ORIGINAL ARTICLE

ASSESSMENT OF KNOWLEDGE, ATTITUDE, AND UTILIZATION OF LONG-LASTING INSECTICIDAL NETS IN JIGAWA STATE: A CROSS-SECTIONAL STUDY

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ABSTRACT

Background: *The sharing of long-lasting insecticide nets (LLINs), and utilization, alongside knowledge and attitude of the communities towards malaria, are vital to Malaria prevention, treatment, and control. This study intends to investigate the current state of knowledge, attitude, and usage of LLINs in Chamo town of Jigawa State, Nigeria.* ***Methods:*** *The study employed a cross-sectional survey with a semi-structured interview questionnaire.* ***Results:*** *Of the total 471 respondents interviewed, comprising males (39.7%) and females (60.3%). The respondents had a mean age of 35.2 (SD = 12.6), and more than half (n= 274; 58.5%) were between 20 and 40 years old. Most of the respondents (n = 390; 82.8 %) know LLINs. However, only 225 (47.8%) believed the role of LLINs in protecting one from a mosquito bite, and 353 (75.8%) of the respondents believed that malaria can be transmitted through a mosquito bite. Educational level, marital status, and occupation show a significant association with knowledge of LLIN use.* ***Conclusion:*** *We concluded that there was a general awareness of LLINs in the study area, and the majority had favorable knowledge regarding malaria transmission. However, nearly half of the participants have a favorable understanding of LLIN use.*

Keywords: Malaria, Long-lasting insecticidal nets, knowledge, attitude, utilization.

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INTRODUCTION

Human malaria is an ancient disease transmitted only by female Anopheles mosquitoes that can be fatal, but curable and preventable if correctly diagnosed and managed appropriately (1). Plasmodium parasite-caused malaria continues to be a major public health issue and is currently important for global health. (1). In 2017, the WHO African Region reported about 200 million cases of malaria (i.e., 92% of world cases), and About 80% of malaria cases worldwide are from sub-Saharan Africa and India, including Nigeria (25%), India (4%), Mozambique (5%), Uganda (4%), and Democratic Republic of the Congo (1%) (2). These five countries contributed to 50% of global malaria cases (1).

A higher percentage of the general population, including asymptomatic patients, has malaria among malaria-core areas like Nigeria (2, 3). These asymptomatic segments of the population are the massive parasite reservoirs accountable for non-stop transmission of malaria parasite (4). The cross-sectional study by Aju-Ameh (2), conducted in Nigeria revealed that more humans are infected with malaria parasites than mosquitoes. As such, leading to the question of who is spreading the infection between the man and mosquitoes? However, only the non-existence of malaria parasites can lead to zero transmission and eventually zero malaria (2).

Malaria prevention measures differ across urban and rural communities (5, 6), and this could have resulted because of socioeconomic and developmental inequality between the urban and rural populations (7-9). The rural or less developed communities tend to have poor housing, lack of efficient and modern diagnosis and treatment compared to urban communities (10). Several studies have revealed that financial obstacles in rural and lower-income regions are a major obstacle to achieving appropriate preventive and therapeutic measures for malaria (7, 11, 14). Additionally, researchers found that ecological elements like Anopheles mosquitoes, Plasmodium parasites, and human hosts, as well as demographic factors like age, sex, lifestyle, and employment, influence the transmission of malaria (10).

LLINs and insecticides are the two key vector control interventions used to lessen the burden of malaria. Several studies from sub-Saharan Africa have reported that LLINs alone have reduced the malaria incidence rate by 50% and malaria fatality rates by 55% amongst under-five children (15, 16). Furthermore, over the last 15 years, there has been a rise in reported LLINs utilization in sub-Saharan Africa (17). In 2008, the National Malaria Elimination Programme (NMEP) and the Roll Back Malaria Programme (RBM) were launched with the aim of improving access to LLINs via mass distribution campaigns in Nigeria (18). Moreover, by 2009, a total of 57,773,191 LLINs (90.2% of the National target) were shared across the country (19).

There was a reported decrease in malaria burden along with increase accessibility of LLINs, however, some studies have shown lower usage of LLINs amongst people at risk (20). For instance, in 2016 the people with access to quality LLINs were 43%, and the people at risk who used LLINs were 54% (20). The factors that promote malaria incidence include individual characteristics, literacy of healthcare services, a dirty neighborhood, the economic condition of individuals, household size, accessibility to healthcare facilities, and ownership of LLINs (21-24). Thus, the purpose of this study is to evaluate the degree of LLIN usage, attitude, and knowledge amongst the people living in Chamo town, Jigawa State, Nigeria, as well as identify the variables related to the respondent's attitude, knowledge, and use of LLINs.

METHODS

Study design

The study employed a cross-sectional survey to investigate the respondent’s knowledge, attitudes, and utilization of LLINs.

Study population

We conducted the survey in Chamo town, situated in outskirt of Dutse town, the capital city of Jigawa State, Northern part of Nigeria, with geographical coordinates of 11° 59' 0", and 9° 23' 0" East. Chamo town is approximately 94km from the city of Kano. We conducted a household census throughout the entire

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town of Chamo, resulting in the identification of 1089 households. We selected 250 of these households using simple random sampling, and then administered study questionnaires to these homes until we reached the required sample size. We conducted the study from July 12 to July 30, 2021, during the Community-Based Medical Education Field Posting (CBME and SP) for third-year medical students. The method of the data collection was explained to the participating students by the researchers. The students conducted door-to-door interviews to obtain the relevant information and only those who agreed to participate were interviewed and considered to be part of this study.

Variables

The outcome variables for the present study were the participant's level of knowledge, attitude, and utilization of LLINs. The independent variables were the participant's characteristics (i.e., age, sex, education, marital status, and employment status).

Measurement tool

We adopted the study measurement tool from a previous study by Tomass and Alemayehu (25).

Data collection

The questionnaire was revised and amended by the study authors to ensure clarity and consistency with the study population. For the respondents who could not understand the English language, the researchers translated it into Hausa language. Before data collection, the research assistants (students) were trained by bilingual lecturers for 3 days, on the translation process, to ensure the quality of the data collection process. The final questionnaire used for the study consists of four sections: section A includes general characteristics of the respondents; Section B includes residents' knowledge of LLINs; Section C includes residents' attitudes toward the use of LLINs; and Section D includes residents' utilization of LLINs.

Sample Size Determination

The study sample size was computed based on the single proportion formula (26) below:

$$n = Z^2 P(1-P))/E^2$$

Where z = 1.96 (for a 0.05 alpha error), accepted error (E) = 0.05, and p = 0.5 (to maximize variance and sample size). A sample of 384 was obtained. After accounting for a 20% dropout rate (to cover missing values and incorrect entries), the adjusted sample size was estimated at 480.

Data analysis

Initially, we conducted data cleaning by investigating incorrect entry of data. The statistical methods used in the investigation included descriptive analysis, Pearson's chi-square, and logistic regression analyses. The descriptive analysis presented frequency, percentages, mean, and standard deviation. We used Pearson's chi-square analysis to determine the relationship between sociodemographic factors and the residents' attitudes towards and use of LLINs. We employed logistic regression analysis to find important variables related to the resident's knowledge of LLINs. Question two of the knowledge section (what is LLINs) was used to classify the participants as having good knowledge or having poor knowledge of LLINs. Those who answered option b (It is an insecticidal net that protects you against mosquito bites) were classified as possessing positive knowledge, while those who answered any of the other options were categorized as having poor knowledge. First, we conducted a simple logistic regression to identify important variables. Variables with a p-value of less than 0.25 were considered important and included in the multiple logistic regression to obtain their adjusted odds ratio. We used both the forward LR and backward LR methods for the multiple logistic regression and then ran the final model using the Enter method to obtain the final significant variables. We performed all statistical analyses using the Statistical Product and Service Solution (SPSS) version 27.

Ethical consideration

The Jigawa State Ministry of Health granted permission for the study as part of the medical student's community-based medical education and special posting training for the 2019/2020 session. The participants were all 15 years of age and above and were asked to give their informed consent by signing a consent form before partaking in the study. For participants who could not

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read and understand the consent form, the researcher read and described the consent for them. All the information obtained was not personal and the participants were assured of their confidentiality.

RESULTS

Socio-demographic analysis: A total of 471 participants, including males (39.7%, n = 187) and females (60.3%, n = 284), completed the study questionnaire. The respondents' ages ranged between 15 and 80 years. Nearly half of the participants (45.6%, n = 214) had attained a primary level of education and were married (58.2%, n = 274). Only 49 (10.4%) of the participants reported their monthly income, with a mean of 22,397 naira (SD = 18,273) (Table 1).

Descriptive analysis: for knowledge; awareness regarding LLINs was highest among the respondents (82.8%), but only 47.8% of them answered correctly about the meaning of LLINs, majority of the participants (58.4%) reported media as their main source of information on LLINs, 98.3% of the participants believed they know what malaria is, whereas only 74.9% of them answered correctly to the meaning of malaria. Regarding attitude, 368 (79.2%) indicated they thought sleeping under LLINs prevented malaria, and 78.2% agreed it was crucial to sleep under LLINs every single day (Table 2). For utilization, 81.9% indicated utilizing LLINs and all of the respondents (100%) reported that they wash their LLINs when it is dirty (Table 3).

Binary logistic regression analysis: four variables (age group, education, marital status, and occupation) were considered important predictors (p-value < 0.25). After adding these variables to the multiple logistic regression, only three factors (education, marital status, and occupation) remained in the final model. In terms of education, individuals with a primary level of education had 2.7 higher odds of having good LLINs knowledge than those with no education (p-value = 0.013); those with a secondary level of education had 3.4 higher odds of having good LLIN knowledge than those with none (p-value = 0.003); and those with a tertiary level had 8.0 higher odds of having good LLINs than those with none (p-value < 0.001). Regarding marital status, singles had 53% lower odds of having good LLIN knowledge than married individuals (p-value = 0.009). In terms of occupation, farmers had 43% lower odds of having LLINs knowledge than the civil servants (p-value = 0.140); individuals involved in business had 55% lower odds of having good LLINs knowledge than the civil servants (p-value = 0.001); and individuals with other types of occupations had 85% lower odds of having good LLINs knowledge than the civil servants (p-value = 0.026) (refer to Table 1). The final model fitness was evaluated based on the Receiver Operating Characteristics (ROC) curve, Multicollinearity (MC), as well as the interaction between the variables. The area under the curve is 74.9%, this indicates sufficient discriminant ability (Figure 1). The result shows that there was no MC, as all VIF (variance inflation factor) < 10. The result shows that there was no multicollinearity (MC), as all VIF (variance inflation factor) values were less than 10. These indicate that all three factors in the final model are not redundant. Furthermore, the results reveal a non-significant interaction between the variables (i.e., education, marital status, and occupation).

Chi-square/Fisher exact test: the attitude of the respondents regarding LLINs only meant for females was only affected by occupation ($\chi2$ = 16.09; p-value 0.001). Age group ($\chi2$ = 8.10; p-value = 0.017), gender ($\chi2$ = 10.09; p-value = 0.001), and level of education ($\chi2$ = 15.17; p-value = 0.002) affected the respondents' attitude regarding LLINs being unsafe for ill people. The attitude of the respondents regarding LLINs being used for malaria prevention was affected by gender ($\chi2$ = 25.55; p-value < 0.001), marital status ($\chi2$ = 28.94; p-value < 0.001), level of education ($\chi2$ = 27.68; p-value < 0.001), and type of occupation ($\chi2$ = 52.88; p-value < 0.001). Furthermore, the participants' attitude regarding the preference of LLINs color was only affected by gender ($\chi2$ = 4.00; p-value = 0.046) (Table 2). For utilization of LLINs, usage by respondents was affected by age group ($\chi2$ = 11.81; p-value = 0.003), gender ($\chi2$ = 27.83; p-value < 0.001), marital status ($\chi2$ = 41.51; p-value < 0.001), educational level ($\chi2$ = 33.85; p-value < 0.001), and type of occupation ($\chi2$ = 53.61; p-value < 0.001). The age group was the only factor that affected the use of LLINs during sleep by respondents ($\chi2$ = 7.21; p-value = 0.027). The retreatment of LLINs after 10–20

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washes were affected by gender ($\chi2 = 8.62$; p-value = 0.003) and level of education ($\chi2 = 11.64$; p-value = 0.009). Furthermore, marital status affects checking holes on LLINs ($\chi2 = 5.00$; p-value = 0.026) and mending holes on the LLINs ($\chi2 = 6.77$; p-value = 0.009) (Table 3).

DISCUSSION

In the tropical poorest and subtropical countries, malaria continues to be a major public health concern (1, 27, 28). The illness is now endemic in Nigeria, where numerous investigations have shown that it is practically always present in different regions of the nation (29–31). A cross-sectional survey was conducted in this study to evaluate the knowledge, attitudes, and use of LLINs among the people living in Chamo town. The majority of the respondents (82.8%) believed they knew about LLINs, and only 47.8% believed that insecticidal nets protect against mosquito bites. These seem to be similar to earlier research studies in Nigeria (2, 3, 32, 33), where there was generally high awareness of LLINs amongst the population; however, there was poor detailed knowledge regarding LLINs.

Numerous studies have shown conflicting results on the contribution of awareness or knowledge to better health commodity utilization (1, 2). For instance, pregnant women increase their usage of LLINs due to their awareness of the risks associated with pregnancy-related malaria and the advantages of LLIN use. LLINs are used by pregnant women to protect themselves against health issues such as anemia and threatened abortion (34). Most people equate the terms "awareness" with "knowledge" (4). Positive knowledge refers to a spectrum that extends from general awareness to a particular piece of precise and in-depth knowledge (35). Offering specific details about LLINs and comprehensive behavioral change communication interventions can promote proper utilization of LLINs (1, 5).

The majority of the respondents (58.4%) reported media as their main source of information on LLINs, and this confirmed the previous study by Israel et al., (34), which found radio and television as the most common sources of information. This indicates that educational programs on LLINs in Nigeria, particularly in rural communities, should implement mass media campaigns to enhance knowledge, attitude, and utilization, taking into consideration that the current study was conducted in a region with lower economic indices and is considered a rural region. Nevertheless, other earlier studies pointed out that the most essential source of information on LLINs was health centers (5, 36). These findings highlight how vital communication and the accessibility of health centers are to the management and prevention of malaria (36).

Furthermore, the study findings revealed that education, marital status, and occupation were significant predictors of good knowledge of LLINs following multiple logistic regression analysis. Specifically, having a tertiary education, being a civil servant, or being married increases your chances of having good knowledge of LLINs. A plausible rationale could be that civil officials possess awareness, and married women have more opportunities to become knowledgeable about LLIN usage due to concern for their children's health. Previous studies have found that maternal education and academic achievement are strong indicators of LLIN usage, along with favorable knowledge (8, 34). Furthermore, professional education encourages caregivers to learn about health conditions and prevention, such as malaria prevention (34).

Regarding the respondent's attitude toward LLINs, 96.4% show their willingness to purchase their LLINs and believe that mosquito bites are responsible for malaria transmission (75.8%). Previous studies reported this high level of awareness in Nigeria (37, 38). This high level of awareness was affected by educational level and occupation. On the utilization of LLINs by the residents, a high proportion of the study participants (81.9%) reported using them, and these were affected by the participant’s age, sex, level of education, marital, and occupation. Similarly, various studies have reported that increasing education level and occupation are associated with increased LLIN usage (39, 40).

This study is not without limitations. Firstly, because the survey used a cross-sectional methodology, care needs to be taken when interpreting the causal links between the variables under investigation. Second, the respondent's knowledge, attitude, and use of LLINs were evaluated by a self-reported measure, which may have caused response bias and decreased the correctness of the information collected. Nonetheless, all participants were reassured that their answers would

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remain private, and we counseled them to fill out the questionnaires truthfully about their true beliefs. Subsequent research attempts should consider reproducing the investigation in more areas of Jigawa State and the northern part of Nigeria to generate compelling proof and identify variables related to awareness, attitude, and utilization of LLINs.

CONCLUSION

The results of this study illustrated the respondent's knowledge, attitude, and utilization of LLINs as high because their overall response about knowledge, attitude, and utilization of LLINs was considered above average. However, there was a variation regarding the perceived knowledge and true knowledge of the respondents. Furthermore, we identified the factors associated with good knowledge, attitude, and utilization of LLINs. Therefore, the findings of the present study emphasize the need for enhancing correct information through media campaigns and health education, along with other intervention efforts in the communities.

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TABLES

Table 1: Factors associated with good knowledge of LLINs, Nigeria, 2021

Factors	F (%)	COR (95% CI)	P	AOR (95% CI)	P
Age group					
≤ 20 years	69 (14.7)	1.72 (0.95, 3.11)	0.073		
21 – 40 years	247 (58.5)	1.34 (0.88, 2.06)	0.175		
> 40 years	125 (26.7)	1			
Gender					
Male	187 (39.7)	1.14 (0.78, 1.65)	0.489		
Female	284 (60.3)	1			
Education					
Primary	214 (45.6)	1.48 (0.77, 2.84)	0.245	2.69 (1.24, 5.87)	0.013
Secondary	104 (22.2)	3.45 (1.70, 6.99)	0.001	3.37 (1.51, 7.49)	0.003
Tertiary	95 (20.3)	10.93 (5.03, 23.76)	< 0.001	8.00 (3.37, 18.99)	< 0.001
None	56 (11.9)	1		1	
Marital status					
Single	197 (41.8)	0.26 (0.17, 0.38)	< 0.001	0.47 (0.27, 0.83)	0.009
Married	274 (58.2)	1		1	
Occupation					
Farming	40 (9.8)	0.53 (0.26, 1.05)	0.070	0.57 (0.27, 1.20)	0.140
Business	184 (44.9)	0.34 (0.22, 0.52)	< 0.001	0.45 (0.28, 0.72)	0.001
Other	12 (2.9)	0.11 (0.02, 0.50)	0.004	0.15 (0.03, 0.80	0.026
Civil servant	174 (42.4)	1		1	

Note: F = frequency, COR = crude odds ratio, AOR = adjusted odds ratio.

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Table 2: factors associated with resident's attitude on LLINs						
Variables responses	**F (%)**	**Associations**				
		Age group (x^2, p-value)	**Gender (x^2, p-value)**	**Marital status (x^2, p-value)**	**Education (x^2, p-value)**	**Occupation (x^2, p-value)**
LLINs is only meant for female						
Yes	36 (7.7)	(4.26, 0.119)	(0.07, 0.798)	(0.12, 0.733)	(1.60, 0.659)	(16.09, 0.001)
No	433 (92.3)					
LLINs is unsafe for ill people						
Yes	97 (20.8)	(8.10, 0.017)	(10.09, 0.001)	(0.58, 0.446)	(15.17, 0.002)	(2.61, 0.456)
No	370 (79.2)					
LLINs is used for malaria prevention						
Yes	368 (78.8)	(3.27, 0.195)	(25.55, < 0.001)	(28.94, < 0.001)	(27.68, < 0.001)	(52.88, < 0.001)
No	99 (21.2)					
Important to sleep under LLINs every day						
Yes	363 (78.2)	(0.44, 0.802)	(0.20, 0.654)	(21.30, < 0.001)	(18.42, < 0.001)	(10.01, 0.019)
No	101 (21.8)					
LLINs should be free of charge						
Yes	452 (96.6)	(0.46, 0.795)	(3.05, 0.081)	(1.50, 0.222)	(3.40, 0.334)	(4.00, 0.265)
No	16 (3.4)					
Do you prefer colored net						
Yes	132 (28.4)	(0.69, 0.709)	(4.00, 0.046)	(0.01, 0.917)	(0.51, 0.917)	(0.72, 0.868)
No	333 (71.6)					
Why						
It is beautiful	49 (42.2)	(8.46, 0.206)	(1.57, 0.666)	(6.89, 0.075)	(18.50, 0.030)	(11.35, 0.252)
It is bigger	15 (12.9)					
Easier to maintain	29 (25.0)					
Other reasons	23 (19.8					
Hanging of long last insecticide net makes the room look untidy						
Yes	125 (26.8)	(0.86, 0.651)	(7.58, 0.006)	(10.84, 0.001)	(7.40, 0.060)	(7.47, 0.058)
No	341 (73.2)					
Note: x^2 = Chi-square statistic, F = frequency						

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Table 3: factors associated with the utilization LLINs by residents						
Variables responses	**F (%)**	**Associations**				
		Age group (x^2, p-value)	**Gender (x^2, p-value)**	**Marital status (x^2, p-value)**	**Education (x^2, p-value)**	**Occupation (x^2, p-value)**
Have you ever used LLINs						
Yes	381 (81.9)	(11.81, 0.003)	(27.83, < 0.001)	(41.51, < 0.001)	(33.85, < 0.001)	(53.61, < 0.001)
No	84 (18.1)					
Does every room in the house have LLINs						
Yes	306 (80.5)	(12.57, 0.002)	(25.55, < 0.001)	(0.01, 0.931)	(7.38, 0.061)	(10.79, 0.013)
No	74 (19.5)					
Do you fold the LLINs after use						
Yes	325 (69.0)	(7.93, 0.019)	(3.31, 0.069)	(1.63, 0.202)	(4.12, 0.249)	(2.43, 0.489)
No	53. (14.0					
Do you use LLINs when you sleep outside your room						
Yes	359 (94.5)	(7.21, 0.027)	(0.06, 0.800)	(0.01, 0.931)	(1.19, 0.756)	(5.12, 0.164)
No	21 (4.5)					
Retreat the LLINs after 10 – 20 washes						
Yes	76 (20.0)	(0.45, 0.799)	(8.62, 0.003)	(0.29, 0.589)	(11.64, 0.009)	(3.39, 0.335)
No	304(80.0)					
Always checked for holes on the LLINs						
Yes	361 (95.0)	(0.32, 0.852)	(0.61, 0.435)	(5.00, 0.026)	(6.93, 0.074)	(4.40, 0.221)
No	19 (5.0)					
Mend the holes on the LLINs						
Yes	346 (91.3)	(0.40, 0.820)	(0.15, 0.697)	(6.77, 0.009)	(4.55, 0.208)	(5.83, 0.120)
No	33 (8.7)					
Avoid use of fire near the LLINs						
Yes	306 (81.6)	(4.35, 0.114)	(0.50, 0.479)	(3.39, 0.066)	(5.12, 0.163)	(29.07, < 0.001)
No	69 (18.4)					
Dry the LLINs away from direct sunlight						
Yes	218 (58.1)	(0.58, 0.747)	(2.55, 0.111)	(2.52, 0.113)	(1.52, 0.679)	(11.25, 0.010)
No	157 (41.9)					
Only the children's beds have LLINs						
Yes	136 (36.1)	(12.14, 0.002)	(5.94, 0.015)	(6.02, 0.014)	(13.83, 0.003)	(17.88, < 0.001)
No	241 (63.9)					
Note: x^2 = Chi-square statistic, F = frequency						

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