to established the relationship between ownership and utilization of treated bed nets.

	<b>B (Regression coefficient)</b>	<b>P-value</b>	<b>COR (95% C.I.)</b>	<b>B (Regression coefficient)</b>	<b>P-value</b>	<b>AOR (95% C.I.)</b>
Size of the family in a household	0.016	0.466	1.016 (0.973 - 1.061)	-0.157	0.000	0.855 (0.798 - 0.916)
Mosquito nets in household						
Yes	2.881	0.000	17.840 (9.177 - 34.682)	2.469	0.000	11.806 (5.513 - 25.279)
No*			1			1
Nets in sleeping spaces						
Yes	0.644	0.000	1.905 (1.600 - 2.267)	0.549	0.000	1.732 (1.443 - 2.078)
No*			1			1
Bed net can reduce the incidence of malaria		0.012			0.012	
Yes	1.013	0.041	2.753 (1.040 - 7.289)	1.361	0.022	3.902 (1.215 - 12.531)
No	0.517	0.391	1.676 (0.515 - 5.459)	0.426	0.550	1.531 (0.378 - 6.203)
Other interventions*			1			1
Constant	-2.655	0.000		-2.655	0.000	
R2 = 35.0% - 47.5%, Omnibus Tests of model coefficient = 164.378 (p value = 0.000), *Reference category, COR=Crude Odds Ratio, AOR=Adjusted Odds Ratio, CI=Confidence Interval (Dependent variable was current utilization of ITNs)						

**Table 6:** Final Binary Logistic regression analysis for current utilization of ITNs by socio-demographic and proximate factors among the household of under five children in Kanifing Municipality, 2018.

Socio-demographic factor that was statistically significant was found to be ethnicity. Ethnicity is link to culture. Since the Wolof were the ethnicities with the lowest utilization rate in the study. The researcher can link cultures such as; regarding malaria as caused by other spiritual factors as well as other myths may hinder people from using bed nets. Education level, family size, marriage status, economic status was not found to be statistically associated with bed nets utilization. The finding was in agreement with those from a study in Port Harcourt Nigeria by (C. I Tobin-West., *et al.* 2016). On the contrary studies done in Eastern Ethiopia states that education level has a significant association with bed nets utilization.

The study further reveals that 78.0% of respondents have bed nets in their households. These ITNs include those in use and those in the cupboards, further more in establishing whether all the bed nets available were in used, the study reveal the number of use of bed nets in each household. From the class intervals listed, majority of households used between 0-2 bed nets amounting to 63.1% from the total study site. The proximate factors that were significantly associated with bed nets utilization in the study were; number of bed nets in the household, number of bed nets in use, number of nets in sleeping spaces, using nets when sitting outside, and factors preventing from acquiring bed nets. A similar study in Mozambique by (M.M. Plucinski., *et al.* 2015) indicates that using sleeping spaces during distribution can affect utilization of bed nets within a household. On the contrary, factors such as net preference by texture or shape as well as sleeping under bed net without preference, number of sleeping places in household has no significant statistical association with bed nets utilization.

The study reveals that majority of individuals in the Kanifing municipality utilized bed nets in their sleeping spaces. A total utilization rate of 61.5% was reported during the study, which is below the World Health Assembly set target for malaria intervention. A margin of ownership and utilization was discovered during the study which commensurate with a study conducted in Ethiopia by (Amsalu., *et al.* 2009). As nationwide distributions routinely take place but still utilization is low. The last nationwide distribution in the Gambia amounted to 911,183 bed nets. Despite the high coverage of distribution in recent years, ownership remain less than utilization. A similar study was carried out in Uganda by (R. Sangare., *et al.* 2012).

Although ownership was seemingly high but utilization was below ownership with a significant difference which was also revealed in a similar study conducted in Southwest Nigeria. Though ownership was high but 61.5% slept under a bed net a night preceding the study. Majority of respondents' belief that the bed net utilization as a malaria intervention is able to reduce the incidence, and prevalence in the kanifing Municipality.

Furthermore the study revealed that 82.2% don't use bed nets outside their sleeping spaces despite having the bed nets in their sleeping spaces. This reveals that inhabitants have contact with mosquitoes outside their sleeping spaces especially during hot weather conditions. This makes most households suffer one or more malaria episode in the season. A total of 47.9% had at least a single episode of malaria within each household. However, 51.4% didn't sleep under a bed net before contracting the disease. The other percentage slept under bed nets and still contracted malaria. The researcher realized that many inhabitants usually stay late outside due to extreme weather condition and power failures [3-16].

## Conclusion

Despite free distribution of LLINs during mass campaigns and routine government health facilities distribution, the ownership was moderately high and utilization remains low. Thus, there is a need to refocus on people's choice of bed nets including the textural properties in order to increase the utilization of ITN to effectively and efficiently control malaria in the municipality. Furthermore, the distribution centers and bed nets choices of individuals as in conical and soft texture should be increased during routine and mass LLIN campaigns.

## Recommendations

1. Increase the number of conical despite the cost attached
2. Train individuals in the procedures involved in redesigning the rectangular bed nets to conical
3. Increases awareness on utilization through mass advocacy using both print and electronic media
4. Increase the number of bed nets and centers of distributions during mass LLINs campaign.

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### Conflict of Interest

No conflict of interest exists.

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