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Original Research Article

Predictors of Daily Utilization of Long-Lasting Insecticidal Nets for Malaria Prevention in Pregnancy among Antenatal Care Recipients in Southern Nigeria

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Abstract

Malaria remains a significant public health concern, particularly among pregnant women in sub-Saharan Africa. Long Lasting Insecticidal Nets (LLINs) have been recognized as an effective preventive measure against malaria transmission. However, the utilization of LLINs among pregnant women remains suboptimal. This study aimed to assess the level of daily LLIN utilization and identify its predictors among pregnant women receiving antenatal care in a tertiary healthcare centre in Southern Nigeria. A cross-sectional study was conducted among antenatal recipients at the University of Uyo Teaching Hospital in Uyo, AkwaIbom State. A total of 323 respondents were recruited for the study. Data were collected using a pre-tested semi-structured questionnaire. Multivariable logistic regression analyses were performed to identify predictors of daily LLIN usage. One hundred and twenty seven (39.3%) of the respondents had ever slept inside a LLIN during the index pregnancy, while 22.6% reported daily usage. LLIN ownership was reported by 47.7% of the respondents, highlighting a discrepancy between ownership and consistent use. Predictors of daily LLIN usage included LLIN ownership (aOR 3.83, 95% CI 1.95-7.48), absence of discomfort during LLIN use (aOR 9.33,95%CI 4.32-20.17), non-use of other malaria preventive measures (aOR 3.7,95% CI 11.51-8.93) and presence of mosquitoes in home dwelling (aOR 3.56 95%CI 1.35-9.37). Health education campaigns should emphasize the benefits of daily LLIN usage during pregnancy. Policy interventions are warranted to increase LLIN distribution and availability to pregnant women through antenatal care clinics.

Keywords: Malaria, pregnancy, long lasting insecticidal nets, Uyo.

INTRODUCTION

Malaria poses a significant public health challenge in tropical and subtropical regions worldwide, particularly affecting vulnerable groups such as pregnant women [1], children under five years of age, immunocompromised individuals, and non-immune immigrants. The burden of malaria remains disproportionately high in the WHO African Region, which accounted for approximately 95% of all malaria cases and 96% of all malaria deaths in 2020 [2]. Each year, an estimated 50 million women living in malaria-endemic countries become pregnant, with about 10,000 of these women and 200,000 of their infants dying from malaria infection during pregnancy [3]. Pregnant women face a high risk of experiencing severe forms of the disease due to the preferential accumulation of the parasites in the placental intervillous spaces [4].

Vector control, including the use of LLINs, has been recognized as an efficacious measure in preventing and reducing malaria transmission [5]. LLINs offer a dual benefit of physical barrier and insecticidal effects, reducing contact between mosquitoes and humans [6]. Regularly sleeping inside Long-lasting Insecticidal Nets (LLINs) significantly decreases the incidence of malaria and its related complications [7]. Although the Nigerian government has made significant efforts to provide Long-lasting

Insecticidal Nets (LLINs) to pregnant women, their utilization remains low. Previous studies in Nigeria have mainly focused on assessing awareness of LLINs among pregnant women [8, 9], with limited research on the factors influencing their utilization, specifically in our study location. This study aims to bridge this research gap by assessing the level of daily LLIN utilization and identifying predictors among pregnant women receiving antenatal care in a tertiary healthcare centre in Southern Nigeria.

MATERIAL AND METHODS

Study Area

The study was done in the University of Uyo Teaching hospital, Uyo, AkwaIbom State, a 500-bed facility located in Uyo with a total of 25 Departments, comprising of 21 Clinical, 4 Non-Clinical departments as well as several Support Units [10]. The Department of Obstetrics and Gynaecology is one of the major clinical departments at the University of Uyo Teaching Hospital. AkwaIbom State is bordered on the east by Cross River State, on the west by Rivers State and Abia State and on the south by the Atlantic Ocean and the southernmost tip of Cross River State. It lies between latitudes of 4°321 and 5°331 north and longitudes of 7°251 and 8°251 east. It consists of 31 local government areas. It has a population of about 3,920,208 according to the 2006 Census. However, the growth rate according to the Nigerian population growth rate socio-demographic characteristics showed 3.4% annual increases, thus bringing the estimated population to about 6,062,978 at 2020 [11].

Study Design

The study was a descriptive cross-sectional survey involving consenting pregnant women attending antenatal clinic of University of Uyo Teaching Hospital, Uyo, in the month of February 2022.

Study Population

The study was carried out among pregnant women who booked for antenatal care and attended the antenatal clinic in University of Uyo Teaching Hospital (UUTH), Uyo, AkwaIbom State, Nigeria. Pregnant women who were too ill to participate in the study and antenatal attendees who refused to give consent for the study were excluded.

Sample Size Determination

To determine the minimum sample size for the study, the Cochrane formula [12] was used,

$$n = \frac{Z^2 \times pq}{d^2}$$

Where:

n is the desired minimum sample size.

Z is the standard normal distribution value (1.96) corresponding to the desired level of confidence or significance level (95% confidence level).

p is the estimated proportion of daily use of LLIN among antenatal from a previous study(25.7%) [13]

q = 1-p; q is complementary proportion equivalent to one (1) minus P; that is, 1 − 0.257 equal to 0.743.

d = desired precision or margin of error, indicating the maximum acceptable difference from the true population parameter.

The calculated minimum sample size was 294. Considering, a 10% non-response rate due to lost or poorly/unanswered questionnaire, the minimum sample size for this study was brought to 323.

Sampling Technique

Simple random sampling technique by balloting was used as the sampling technique. Every antenatal attendee was offered an opportunity to be part of the study. They were given an option to pick folded pieces of papers with ‘yes’ and ‘no’ written on it. Only those who picked ‘yes’ were recruited into the study. This was done on every clinic day until the required sample size was achieved. Health records of respondents who were recruited were flagged to ensure that they were not recruited again during another antenatal visit.

Study Instrument

Data was collected using a semi-structured interviewer and self-administered questionnaire. The instrument was developed by the researchers according to the objectives of the study and was pre-tested in an ANC clinic in a secondary health facility in Uyo. The questionnaire had various sections which collected information on socio-demographic characteristics of participants (age, marital status, educational level, occupation); ownership of LLINs; utilization of LLINs; and factors associated with LLIN utilization.

Statistical Analysis

Data collected were examined for correctness and completeness and coded for statistical analysis. Observations with non-response, item omission, entry errors or logical inconsistencies were excluded. Descriptive statistics (number, percentage, median[interquartile range], mean[standard deviation]) was used to summarize respondents’ characteristics. Univariable and multivariable logistic regression models were fitted to assess predictors of daily LLIN use among the respondents. The following covariates were included in the univariable and multivariable analysis: level of education, ownership of LLIN; discomfort from LLIN use; use of other malaria preventative measures; presence of mosquitoes in home dwelling, fear of insecticides in LLIN; partner non-support for LLIN use; untidy appearance of LLIN in home dwelling; and knowledge of malaria symptoms and complications. Covariates with a P-value < 0.2 from the univariate analysis were included in the initial multivariate model, and only those with a P-value < 0.05 were retained in the final model. Crude and

adjusted odds ratios (aOR) with 95% confidence intervals (95% CIs) were reported as measures of association. Diagnostics necessary to validate the assumptions of the multivariable logistic model were performed, including nominal dependent variable; continuous, ordinal, or nominal independent variables; independence of observations; absence of multicollinearity; linear relationship between continuous independent variables and the logit transformation of the dependent variable; and absence of outliers, high leverage values or highly influential points.

Ethical Considerations

The survey was conducted after an informed consent was obtained from all respondents. Ethical approval was obtained from Institutional ethical committee of the University of Uyo Teaching Hospital, AkwaIbom state, Nigeria. Permission to conduct the study in the Department of Obstetrics and Gynaecology was also obtained from the head of department. Participation of clients in the study was voluntary and at no cost to them and clients were free to withdraw from the study at any point in time.

RESULTS

Table 1 presents the characteristics of the study population. The mean (Standard deviation, SD) age of respondents was 31.0 (4.7) years. More than half of respondents (52.6%) were less than 31 years. Almost all were married (98.1%). The predominant occupations were trading (41.5%) and civil service (30.7%). Most had completed tertiary level of education (78%) and lived in urban areas (81.4%). Most respondents had 2-3 previous pregnancies (52.2%) with 1-2 children alive (49.7%) at time of the study.

Table 1: Characteristics of the study population (N = 323)

Variable	Frequency	Percent
Age (years)		
≤ 30	170	52.6
≥ 31	153	47.4
Marital status		
Single	5	1.5
Married	317	98.1
Widow	1	0.3
Occupation		
Farming	3	0.9
Housewife	36	11.1
Trading	134	41.5
Civil servant	99	30.7
Students/applicants	11	3.4
Artisans	23	7.1
Others	17	5.3
Highest education level		
No formal education	1	0.3
Primary education	4	1.2
Secondary education	66	20.4
Tertiary education	252	78.0
Residence		
Rural	60	18.6
Urban	263	81.4
Number of times pregnant		
1	104	32.7
2 - 3	166	52.2
≥4	48	15.1
Number of living children		
0	123	38.6
1-2	158	49.7
≥ 3	42	13.2
Place of delivery of last child(n=200)		
*Health facility	189	94.5
Traditional Birth Attendant	5	2.5
Home	4	2.0
Others (church)	2	1.0

(*PHC=5, Hospital=184)

One hundred and fifty four (47.7%) currently had an LLIN. A greater proportion of respondents 62 (40.3%) owned 2 LLINs in a household. One hundred and twenty-seven (39.3%) had ever slept inside an LLIN in this pregnancy, 20.4% slept inside an LLIN the night before the survey and 22.6% sleep inside an LLIN every night in the index pregnancy (Table 2).

Table 2: Ownership and Utilisation of Long-Lasting Insecticidal Treated Nets (LLIN) (N= 323)

Variable	Frequency (%)
Currently have an LLIN	
Yes	154 (47.7)
No	169 (52.3)
Number of LLINs per household	
1	47 (30.5)
2	62 (40.3)
≥ 3	45 (29.2)
Ever slept inside LLIN in this pregnancy	
Yes	127 (39.3)
No	196 (60.7)
Slept inside LLIN last night before the survey	
Yes	66 (20.4)
No	257 (79.6)
Sleep inside LLIN every night in this pregnancy	
Yes	73 (22.6)
No	250 (77.4)

In the multivariate analysis presented in Table 3, ownership of LLIN (aOR: 3.83; 95% CI: 1.95 – 7.48) predicted use of LLIN. Also, no discomfort from LLIN use (aOR: 9.33; 95% CI: 4.32 – 10.27), non-use of other malaria preventative measures (aOR: 3.67; 95% CI: 1.51 – 8.93), and presence of mosquitoes in home dwelling (aOR: 3.56; 95% CI: 1.35 – 9.37), were significant predictors of LLIN use.

Table 3: Predictors of Daily LLIN Use by Respondents (N = 323)

Variable	Univariate analysis		Multivariate analysis	
	Crude OR (95% CI)	**P value**	**Adjusted OR (95% CI)**	**P value**
Ownership of LLIN		<0.01		<0.01
No	1.0 (ref)		1.0 (ref)	
Yes	2.08 (1.22 – 3.55)		3.83 (1.95– 7.48)	
Discomfort from LLIN use		<0.01		<0.01
Yes	1.0 (ref)		1.0 (ref)	
No	8.85 (4.72 – 16.59)		9.33 (4.32 – 20.17)	
Use of other malaria preventative measures		<0.01		<0.01
Yes	1.0 (ref)		1.0 (ref)	
No	6.38 (2.93 – 13.87)		3.67 (1.51 – 8.93)	
Mosquitoes in home dwelling		<0.01		0.01
Yes	3.76 (1.56 – 9.09)		3.56 (1.35 – 9.37)	
No	1.0 (ref)		1.0 (ref)	

OR – Odds ratio; 95% CI – 95% Confidence Interval

DISCUSSION

This study was conducted at the University of Uyo Teaching Hospital to investigate the utilization of LLINs among antenatal attendees and identify predictors of daily LLIN use. Our findings demonstrated that 39.3% of participants had ever slept inside an LLIN during the index pregnancy, while 22.6% slept inside an LLIN every night during that period. These utilization rates demonstrate a discrepancy between LLIN ownership (47.7% in our study) and consistent usage. Our results align with a similar study conducted among 400 antenatal clinic attendees in Abakaliki, South Eastern Nigeria [14], where 37.5% slept inside LLINs during the index pregnancy. Additionally, another study conducted in Abuja, Nigeria [15], showed that 19% of pregnant women slept inside LLINs the night before the survey, which is comparable to our finding of 20.4%.

This study also revealed a significant association between LLIN ownership and daily usage. Among the respondents, 47.7% reported owning

LLINs, highlighting the importance of ownership as a determining factor for LLIN utilization. However, the ownership rates observed in this study are lower than the findings of a similar study conducted across 18 states in Nigeria, which reported a household ownership rate of 64.6% [16]. Nevertheless, our rates were slightly higher than the LLIN ownership rate of 43.1% [17] reported in an Enugu study conducted in South-Eastern Nigeria. The median number of LLINs owned per household was 2 (IQR: 1, 3), aligning with the 2018 National Demographic and Health Survey (NDHS) report, which indicated an average of one Insecticide Treated Net (ITN) per household [18].

This study identified that respondents who experienced discomfort during LLIN use were significantly less likely to utilize it on a daily basis compared to those who did not experience discomfort. Respondents who did not employ other malaria preventive measures were more likely to use LLINs daily compared to those who used alternative prevention methods. A significant proportion of our respondents (more than half) reported non-usage of LLINs due to discomfort, which is consistent with the findings of a cross-sectional study conducted on 832 antenatal care attendees in Enugu, Southern Eastern Nigeria, where heat discomfort emerged as one of the primary reasons for non-usage of LLINs [17]. Another cross-sectional study assessing the awareness and utilization of LLINs among 400 antenatal clinic attendees in Abakaliki, Southeast Nigeria, demonstrated that 40% of women did not use LLINs due to discomfort or heat[14]. Our findings also align with a study conducted in Southern Rwanda, which highlighted that the utilization of alternative methods for malaria prevention was significantly associated with LLIN use [19].

Our findings indicate that the level of education did not have a significant impact on the utilization of LLINs. This contrasts with the results of a similar study conducted in Enugu, Southern Eastern Nigeria [17], where higher educational levels were significantly associated with increased LLIN usage. Another study examining LLIN utilization among pregnant women in Anambra State, Nigeria [20], also reported significant associations between educational level and LLIN use. The disparity between our findings and those of these studies can be attributed to the relatively higher educational attainment observed in our study population, with 78% of respondents having tertiary educational qualifications.

Limitations

This study is subject to certain limitations that should be considered while interpreting the findings. Due to the cross-sectional design of the study, causal relationships between the identified factors and daily LLIN use cannot be established. The study primarily focused on LLIN utilization among antenatal attendees within the tertiary healthcare setting, potentially overlooking the broader range of LLIN usage patterns in other settings. It is plausible that actual utilization rates may be lower than reported, as the values obtained in this study were self-reported and could not be verified by the researchers.

CONCLUSION

This study examines the predictors of daily LLIN use among antenatal attendees in a tertiary healthcare centre in Southern Nigeria. Our findings indicate a low rate of daily LLIN usage during pregnancy. Ownership of LLINs, discomfort during LLIN use, the use of alternative malaria preventive measures, and the presence of mosquitoes in home dwelling significantly affected the likelihood of daily LLIN usage. It is important to prioritize health education, campaigns, and advocacy regarding the importance of LLIN use during pregnancy, particularly within the antenatal clinic setting. Efforts should be made to ensure the constant availability and distribution of LLIN to pregnant women at their initial antenatal visit.

COMPETING INTERESTS

The authors declare no competing interests.

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