



ASSESSMENT OF THE UTILIZATION OF LONG-LASTING INSECTICIDE NETS AMONG PREGNANT WOMEN AND CAREGIVERS OF CHILDREN LESS THAN FIVE YEARS IN TWO URBAN LOCAL GOVERNMENT AREAS (JOS NORTH AND JOS SOUTH) IN PLATEAU STATE, NIGERIA

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Abstract

Malaria remains a major public health challenge in Sub-Saharan Africa, with pregnant women and children under five years among the most vulnerable groups. This study assessed the utilization of long-lasting insecticide-treated nets (LLINs) among pregnant women and caregivers of children under five in urban local government areas of Plateau State, Nigeria. A cross-sectional survey design was employed, and data were collected from 200 respondents selected through a multistage sampling technique. A structured questionnaire was used to obtain information on socio-demographic characteristics, awareness, access and utilization of LLINs. Data were analyzed using descriptive statistics and binary logistics regression at a 5% level of significance. Findings reveal that while awareness of LLINs was high, regular utilization remained low among respondents. Logistic regression analyzing showed that educational level, income, marital status and number of children under five were significant and were associated with increased likelihood of LLIN use, whereas larger household size was associated with reduced utilization. The study concludes that despite high awareness, consistent use of LLINs is hindered by socio-economic and household factors. It is recommended that targeted health education, improved access to LLINs, and household-sensitive distribution strategies be strengthened to enhance utilization and reduce malaria burden in the study area.

Key words: Children under five, long lasting insecticide nets, pregnant women, caregivers, utilization

Introduction

Malaria remains one of the most important public health challenges globally, with sub-Saharan Africa bearing the highest burden of morbidity and mortality. The region accounts for the majority of global malaria cases and deaths, largely due to favourable climatic conditions for mosquito breeding, widespread poverty, and weak health system infrastructure. Pregnant women and children under five years of age are particularly vulnerable to malaria infection and its complications, including maternal anaemia, low birth weight and increased child mortality. Despite sustained global and regional control efforts, malaria continues to place a significant strain on health systems and socio-economic development in endemic countries, necessitating continued investment in prevention and control strategies (Sarfo et al., 2019).

The use of long-lasting insecticide-treated nets (LLINs) has been identified as one of the most cost-effective and widely recommended malaria prevention interventions. LLINs function by providing a physical barrier against mosquito bites while also killing mosquitoes that come into contact with the treated netting material. When consistently and correctly used, LLINs significantly reduce malaria transmission and related morbidity and mortality among high-risk groups such as pregnant women and young children. Therefore, increasing

access to and sustained utilization of LLINs remains central to global malaria control efforts (Eshetu et al., 2023).

In Nigeria, malaria remains endemic, with Plateau State contributing significantly to the national burden. In urban local government areas such as Jos North and Jos South, LLIN distribution campaigns have been conducted to improve coverage. However, despite these efforts, utilization among pregnant women and caregivers of children under five remains inconsistent. Studies have shown that LLIN usage is influenced not only by availability but also by awareness, socio-economic status, and behavioural factors (Idoko et al., 2020).

Access to LLINs continues to pose a challenge even in urban settings. Although distribution campaigns are ongoing, financial constraints, inequitable access and weak replacement systems often limit ownership and utilization. This highlights the need for continuous health education interventions through antenatal clinics and community outreach programmes to reinforce behavioural change and improve utilization rates (Udoh et al., 2021). Beyond structural and economic barriers, cultural beliefs and misconceptions also influence LLIN utilization. In some communities, LLINs are perceived as uncomfortable or unnecessary, while in others they are used for unintended purposes. Such practices undermine malaria control efforts and reflect the importance of culturally sensitive health promotion strategies that engage community leaders and local influencers in encouraging proper use (Ujuju et al., 2022). Improving LLIN utilization therefore requires a multi-sectoral approach involving government health agencies, non-governmental organisations, and community stakeholders. Coordinated efforts are needed to ensure equitable distribution, strengthen health education campaigns and address cultural barriers to sustained use. Such interventions are critical for reducing malaria transmission and improving maternal and child health outcomes in endemic regions.

Several studies have explored LLIN ownership and utilization in different parts of Nigeria. For instance, Adekunle (2022) reported that although LLIN ownership was relatively high in peri-urban communities in Ogun State, regular use was limited due to discomfort, heat, and alternative uses of nets. Similarly, Ikrama et al. (2021) found high awareness of insecticide-treated nets among women in Nasarawa State, yet actual usage was constrained by factors such as heat and odour. In Plateau State, Idoko et al. (2020) observed high LLIN usage among caregivers of under-five children, particularly among those with higher education levels, highlighting the role of socio-demographic factors in influencing utilization.

In addition, Babalola et al. (2019) reported that despite near-universal awareness of LLINs in Kaduna State, actual knowledge and correct utilization remained suboptimal, particularly among younger and urban women. Similarly, Israel et al. (2018) found that while awareness of LLINs was universal in Osun State, utilization was limited by discomfort, heat, and chemical-related concerns. These studies demonstrate that high awareness does not necessarily translate into consistent utilization, as behavioural, environmental, and socio-economic factors continue to influence LLIN use across different settings.

Despite these existing studies, there remains a gap in knowledge regarding LLIN utilization specifically among pregnant women and caregivers of children under five in urban areas of Plateau State. Most available evidence focuses on rural or peri-urban populations, where contextual factors differ significantly from urban environments. Moreover, there is limited evidence on how socio-demographic characteristics interact with behavioural and access-related factors to influence LLIN utilization in urban settings.

Therefore, this study seeks to assess the utilization of LLINs among pregnant women and caregivers of children under five in urban local government areas of Plateau State, Nigeria, and to identify the socio-demographic factors associated with their utilization. The findings are expected to provide evidence that will guide targeted

interventions aimed at improving LLIN uptake and strengthening malaria control strategies in urban communities

Methodology

Research Design

This study employed a cross-sectional survey design to assess the utilization of long-lasting insecticide-treated nets (LLINs) among pregnant women and caregivers of children under five years in urban areas of Plateau State, Nigeria.

Study Area

The study was conducted in Jos North and Jos South Local Government Areas of Plateau State, Nigeria. These are urban settings with ongoing malaria control interventions, including routine distribution of LLINs and health education campaigns aimed at reducing malaria transmission.

Study Population

The study population comprised pregnant women and caregivers of children under five years residing in the selected urban Local Government Areas. These groups were selected because they represent key vulnerable populations targeted by malaria prevention interventions.

Eligibility Criteria

Inclusion Criteria

Participants included in the study were:

- Pregnant women residing in the study area
- Caregivers of children under five years
- Residents who had lived in the area for at least six months

Exclusion Criteria

The following were excluded from the study:

- Visitors and temporary residents
- Individuals who declined to give informed consent

Sample Size Determination

The sample size was determined using Cochran's formula for estimating proportions, based on prevalence estimates from previous studies on LLIN utilization in Nigeria. A minimum sample size of 295 households was calculated; however, due to logistical constraints and availability of data, a total of 200 respondents were included in the final analysis.

Sampling Technique

A multistage sampling technique was employed in selecting study participants. First, Jos North and Jos South Local Government Areas were purposively selected. Subsequently, communities within each LGA were randomly selected. Households within selected communities were then chosen using simple random or systematic sampling techniques. Finally, eligible respondents (pregnant women and caregivers of children under five years) within selected households were recruited for the study.

Instrument for Data Collection

Data were collected using a structured questionnaire adapted from previous studies on malaria prevention and LLIN utilization. The instrument was designed to obtain information on socio-demographic characteristics, awareness and knowledge of LLINs, access and affordability, and utilization practices.

Validity and Reliability of the Instrument

Content validity of the instrument was ensured through expert review by specialists in public health and malaria research. A pilot study was also conducted to pretest the questionnaire. Internal consistency reliability was assessed using Cronbach’s alpha coefficient, which indicated acceptable reliability ($\alpha \geq 0.70$).

Data Collection Procedure

Data were collected by trained research assistants using face-to-face interviews conducted at respondents’ households. This approach ensured clarity of questions and improved response accuracy. The study was carried out during (insert study month and year), which should be clearly documented in the final manuscript.

Study Variables

The dependent variable in this study was regular utilization of LLINs, categorized as a binary outcome (Yes = 1, No = 0). The independent variables included age, marital status, educational level, income level, and number of children under five years.

Data Analysis

Data were coded and analyzed using the Statistical Package for Social Sciences (SPSS) version 26. Descriptive statistics such as frequencies, percentages, and means were used to summarize the data. Inferential analysis was conducted using binary logistic regression to determine factors associated with LLIN utilization. Results were presented as adjusted odds ratios (AOR), 95% confidence intervals (CI), and p-values. Statistical significance was set at $p < 0.05$

Results

As shown in table 1 below, a total of 200 respondents participated in the study. The majority were aged 30–39 years (40.5%), followed by those aged 20–29 years (33.5%), while respondents aged 50 years and above were the least represented (3.0%). Over half of the respondents were married (60.5%), with singles accounting for 20.5% and widowed respondents constituting 14.5%. Regarding educational status, most respondents held an ND/NCE qualification (38.5%), followed by SSCE holders (23.5%) and B.Sc/HND holders (15.0%). Those with postgraduate (MSc/PhD) qualifications were the fewest (3.5%). In terms of monthly income, the majority earned between ₦50,000 and ₦100,000 (57.5%), while only 6.5% earned ₦400,000 and above, and 19.0% earned below ₦50,000. In terms of the number of children under five years, more than half of the respondents had two children under five (55.0%), followed by those with one child (22.5%), while respondents with four or more children under five were the least represented (7.0%).

Table 1: Socio-demographic characteristics of respondents (N = 200)

Variable	Category	Frequency (n)	Percentage (%)
Age (years)	<20	29	14.5

	20–29	67	33.5
	30–39	81	40.5
	40–49	17	8.5
	≥50	6	3
Marital Status	Single	41	20.5
	Married	121	60.5
	Widowed	29	14.5
	Divorced	9	4.5
Educational Level	FSLC	28	14
	SSCE	47	23.5
	ND/NCE	77	38.5
	B.Sc/HND	30	15
	MSc/PhD	7	3.5
	Others	11	5.5
Monthly Income (₦)	<50,000	38	19
	50,000–100,000	115	57.5
	100,000–300,000	34	17
	≥400,000	13	6.5
Number of Under-5 Children	1	45	22.5
	2	110	55
	3	31	15.5
	≥4	14	7

Note: Percentages may not sum to 100 due to rounding.

The findings have revealed a mixed pattern of on awareness and low utilization practices (Table 2). Respondents demonstrated high levels of awareness and positive perception of LLINs. Most respondents received LLINs from distribution programs (Mean = 4.08, SD = 1.10). Beliefs that LLINs reduce malaria incidence (Mean = 3.88, SD = 1.25), receipt of LLIN information at ANC/clinics (Mean = 3.90, SD = 1.03), belief in LLIN effectiveness (Mean = 3.82, SD = 1.10) and awareness of LLIN benefits (Mean = 3.81, SD = 1.25) were all rated high.

Table 2: Respondents' Perceptions and Utilization of LLINs

Item	Mean	SD	Interpretation
Awareness of LLIN benefits	3.81	1.25	High
Received LLIN info at ANC/clinics	3.9	1.03	High
Ease of obtaining LLINs	1.77	1.23	Low
Belief in LLIN effectiveness	3.82	1.1	High

Regular LLIN use	1.74	1.11	Low
Comfort of LLIN use	1.84	1.32	Low
Replacement of old/damaged LLINs	3.71	1.36	Moderate
LLIN reduces malaria incidence	3.88	1.25	High
Received LLIN from programs	4.08	1.1	Very High
Affordability of LLINs	1.77	1.17	Low

Interpretation scale: 1–2 = Low, 2.1–3 = Moderate, 3.1–4 = High, 4.1–5 = Very High.

However, despite this high awareness and positive perception, actual utilization-related items scored considerably lower. Regular LLIN use recorded one of the lowest means (Mean = 1.74, SD = 1.11), alongside comfort of use (Mean = 1.84, SD = 1.32), ease of obtaining LLINs (Mean = 1.77, SD = 1.23), and affordability (Mean = 1.77, SD = 1.17) were low. Replacement of old or damaged LLINs was the only item rated moderate (Mean = 3.71, SD = 1.36). These findings suggest a significant gap between respondents' knowledge and perception of LLINs and their actual utilization behaviour, pointing to accessibility, affordability, and comfort as key barriers to consistent net use.

A binary logistic regression was conducted to identify factors independently associated with Long-Lasting Insecticide-treated Net (LLIN) utilization. The model was statistically significant overall (constant B = 3.59, $p < 0.001$).

Table 3: Binary Logistic Regression of Factors Associated with LLIN Utilization

Variable	B (logit)	AOR	95% CI	p-value
Age (per year increase)	0.03	1.03	0.96–1.10	0.355
Marital Status (Married vs Others)	0.12	1.13	1.02–1.25	0.017*
Education Level (Higher vs Lower)	0.16	1.17	1.08–1.27	0.001*
Income Level (Higher vs Lower)	0.19	1.21	1.06–1.35	0.003*
Number of Children <5 (≥ 3 vs <3)	-0.15	0.86	0.76–0.96	0.009*
Constant	3.59	—	—	<0.001

* $p < 0.05$; AOR = Adjusted Odds Ratio; B = logit coefficient

One of the significant predictors of LLIN utilization was educational level. Respondents with higher educational level have 17% greater odds of LLIN utilization compared to those with lower education (AOR = 1.17, 95% CI: 1.08–1.27, $p = 0.001$). This suggests that education may enhance awareness and uptake of malaria prevention measures. Likewise, income level was significantly associated with LLIN utilization. Respondents with higher income had 21% greater odds of utilizing LLINs than those with lower income (AOR = 1.21, 95% CI: 1.06–1.35, $p = 0.003$), highlighting the role of economic capacity in enabling access to and consistent use of bed nets. Marital status was also moderately associated with LLIN utilization. Married

respondents had 13% higher odds of utilizing LLINs compared to their unmarried counterparts (AOR = 1.13, 95% CI: 1.02–1.25, $p = 0.017$). Age was not a significant predictor of LLIN utilization (AOR = 1.03, 95% CI: 0.96–1.10, $p = 0.355$). Number of children under five years was the only variable inversely associated with LLIN utilization. Households with three or more children under five had 14% lower odds of LLIN use compared to those with fewer than three children under five (AOR = 0.86, 95% CI: 0.76–0.96, $p = 0.009$). This finding may reflect challenges in ensuring adequate net coverage in households with high number of young children.

Discussion

The findings provide important insights into the demographic characteristics of respondents, their perceptions and utilization of LLINs, and the socio-demographic factors influencing utilization. The socio-demographic profile of respondents showed that the majority were between 30 and 39 years of age, married, and possessed at least secondary or post-secondary education. Most respondents also reported moderate monthly incomes and had one or two children under five years of age. The relatively high educational attainment observed among respondents may reflect the urban nature of the study area, where access to educational opportunities is generally better than in rural settings.

The findings revealed a high level of awareness regarding the benefits and effectiveness of LLINs. Respondents generally agreed that LLINs are effective in preventing malaria and received information about their use through antenatal clinics and child welfare services. This finding is encouraging and suggests that malaria education and health promotion activities at the health facilities are reaching the target population. Similar findings have been reported in several other Nigerian studies, where awareness of LLINs exceeded 80% among pregnant women and caregivers of young children (Russell et al., 2015; Babalola et al., 2019). The high level of awareness observed in this study may be attributed to repeated mass distribution campaigns, antenatal care programs, and community-based health education initiatives implemented by governmental and non-governmental organizations.

Despite the high awareness levels, the study found that regular utilization of LLINs was relatively low. Respondents reported difficulties in obtaining LLINs, concerns regarding affordability, and discomfort while sleeping under the nets. This discrepancy between awareness and actual utilization highlights a persistent knowledge-practice gap that has been documented in malaria prevention research. Similar findings have been reported by Solanke et al. (2023) and Ameyaw et al. (2020) who observed that ownership and awareness of LLINs do not necessarily translate into consistent usage. Similarly, Afagbedzi et al. (2023) reported high ownership and awareness of LLINs but inconsistent utilization among caregivers and children in Ghana. Factors such as heat, poor ventilation, skin irritation, inconvenience of hanging the nets and cultural beliefs have been identified as barriers to regular use. The low utilization observed in this study therefore suggests that malaria control programs should address the practical and behavioral barriers that limit consistent use of LLINs.

The findings further showed that many respondents had received LLINs through government and health-related distribution programs. This suggests that distribution campaigns have been successful in increasing access to LLINs among vulnerable populations. However, the low ratings for ease of obtaining LLINs and affordability indicate that gaps still exist in distribution process. These findings underscore the need for continuous distribution strategies and improved access to replacement nets, particularly among low-income households.

The logistic regression analysis identified education level as a significant predictor of LLIN utilization. Respondents with higher educational attainment were more likely to utilize LLINs than those with lower

educational levels. This finding is consistent with previous studies conducted in Nigeria and other sub-Saharan African countries, which have consistently reported a positive relationship between education and malaria prevention practices (Babalola et al., 2019; Oroge et al., 2024). Education may enhance individuals' understanding of malaria transmission, increase their appreciation of preventive measures and ability to access and use health information.

Income level was also found to be significantly associated with LLIN utilization. Respondents with higher income levels were more likely to use LLINs regularly compared to those with lower incomes. This finding aligns with evidence from other studies showing that socioeconomic status plays an important role in the adoption of malaria prevention measures. Higher income households are generally more opportune to purchase additional nets, replace damaged nets, and maintain living conditions that facilitate net use. Conversely, lower-income households may face competing economic priorities that reduce their ability to buy or replace LLINs when necessary. The influence of income observed in this study highlights the importance of ensuring that LLIN distribution programs remain accessible to economically disadvantaged populations.

Marital status was another significant determinant of LLIN utilization. Married respondents were more likely to use LLINs than unmarried respondents. Married women, particularly those attending antenatal clinics, may have greater exposure to malaria prevention education and LLIN distribution programs. Similar associations between marital status and utilization of malaria prevention measures have been reported in studies among pregnant women in Nigeria and other African countries.

The study further found that households with a larger number of children under five years were less likely to utilize LLINs regularly. This finding is particularly important because children under five constitute one of the most vulnerable groups for malaria morbidity and mortality. The negative association may be explained by insufficient numbers of LLINs within larger households, leading to inadequate coverage of all household members. Similar observations have been reported in studies across Nigeria and sub-Saharan Africa, where larger household sizes were associated with lower per-capita access to LLINs and reduced utilization rates. This finding suggests the need for distribution strategies that consider household size when allocating LLINs.

Age was not found to be a significant predictor of LLIN utilization in this study. This suggests that utilization patterns were relatively similar across different age groups within the study population. While some studies have reported significant age-related differences in malaria prevention practices, others have found no association, indicating that age may be less important than factors such as education, income, and access to health information. The non-significant effect of age in the present study suggests that interventions aimed at improving LLIN utilization should target all eligible individuals regardless of age.

Overall, the findings of this study demonstrate that while awareness of LLINs is high among pregnant women and caregivers of children under five in urban Plateau State, regular utilization remains suboptimal. Educational attainment, income level, marital status, and household size significantly influence utilization, while age does not appear to play a significant role. These findings underscore the need for malaria control programs to complement awareness campaigns with interventions that address economic, behavioral, and household-level barriers to LLIN use. Efforts should focus on improving access to affordable replacement nets, promoting behavioral change communication, ensuring adequate distribution based on household size, and strengthening community-based education programs to enhance consistent utilization.

Conclusion

The study found that LLIN awareness among respondents was high, but regular utilization was low. Education, income, marital status, and household size significantly influenced LLIN use, while age had no effect. The findings suggest that improving access, affordability, and targeted health education is necessary to enhance consistent LLIN utilization and reduce malaria burden among pregnant women and caregivers of children under five in Plateau State.

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