

RESEARCH ARTICLE

Determinants of the Utilization of Long-Lasting Insecticidal Nets in Jigawa State

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Abstract

Background: The most extensively used vector control strategies for reducing the risk of malaria transmission are long-lasting insecticidal nets (LLINs). The aim of this study is to determine the socio-cultural and economic factors associated with regular purchase of LLINs. **Methods:** A total of 471 respondents were selected, with 187 (39.7%) and 284 (60.3%) being males and females. This was a cross-sectional study conducted using a semi-structured interview questionnaire to assess the study variables, including socio-demographic variables, socio-cultural factors, and economic factors influencing the use of LLINs. A Chi-square (χ^2) test was used to determine the associations between the socio-demographic variables of the respondents and their response to whether they have ever purchased LLINs. **Results:** More than half (58.2%) of the respondents were between 21 and 40 years old. The majority of the respondents (45.6%) have a primary level of education. LLIN purchase was associated with gender ($P = 0.001$), education level ($P < 0.001$), marital status ($P = 0.040$), and monthly income ($P < 0.001$), with females, those who were married, those with tertiary education, and those with higher monthly income more likely to purchase LLINs. **Conclusion:** There was a general awareness regarding the use of LLINs, as majority of the respondents have no superstitions about using them. However, socio-cultural and economic factors play a role in the use of LLINs. To promote community acceptance and proper use of LLINs, mass distribution should consider socio-cultural and economic factors.

Keywords: Chamo, Long-lasting insecticidal nets, Malaria, Purchase, Utilization

Introduction

Human malaria is an ancient infection that can be fatal and is only spread by female *Anopheles* mosquitoes. If it is diagnosed and treated properly, however, it is treatable and preventative (Anderson et al., 2020; Bastaki et al., 2018; Than et al., 2019). Malaria, which is caused by *Plasmodium* parasites, has continued to be a major public health concern (Cheaveau et al., 2019; Sanchez-Castro et al., 2022). In particular, it has consistently been a major issue for public health in underdeveloped nations because it is a significant cause of illness and mortality (WHO, 2020b). According to

the World Malaria Report 2020, there were about 229 million cases of malaria worldwide in 2019, and the African continent has continued to be responsible for 94% of the disease's burden (WHO, 2020b).

Nigeria has the largest estimated number of malaria cases and deaths worldwide with an estimated 27% of all malaria cases and 23% of all malaria fatalities (WHO, 2017). Malaria is more likely to cause serious illness and fatality in children, especially those under the age of five (WHO, 2020b). Nearly one-third of children under the age of five die in Nigeria due to malaria, which is also linked to one-tenth of maternal

deaths (Federal Ministry of Health Strategic Plan, 2009). Malaria is responsible for over 63% of hospital admissions in Nigerian healthcare facilities (Ambe et al., 2020; Ezire et al., 2015). Due to the severity of the burden, over 70% of illnesses in children under the age of five are caused by malaria, and nearly 300,000 children die from it every year. Malaria damages foetal development and results in abortion and low birth weight (Ahuru & Iseghohi, 2018; Ambe et al., 2020; Aribodor et al., 2016).

The World Health Organization (WHO) recommends long-lasting insecticidal nets (LLINs) and indoor residual spraying (IRS) as ways to control vectors and lower malaria transmission in people who are at risk (WHO, 2020a). In addition to providing physical protection against mosquito bites, LLINs also employs pyrethroid to kill mosquitoes by paralysing them (Glunt et al., 2013; Killeen & Moore, 2012; Odeyemi et al., 2022). The nearly 50% reduction in malaria episodes can be directly attributed to the use of LLINs (Kleinschmidt et al., 2015; Thiévent et al., 2018). Furthermore, several studies from sub-Saharan Africa found that the use of LLINs alone reduced the incidence of malaria by 50% and the mortality rate among children under the age of five by 55% (Eisele et al., 2010; Pryce et al., 2018).

Although there has been a reported decrease in malaria burden as well as increased accessibility of LLINs, some studies have shown lower use of LLINs among people at risk (Barber et al., 2017). For instance, in 2016, 43% of the people at risk had access to high-quality LLINs, while only 54% of those at risk used them (Barber et al., 2017). Factors associated with LLINs' usage were socio-cultural factors, knowledge about LLINs, environmental factors, and the seasonality of malaria (Iwuafor et al., 2019; Odeyemi et al., 2022). Despite numerous advocacy efforts and the evidence-based benefits of LLINs, household adoption remains far from universal (WHO, 2020a). Therefore, the present study aimed to assess the level of LLINs purchase and its determinants among residents of Chamo town in Jigawa State, Nigeria.

METHODS

The Study Area

The study was conducted in Chamo town, which is near Dutse town, the capital of Nigeria's Jigawa State (Figure 1).



Figure 1. Map of Chamo (source: Google Maps)

The Study Design

This study was cross-sectional and is set out to determine the level of utilisation of long-lasting insecticidal nets (LLINs) and its associated factors among the residents of Chamo Town, Jigawa State.

The Study Questionnaire

A semi-structured interview questionnaire for monitoring the use of LLINs (Aberese-Ako et al., 2019) was adapted for the study. The questionnaire was composed of socio-demographic variables (i.e., age, gender, level of education, marital status, occupation, and monthly income), socio-cultural factors (i.e., perception towards any superstition on the use of LLINs, itching or burning sensation when sleeping under the LLINs, breathing discomfort while sleeping under the LLINs, health talk on the importance of using LLINs, and preference for using mosquito coil or spray over LLINs), and economic factors that influence the use of LLINs (i.e., have you ever bought LLINs, do you think sales of LLINs should be banned, do you think LLINs are sold at unfair prices, do all beds in the household have separate LLINs, and do you think the

government should do more in providing LLINs to prevent malaria). Before data collection, the students were trained by the lecturers for 3 days on how to interpret the questions into Hausa, and all the respondents were interviewed in Hausa.

Sample Size Determination

The sample size was estimated using the single proportion formula (Adam, 2021).

$$n = \frac{Z^2 P(1-P)}{E^2}$$

Where: $z = 1.96$ (for a 0.05 level of significance), margin of error (E) = 0.05, and $p = 0.5$ (for the greatest variance and sample size). The calculated sample size was 384. After adding a 20% dropout rate (for missing values and wrong data entry), the adjusted sample size was estimated at 480.

Data Collection

A household census was conducted for the entire Chamo town, and a total of 1089 households were identified. Out of this, 250 households were randomly selected through a simple random sampling method, and the study questionnaires were administered to these 250 households to obtain the desired sample size. The purpose of the study and the method of data collection was explained by the researchers to the participating students. The students went to the selected houses to interview the participants using the study questionnaire. Only those who agreed to take part were interviewed and counted as part of this study.

Statistical Analysis

Initial data cleaning and exploration to look into missing values and incorrect data entry were performed as part of the preliminary data analysis using Microsoft excel. A descriptive analysis and Pearson's chi-square test were the statistical methods used in the study. The frequency and percentages of the sociodemographic variables, as well as the sociocultural and economic factors regarding the use of LLINs are presented in the descriptive analysis. The association between the sociodemographic factors (age, gender, level of education, marital status, occupation, and monthly income) and the respondents' response to whether they

have ever purchased LLINs was analysed using Pearson's chi-square test. All statistical analyses were performed using the Statistical Product and Service Solution (SPSS) version 27. Figure 2 below illustrates the flowchart of the overall research methods employed in the study.

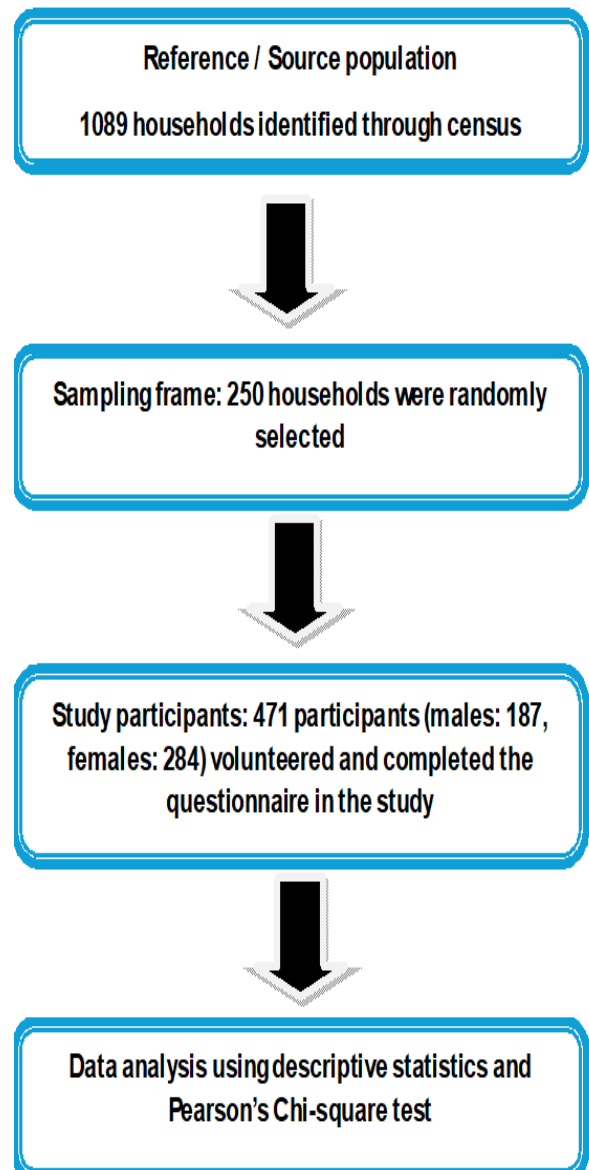


Figure 2. Flowchart of the Study Method

RESULTS

Table 1: Socio-demographic Variables and Their Association with LLINs Purchase (n = 471)

Variables	Have you ever bought LLINs?			P*
	Total F (%)	No F (%)	Yes F (%)	
Age (years)				
≤ 20	69 (14.7)	43 (67.2)	21 (32.8)	0.918
21 – 40	274 (58.2)	186 (69.7)	81 (30.3)	
> 40	125 (26.7)	86 (69.9)	37 (30.1)	
Gender				0.001
Male	187 (39.7)	140 (78.2)	39 (21.8)	
Female	284 (60.3)	176 (63.8)	100 (36.2)	
Education				< 0.001
Primary	214 (45.6)	151 (75.1)	50 (24.9)	
Secondary	104 (22.2)	87 (83.7)	17 (16.3)	
Tertiary	95 (20.3)	40 (43.0)	53 (57.0)	
None	56 (11.9)	37 (66.1)	19 (33.9)	
Marital status				0.040
Single	197 (41.8)	137 (74.9)	46 (25.1)	
Married	274 (58.2)	179 (65.8)	93 (34.2)	
Occupation				0.090
Farming	40 (9.8)	25 (65.8)	13 (34.2)	
Business	184 (44.9)	139 (75.5)	45 (24.5)	
Civil servants	174 (42.4)	109 (66.5)	55 (33.5)	
Others	12 (2.9)	11 (91.7)	1 (8.3)	
Monthly income				< 0.001
< 20,000	26 (27.1)	20 (80.0)	5 (20.0)	
20,000 – 40,000	25 (26.0)	10 (40.0)	15 (60.0)	
> 40,000	45 (46.9)	6 (13.3)	39 (86.7)	

*Chi-square test; F = frequency; LLINs = long-lasting insecticidal nets.

Table 1 shows the socio-demographic information of the participants and how that information is related to the fact on whether or not they have ever purchased LLINs. A total of 471 (male: 39.7% and female: 60.3%) participants took part in the study. Majority of the participants (58.2%) were between the ages of 21 and 40 and have a primary level of education (45.6%). More than half (58.2%) of the participants were married. Furthermore, majority of the participants (44.9%) reported 'business' as their occupation, with a monthly income above 40,000 naira (46.9%). None of the participants, however, stated that their total monthly income was greater than 70,000 naira. There was a significant association between LLINs purchase and gender, level of education, marital status, and monthly income. The females were more likely to purchase LLINs (36.2%) than the males (21.8%), $P = 0.001$ (Figure 3). Those with a tertiary level of education were more likely to purchase LLINs (57.0%) than others, $P < 0.001$ (Figure 4). The married were more likely to purchase LLINs (34.2%) than the single (25.1%), $P = 0.040$. Those with a monthly income of more than 40,000 naira were more likely (86.7%) to purchase LLINs than others; $P < 0.001$. Age group and occupation have no significant association with the purchase of LLINs ($P > 0.05$). However, those below 20 years of age (32.8%) and civil servants (33.5%) were more likely to purchase LLINs ($P = 0.918$ and 0.090).

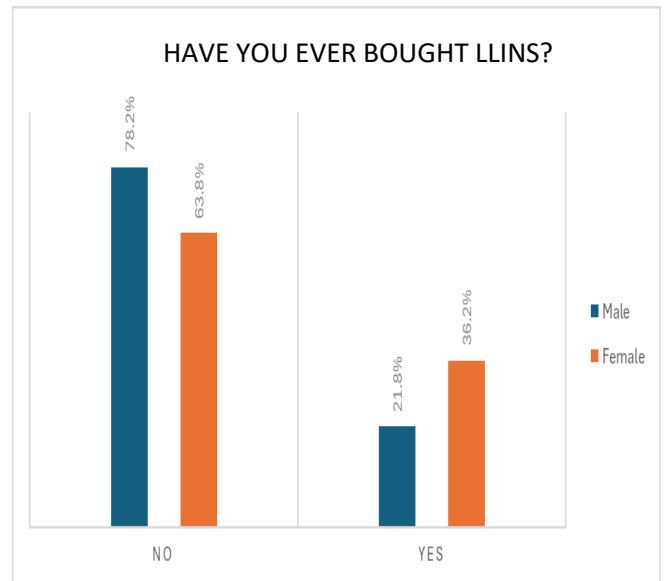


Figure 3. The association between LLINs purchase and gender

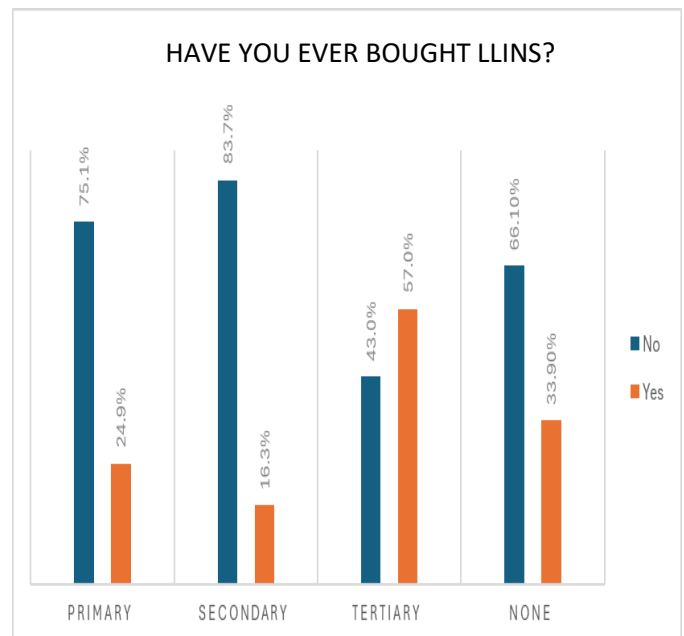


Figure 4. The association between LLINs purchase and educational level

Table 2: The Descriptive Characteristics of the Socio-cultural and Economic Factors of the Participants

Socio-cultural Factors	No F (%)	Yes F (%)
Do you have any superstitions on the use of LLINs?	437 (94.6)	25 (5.4)
Do you feel an itch or burning sensation, when sleeping under the LLINs?	310 (66.5)	156 (33.5)
Do you ever experience breathing discomfort while sleeping under LLINs?	405 (86.9)	61 (13.1)
Do you think a health talk on the importance of using LLINs is useful?	69 (14.8)	397 (85.2)
Do you prefer using mosquito coil/spray over LLINs?	388 (83.8)	75 (16.2)
Economic Factors		
Have you ever bought LLINs?	316 (69.5)	139 (30.5)
Do you think sales of LLINs should be banned?	141 (30.5)	322 (69.5)
Do you think LLINs are sold at unfair prices?	176 (38.9)	277 (61.1)
Do all beds in the household have separate LLINs?	109 (23.6)	252 (76.4)
Do you think the government should do more in providing LLINs to prevent malaria?	5 (1.1)	460 (98.9)

F = Frequency; LLINs = Long-Lasting Insecticidal Nets.

Table 2 summarises the socio-cultural and economic factors influencing the use of LLINs. For the socio-cultural factors, almost all of the participants (94.6%) have no superstition about the use of LLINs, and about one-third of the participants (33.5%) experienced itching or burning sensations when sleeping under LLINs. Only 13.1% of the participants experienced breathing discomfort while sleeping under LLINs. Majority of the participants (85.2%) believed that there was a need for health education on the importance of LLINs. In addition, only 16.2% of the participants preferred using mosquito coils or sprays over LLINs. For the economic factors, more than half of the participants (69.5%) had previously purchased LLINs and thought that LLINs sales should be banned. Majority of participants (61.1%) reported that LLINs were priced unfairly, and that not all of the beds in the house had individual LLINs (76.4%). Additionally,

nearly everyone (98.9%) agreed that the government needed to make a greater effort to provide LLINs.

DISCUSSION

Malaria remains a major public health concern in the world's poorest tropical and subtropical countries (Anderson et al., 2020; Barber et al., 2017; Sanchez-Castro et al., 2022). The disease has become endemic in Nigeria, with numerous studies reporting a nearly high prevalence of the disease in many areas of the country (Ambe et al., 2020; Ezire et al., 2015). The present study is a cross-sectional survey carried out among the residents of Chamo town to assess socio-cultural and economic factors determining the utilisation of LLINs. The findings of this study indicate that the level of residents' awareness of LLINs was very high, as 94.6% of the respondents have no superstition regarding LLINs usage, and 69.5% of them had previously purchased LLINs. This finding is similar to the previous studies carried out in Nigeria (Iwuafor et al., 2019; Odeyemi et al., 2022; Okeke, 2012).

The findings of this study revealed that the purchase of LLINs was significantly associated with gender and marital status. Those who were married, and female were more inclined to buy LLINs. This indicates that married women are more likely to purchase LLINs. One possible explanation is that married women may be willing to buy LLINs because of their children. Previous studies have reported greater use of LLINs among married women (Ankomah et al., 2014; Ezire et al., 2015). Furthermore, educational level and monthly income have a significant relationship with LLINs purchase, with those with tertiary education and higher incomes being more likely to purchase LLINs. Although there was no significant association between occupation and LLINs purchases, civil servants were more likely to do so. All of these relationships may show that most people with tertiary education work for the government and have higher monthly incomes in the community, which makes them more likely to purchase LLINs. According to earlier studies (Ifezulike et al., 2015; Israel et al., 2018; Ouattara et al., 2011), formal education influences the ownership and utilisation of LLINs.

Almost a third (33.5%) of the respondents reported feeling itchy or burning sensation while sleeping under

LLINs, while 13.1% of the participants reported feeling uncomfortable breathing. This may be the reason why 16.1% of them choose to use repellent sprays or coils. These findings demonstrate that fabric integrity is still a limitation on the use of LLINs. This is in line with the conclusions of earlier studies, which identified that the main obstacles to the use of LLINs were the nets' stuffiness, odour, allergic reactions, and darkened sleeping areas (Birhanu et al., 2015; Koenker et al., 2013; Malede et al., 2019). Additionally, more than half of the participants believed that the sale of LLINs should be banned (69.5%) and that they are sold at an unfair price (61.1%). This explains why cost is still a major factor affecting LLINs usage, especially in low-income communities (Malede et al., 2019; Odeyemi et al., 2022). This illustrates why the overwhelming majority of respondents (98.9%) believe the government should do more to provide LLINs.

This study is not without limitations. First, the survey is of a cross-sectional design, and as such, caution must be given to the causal relationships between the study variables. Secondly, a self-reported measure was used to assess the respondent's socio-cultural and economic factors influencing LLINs usage, which could lead to a response bias, thereby reducing the accuracy of the data obtained. Finally, future studies should consider replicating this study in other areas of Jigawa state and the northern part of Nigeria to generate strong evidence and to identify factors associated with the use of LLINs.

CONCLUSION

The current study examines the socio-cultural and economic determinants of LLINs usage among residents of Chamo town, Jigawa state. The findings showed that females, married people, and those with tertiary education are more likely to purchase LLINs. Also, majority of the participants believes that there is the need for health talks on the importance of LLINs and that the government should do more to provide LLINs to prevent malaria. Therefore, there should be ongoing health education regarding the advantages of routine LLINs usage, as well as a favourable cultural and economic shift toward the use of LLINs as a malaria control strategy.

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Conflict of Interest:

The authors declare no competing interests.

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Authors' Contributions:

Conceptualization: AS, US; Data curation: AS, US; Formal analysis: AS, US; Investigation: MSR, AS, US, ZFA, UI, JA, MAA, AYS, IMS, AG, YK, SY; Methodology: MSR, AS, US, ZFA, UI, JA, MAA, AYS, IMS, AG, YK, SY; Supervision: US, UI, MAA, YK, SY; Writing original draft – MSR, AS; Writing, review and editing – US, ZFA, UI, JA, MAA, AYS, IMS, AG, YK, SY.

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