The predictors of ownership and utilization of Long-Lasting Insecticidal Nets among caregivers of under-five children in Ekiti State, South-West, Nigeria

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Abstract

Background - Malaria is a life-threatening disease associated with a high level of morbidity and mortality in sub-Saharan Africa especially among children under five years of age. Long-lasting insecticidal Nets (LLINs) ownership and utilization are some of the proven interventions to reduce the burden of the disease. This paper aims to assess and compare the predictors of ownership and utilization of LLINs among caregivers of under-five children living in urban and rural settlements in Ekiti State, Nigeria.

Methods - This was a cross-sectional comparative study among 800 under-five caregivers. A multistage sampling technique selected 400 caregivers each from urban and rural settlements. A semi-structured interview questionnaire was used to elicit information from the respondents. Data were analyzed using Statistical Product and Service Solution (SPSS) IBM version 23. Univariate analysis was conducted to summarize the data and inferential statistics were generated using chi-square and binary logistic regression at 95%CI.

Results- The results showed much lower ownership rates in urban (32.3%) than the rural (33.0%). The predictor of ownership of LLINs among respondents in urban settlements was, obtaining their information about LLINs from health workers, friends as sources of information, awareness, good knowledge, and having positive attitudes about LLINs. Utilization is better in the rural (78.0%) compared to the urban (61.2%). The predictor of utilization of LLINs in urban settlements was having positive attitudes towards LLINs while the predictors of the utilization of LLINs in rural were the number of under-five children with caregivers and positive attitude to LLINs.

Conclusion –Ownership of LLINs in both settlements was very low and lagged in urban. The utilization was however higher but also lagged in urban. However, it has not reached the 80% proposed by the National Malaria Control Programme. It is therefore recommended that the Government and partners sustain the free distribution of LLINs throughout the year in the communities to improve ownership and Social and Behavioral Change Communication (SBCC) intervention is necessary to improve utilization.

Les prédicteurs de la possession et de l'utilisation de moustiquaires insecticides longue durée parmi les soignants d'enfants de moins de cinq ans dans l'État d'Ekiti, sud-ouest du Nigeria

Resume

Contexte - Le paludisme est une maladie potentiellement mortelle associée à un niveau élevé de morbidité et de mortalité en Afrique subsaharienne, en particulier chez les enfants de moins de cinq ans. La possession et l'utilisation de moustiquaires insecticides de longue durée (MILDA) font partie des interventions éprouvées pour réduire le fardeau de la maladie. Cet article vise à évaluer et comparer les prédicteurs de la possession et de l'utilisation des MILD parmi les soignants d'enfants de moins de cinq ans vivant dans des établissements urbains et ruraux de l'État d'Ekiti, au Nigeria.

Méthodes - Il s'agissait d'une étude comparative transversale auprès de 800 soignants de moins de cinq ans. Une technique d'échantillonnage à plusieurs degrés a sélectionné 400 soignants chacun dans des établissements urbains et ruraux. Un questionnaire d'entretien semi-structuré a été utilisé pour obtenir des informations auprès des répondants. Les données ont été analysées à l'aide de la solution statistique de produits et services (SPSS) IBM version 23. Une analyse univariée a été réalisée pour résumer les données et des statistiques inférentielles ont été générées à l'aide d'une régression logistique chi carré et binaire à un IC à 95 %.

Résultats- Les résultats ont montré des taux de propriété beaucoup plus faibles en milieu urbain (32,3 %) qu'en milieu rural (33,0 %). Le prédicteur de possession de MILDA parmi les répondants des établissements urbains était le fait d'obtenir leurs informations sur les MILDA auprès des agents de santé, tandis que ceux des établissements ruraux avaient des cuisines séparées, des amis comme sources d'information, une sensibilisation, de bonnes connaissances et une attitude positive à l'égard des MILDA. L'utilisation est meilleure en milieu rural (78,0 %) qu'en milieu urbain (61,2 %). Le prédicteur de l'utilisation des MILDA dans les établissements urbains était une attitude positive à l'égard des MILDA, tandis que les prédicteurs de l'utilisation des MILDA en milieu rural étaient le nombre d'enfants de moins de cinq ans accompagnés de soignants et une attitude positive à l'égard des MILDA.

Conclusion – La possession de MILDA dans les deux établissements était très faible et décalée en milieu urbain. L'utilisation était cependant plus élevée, mais également à la traîne en milieu urbain. Cependant, il n'a pas atteint les 80% proposés par le Programme National de Lutte contre le Paludisme. Il est donc recommandé que le gouvernement et les partenaires maintiennent la distribution gratuite de MILD tout au long de l'année dans les communautés afin d'améliorer l'appropriation et qu'une intervention de communication pour le changement social et comportemental (CCSC) soit nécessaire pour améliorer l'utilisation.

INTRODUCTION

Malaria is a life-threatening disease caused by a protozoan blood parasite known as *Plasmodium species*- it is preventable and curable.[1] Under-five children with malaria may have symptoms such as chills, fever, vomiting, and headache and if not treated on time, it can progress to severe illness or death. Current treatments and vector control interventions to combat malaria include Artemisinin-based Combination Therapy (ACT), Intermittent Preventive Treatment in pregnancy (IPT), indoor residual spraying of insecticide (IRS), and the use of Long-Lasting Insecticidal Nets (LLINs).[1]

At the historic Malaria Summit hosted by Nigeria in 2000, African Heads of State made a declaration to halve the burden of malaria by the year 2010. One of the targets set for the first five years was to ensure that the vulnerable groups have access to and sleep under Insecticide Treated Nets (ITNs). [1]

Globally, there were 216 million cases of malaria in 2018; up from 211 million cases in 2015.[1] The estimated number of malaria deaths globally stood at 445,000 in 2018, a similar number to the previous year.[1] The African region continues to carry a high share of the global malaria burden. In 2018, the region was home to 90% of malaria cases and 91% of malaria deaths. Some 15 countries, all in sub-Saharan Africa accounted for 80% of the global malaria burden.[1]

In Nigeria, malaria is the leading cause of under-five mortality contributing 33% of all childhood deaths and 25% of infant mortality.[3] As a child will typically be sick with malaria between 3–4 times in a year, the disease is a major cause of absenteeism in school-aged children. [3] This will impede their educational and social development and subsequently rob the country of its future human resources potential. [3]

The Abuja Declaration on Roll Back Malaria by African Heads of State on the 25th of April 2000 committed national governments and their development partners to the goal of increasing coverage of LLINs to 60% of target groups by 2005.[4] In 2006 the Roll Back Malaria (RBM) Partnership revised the ITN target to 80% coverage of vulnerable groups by 2010.[5] There are two important RBM indicators for monitoring progress towards the set target. They are the proportion of households that own one or more nets and the proportion of under-five children who sleep under a net.[5, 6]Net ownership is important to assess the effectiveness of the distribution channels of the RBM programme and suggest modifications where there are lapses. Utilization is a crucial indicator that will generate the desired epidemiological impact.[7]

There is still a continuous debate on how to meet the set targets of LLINs ownership and utilization among vulnerable groups as previously set in Abuja. [8] The WHO Strategic Framework for scaling up LLINs advocates a pluralistic approach, [9] in which emphasis is placed on developing commercial distribution systems, with subsidies targeted at those who are unable to afford nets at commercial prices. On the other hand, some argue that poverty is so widespread among those rural populations most at risk of malaria that other mechanisms, such as free distribution, need to be explored. [10]

In Nigeria, the same debate about the appropriate means of delivering this key public health tool is echoed. The Nigerian National Malaria Control Strategy emphasizes the sale of LLINs on a user-fee basis.[11] However, the Federal Government announced some years ago the free distribution of LLINs to pregnant women and children. This pronouncement has not been followed up either with policy documentation or by the identification of sources of funding.

The ownership of LLINs remains stubbornly low, reported to be under 50% in sub-Saharan Africa. [12, 13] It may be due to affordability problems as household economic status has been related to net ownership in several studies.[8] As a result of the prolonged economic crisis, poverty levels in Nigeria have continued to climb, with the majority of the poor located in rural areas where about 48% of the population is reported to be living in extreme poverty. [8] The perceived risk of malaria and the benefits of the LLINs by the community also drive demand. [14]Onwujekwe*et al*, in a Nigerian study, found that households with a recent attack of malaria and those with higher willingness to pay were more likely to purchase a net than their counterparts. [15]

Utilization has, however, been found to vary with the seasons of the year and the acceptability of the nets in terms of size, colour, and shape. Binka *et al* showed that the time of the year during which the nets are delivered affects use. [12] Up to 80% of the net recipients were found to use the nets during the rainy season due to associated high mosquito density, while only 20% used it during the dry season due to heat-related discomfort.[12] Demographic characteristics like age, education level of head of households, size of household, and ethnicity also influence the use of bed nets. Some studies show that children are less likely to use nets, [16, 17, particularly in rural areas, while others found no

significant association between age and net use [18]. Some studies have also identified disruptive sleeping arrangements, [19] and net misuse such as bed nets being used for activities in agriculture and fishing particularly in rural areas as factors that determine the utilization of LLINs. [20]

Study Objectives: This paper aims to assess and compare, the ownership rates, the utilization rates and the predictors of ownership and utilization of LLINs among caregivers of under-five children living in urban

MATERIALS AND METHODS

Design

The study adopted a cross-sectional comparative study. The study was carried out in Ekiti State, southwest Nigeria. It has 16 Local Government Areas (LGAs). Four (4) LGAs i.e. Ado, Ikere, Ikole, and Ijero LGAs are predominantly urban while also four (4) LGAs, Ilejemeje, Emure, Gbonyin, and Ise/Orun LGAs are predominantly rural according to the stratification of Local government in Ekiti State. All these mainly rural and urban LGAs were involved in the study.

Ekiti State enjoys a tropical climate, with two distinct seasons which are the rainy and the dry season. The annual temperature ranges between 21°C and 28°C, accompanied by high humidity.[21]Health facilities in the state are providing promotive, preventive, and curative health services for the inhabitants. The distribution of LLINs is one of the promotive and preventive services being rendered. The study population was made up of caregivers of under-five children living in rural and urban settlements in Ekiti State. In this study, a caregiver of under-five children included biological parents, step-parents, adopted parents, guardians, uncles, and aunties who had been with a child for 6 -12 months. The inclusion criteria for the study involve only caregivers of under-5 children who were permanently resident in the selected settlements. The sample size of 400 each for urban and rural settlements was calculated using the formula for comparing two (2) proportions in two (2) independent study samples (considering both Alpha and Beta error)[22]

$$n = \frac{(Z_{1-\alpha/2} + Z_{1-\beta})^2 [P_1(1-P_1) + P_2(1-P_2)]}{(P1-P2)^2}$$

Where:

n = minimum sample size for each group

$Z_{1-\alpha/2}$ = standard normal deviate of α at 95% confidence level, (i.e. probability of making a type 1 error) =1.96

$Z_{1-\beta}$ = standard normal deviate of β at 80% confidence level (i.e. probability of making a type 2 error) Power = β = 0.84

Sample size as calculated using LLINs utilisation prevalence:

P_1 = Proportion of under-five caregivers utilising LLINs in rural areas of 69.3% was used in calculating the minimum sample size. [137]

P_2 = Proportion of Under-five caregivers utilising LLINs in urban communities estimated at 59.3%; assuming a 10% difference in prevalence of utilisation among urban caregivers.

$$\mathbf{n = \frac{(1.96 + 0.84)^2 [0.693(1-0.693) + 0.593(1-0.593)]}{(0.693 - 0.593)^2}}$$

n = 356

n = 356 respondents for either rural or urban community

Adjusting for non-response, assuming a non-response rate of 10%, the sample size was adjusted using the formula.

$n_f = n/1 - NR$, NR = non response rate

$n_f = 356/0.9 = 395.55$

n_f = 395.55 (approximate to the nearest tenth = 400)

A multistage sampling technique was used to recruit participants into the study. The Lots Quality Assurance Survey (LQAS) sampling methodology commonly used by the WHO office in Ekiti State for the National Immunization Days Plus (NIDP) was deployed, to select the caregiver under-five pairs.

Stage 1: Selection of Local Government Areas (LGAs)

According to the stratification of LGAs in Ekiti State, there are 4 predominantly rural LGAs and 4 predominantly urban LGAs out of 16 LGAs. All these predominantly rural and urban LGAs were involved in the study. There was a proportional allocation of the sample size to each LGA depending on the fractional proportion of the LGA population to the total population sum (rural or urban).

Stage 2: Selection of Wards

A list of all the wards in the selected rural and urban LGAs was obtained from the Ekiti State WHO office. One ward was selected from each of the identified rural and urban LGAs using simple random sampling by balloting. Four (4) rural and four urban wards were selected for the study (making a total of eight wards).

Stage 3: Selection of Settlements

A settlement was selected from each previously selected ward using the simple random sampling technique by balloting. A list of settlements for each of the wards had been earlier obtained from the WHO office. In the end, four rural and four

urban settlements were selected.

Stage 4: Selection of Houses.

Rural settlements - In each of the selected settlements, the centre of the community was identified and a bottle was spurned to determine the direction of movement. The researcher according to the sample size allocated to each ward, moved round the settlement always turning right at the boundaries. Houses were selected from the settlements using a systematic sampling technique with a sampling interval of 2. The total number of houses that were selected was determined by the proportion of the sample size allocated to the settlement. In the process of selection, any house without an identified caregiver was skipped. If the researcher could not obtain the required number of houses from any settlement, the selection continued in the next contiguous settlement in the same ward.

Urban settlements - In each of the selected urban settlements, the centre of the community was also identified and a bottle was spurned to determine the direction of movement. The researcher according to the allocated sample size to each ward, moved around the settlement, always turning right at the boundaries. Houses were selected from the settlements using a systematic sampling technique with a sampling interval of 3. The total number of houses that were selected was determined by the proportion of the sample size allocated to the settlement. In the process of selection, any house without an identified caregiver was skipped. If the researcher could not obtain the required number of houses from any settlement, the selection continued in the next contiguous settlement in the same ward.

Stage 5: Selection of Households

In each of the selected houses, households with caregivers were identified. .If there were more than one household with caregivers in any house, simple random sampling by balloting was used in determined the household to be selected. If there was no household with a caregiver in any selected house the next house was automatically selected for study.

Stage 6: Selection of under- five Caregivers

In any household with one caregiver, the identified caregiver was automatically selected for the study. In any household with more than one caregiver, simple random sampling by balloting was used to select.

If any caregiver refused to consent to participate, another one was selected from the house or the next house.

Instruments for Data Collection Method.

A pre-tested semi-structured interviewer-administered questionnaire that was adapted from similar studies was used.[16]The questionnaire consisted of sections that assessed caregivers' socio-demographic characteristics, the ownership and utilization rate of LLINs, and factors affecting the ownership and the utilization. The dependent variables of the study were ownership and utilization of LLINs among caregivers of under-five children. Ownership of LLINs was defined as the presence of more than one LLIN in a household. Utilization means using the nets for the under-five a night before the survey. The independent variables were socio-demographic characteristics of the respondents including age, gender, marital status, and relationship to the child, the presence of feeling heat at home, maintenance of cross ventilation, sources of lighting, occupational status, and monthly income.

Data Analysis

A scoring system was used to assess the knowledge and attitudes of caregivers about LLINs and proper categorizations were made. Summary statistics were presented using tables and bar charts. Categorical variables were presented as proportions and analyzed using the Chi-square test with Fisher's exact test applied where more than 20% of expected counts were less than 5. The continuous variable (age) was found to be skewed using the Shapiro-Wilk test and was presented as median (inter-quartile range) and analyzed using the Mann-Whitney U test. Binary logistic regression (multivariable analysis) was used to identify the determinants of ownership and utilization of LLNIs. level. A p-value of less than 0.05 at a 95% confidence limit can be used to determine statistical significance independently of the confidence interval. .

Ethical Consideration: Ethical approval was obtained from the Ethics and Research Review Committee of the Ekiti State University Teaching Hospital, Ado-Ekiti with approval number EKSUTH/A67/2017/06/007. We obtained written informed consent from all participants after explaining the details of the study.

RESULTS

Socio-demographics data of the respondents

Table 1 shows the demographic characteristics of the respondents and it was of note that most of the respondents (42.0%) fell into the 21-30 years age group in the urban while most of the respondents (40.5%) fell into the 31-40 years age group in the rural. More than three-

quarters of the respondents felt the heat at home (urban 83.5% and rural 90.5%). The difference in feeling the heat at home between both groups was statistically significant (p=0.003). Most respondents in both groups (urban, 49.6%; rural 70.1%) maintained ventilation in their rooms by cross-ventilated windows and the difference in maintaining cross-ventilated windows was statistically significant (p =0.001). The number of respondents using rechargeable lamps as sources of light was higher in urban (75.8%) than in rural (66.8%). This was also the same trend for respondents using electricity/solar in urban (83.5%) and rural (54.5%). The difference in the source of light in both groups was statistically significant (p=0.003 and < 0.001 respectively). Most of the under-five children slept on the same bed with their parents/uncles in urban (79.5%) as compared to almost all under-five children who slept with their parents/uncles in rural (91.0%). The difference was statistically significant (p=<0.001). Nearly half of the respondents in the urban (45.8%) and rural (43.8%) settlements were traders. The differences in the occupational status of respondents in these settlements were statistically significant. (p= 0.025). The majority of the respondents had an average monthly income of less than or equal to 30,000 naira (Urban, 81.8%; rural, 89.8%). The difference in monthly income was statistically significant. (p=0.005)

Ownership of the LLINs

Table 2 shows ownership of LLINs among respondents. Less than half of the respondents in both settlements owned LLINs (urban 32.3%, rural 33.0%). About half of the respondents in both settlements had one LLIN (urban 58.9%, rural 50.0%). The difference in having one LLIN was statistically significant. (p=0.019). Out of the respondents who owned LLINs, the majority of them possessed LLINs for all under-five children in both settlements. (Urban 69.8%, rural 87.1%). The difference was statistically significant (p=0.001). For reasons not having LLINs, the majority of the respondents in both settlements claimed that LLINs were not just available (urban 71.6%, rural 79.1%). The difference was statistically significant (p=0.043)

Utilization of LLINs

Table 3 shows the utilization of LLINs among respondents. Out of 129 respondents who owned LLINs in urban settlements, less than three-quarters of them (61.2%) hung LLINs the night before the survey. In rural settlements, out of 132 respondents who owned LLINs, more than three-quarters (78.0%) hanged LLINs the night before the survey. The difference in hanging was statistically significant. (p=0.003%). About half (52.7%) of the respondents in urban were using LLINs every night while more than three-quarters (77.3%) of the respondents were using LLINs every night in rural settlements.

About half (49.5%) of the respondents in urban noticed that LLINs produced heat while more than half (63.3%) of the respondents in rural noticed that LLINs produced heat. Many of the respondents (70.5%) in urban claimed that LLINs are not comfortable to use while less than half of the respondents in rural claimed that LLINs are not comfortable to use. The difference in comfortability was statistically significant. (p=0.027).

About one-third (37.7%) of the respondents in urban smell chemicals in LLINs while few respondents (13.3%) in rural smell chemicals in LLINs. The difference in smelling chemicals was statistically significant. (p=0.017). More than half (58.9%) of the respondents in urban inspected LLINs regularly for effectiveness while about three-quarters (73.5%) of the respondents in rural inspected LLINs for effectiveness. The difference was statistically significant. (p=0.013). About half of the respondents in both settlements discarded LLINs when holes were found in them (urban 45.7%, rural 46.2%). The difference was statistically significant. (p=0.002).

The predictors of ownership of LLINs in Urban

The predictors of ownership of LLINs in the urban using binary logistic regression (multivariable analysis) are shown in Table 4. The only access to information about LLINs from health workers was found to be an independent predictor of ownership (p values 0.005). Those who have information from health workers have a 2 times increase in the odds of having LLNIs (aOR: 2.252; 95% CI: 1.274 – 3.978).

The Predictors of Ownership of LLINs in Rural

Table 5 shows the predictors of ownership of LLINs in the rural area using binary logistic regression (multivariable analysis). Significant independent predictors of ownership identified include; friends as sources of information, ever heard about LLINs, and knowledge of LLNs. Respondents who got

information about LLINs from friends have lesser odds of having LLINs (0.544; 95%CI: 1.679-12.105) . A higher odd of having LLIN was however found with ever heard about LLINs and good knowledge (aOR: {(4.509; 95%CI: 1.679-12.105 and 5.759; 95%CI: 1.062-31.24)}respectively.

The Predictors of Utilization in Urban

Table 6 showed the attitude of respondents towards LLINs remained the only independent predictor of utilization of LLNIs in the urban area (*p*-value 0.039). Respondents who have a positive attitude towards LLNIs have about 5 times increase in the odds of utilizing it as compared with those with a negative attitude (OR: 4.935; 95% CI: 1.088 – 22.389). Those with good knowledge of LLNIs were also found to have higher odds of using it, however, this was not found to be statistically significant (*p* values 0.068).

The Predictors of Utilization in Rural

The number of under-five children under care and the caregivers' attitudes towards LLINs were found to be independent predictors of the utilization of LLINs in the rural area as shown in table 7. Respondents with one child under five years have slightly increased odds of utilizing LLINs as compared with those with more than two children (OR: 1.296; 95% CI: 0.105 – 8.030). In the same vein, those who have a positive attitude towards LLINs are about 5 times more likely to use them as compared with those with a negative attitude (OR: 4.598; 95% CI: 1.008 – 10.969).

DISCUSSION

The ownership rate of LLINs among under-five caregivers as reported in this study was 32.3% in urban and 33.0% in rural settlements. The slight difference noticed might be because caregivers in rural in this present study were more knowledgeable about LLINs than their counterparts in urban. This low level of ownership of LLINs had been similarly reported in previous studies conducted among caregivers of under-five children by Adebayo A.M et al in Oyo state where an 11% ownership rate was reported [23]Esimai O.A et all in Osun state and Tobin-West C. I et al in River State also reported 34% and 30.2% ownership rates respectively.[24,25] Also, a study in Zimbabwe reported a 42% ownership rate among caregivers of under-five children.[26] However, higher ownership rates of 82.9% and 85.4% respectively were reported among caregivers of under-five children in studies conducted by Isreal et al in Osun state [27] and Admasu T et al in Ethiopia[28] The difference in the two studies might be because the study in Osun state was done some months after the mass free distribution of LLINs.

The National Nutrition and Health Survey (NNHS) 2018 reported less than three quarters (62.3%) of ownership of LLINs among caregivers of under-five children.[29] Similarly, the Nigeria Demographic and Health Survey (NDHS) 2018 [30] also reported more than half (52.6%) of respondents in urban owned LLINs while 66.9% owned LLINs in rural. These results were different from the ones reported in this study because the free distribution of LLINs was done about a year before the NNHS and NDHS studies. LLINs ownership, that is the proportion of households that own one or more LLINs is important to assess the effectiveness of the distribution channels of the RBM programme and suggest programme modification where there are lapses.[31]About half (41.1%, 50.0%) of the respondents who own LLINs in urban and rural respectively had more than one LLINs in the present study. This result was higher than what was reported in NDHS 2018 where 25.5% of urban and 33.0% of rural caregivers with under-five children had more than one LLIN.[32] However, a study conducted by Gonahassa et al in Uganda reported 65% of caregivers having more than one LLINs.[34]

More than half of the respondents (urban 52.3%, rural 59.4%) gave reasons for not possessing LLINs to non-availability. There has not been a mass distribution of LLINs in all the LGAs in Ekiti state over the last three years before the time of the study. Many under-five caregivers claimed to have possessed their LLINs more than two years ago. Also, LLINs were not consistently available at the different health facilities for accessibility.

The second important RBM indicator for monitoring progress toward the set target of 100% is utilization which is the proportion of under-five children who sleep under the LLINs.[35] Utilization is the crucial indicator that will generate the desired epidemiological impact.[36] Utilization is defined as when the studied under-five caregivers responded in the affirmative that their under-five children slept under the LLINs in the night preceding the survey.

Among 129 under-five caregivers who possessed LLINs in urban settlements, more than half of them (61.2%) responded to the affirmative that their under-five children slept under the

LLINs in the night preceding the survey. This result was higher than 18.5% which was reported by Esimai O.A et al in a study conducted among urban communities in Osun state.[37] In the rural settlements, among 132 caregivers that owned LLINs, about three-quarters (78.0%) responded to the affirmative that their under-five children slept under the LLINs in the night preceding the survey. This result was a little higher than the 69.3% that was reported in a study conducted among rural communities in Oyo state.[38] Results from this study revealed that a larger number of caregivers of under-five children in rural settlements utilized LLINs than their urban counterparts. (Urban 61.8%, rural 78.0%). The difference noticed might also be because under-five caregivers in rural were more knowledgeable about LLINs than their urban counterparts. These findings were higher than the findings of NNHS which reported 20.9% of utilization of LLINs among under-five caregivers in Ekiti state.[39] It was also higher than the findings of NDHS which reported 26.4% utilization among under-five caregivers in Ekiti state.[32]

This difference in findings was because the researchers in the two National surveys (NNHS and NDHS) took a further step to inspect the rooms of the under-five caregivers to be sure of the hanging of LLINs. When this concept was practiced in the present study, the findings were similar to what was reported in NNHS and NDHS studies. (Urban 34.9%, rural 37.9%). The common reasons for the non-use of LLINs among caregivers include excessive heat, non-comfortability while using, and irritation by chemicals.

The predictor of ownership of LLINs among urban respondents was access to information from health workers. Those who had information from health workers were two times more likely to own LLINs than those who did not have information. The implication of this is that Health workers should take more responsibility in the distribution of LLINs. They should be used as media by which caregivers with under-five children can have access to LLINs. However, caution needs to be taken by properly monitoring the personnel involved so that the distribution will not be abused.

The predictors of ownership of LLINs among rural respondents are having a separate kitchen, sources of information from friends, good knowledge, and positive attitudes. Respondents who have a kitchen in the room have lesser odds of having LLINs as well as those who got the information about LLIN from friends. A higher odd of having LLINs was however found with good knowledge and a positive attitude. The implication of this is that respondents should be encouraged to have a separate kitchen at their homes. This will reduce the effects of heat coming out from the kitchen thereby discouraging ownership of LLINs. There is also a need to sustain the knowledge and attitudes of under-five caregivers about LLINs through different health education methods.

The predictors of utilization of LLINs among the urban respondents are positive attitudes. Those with positive attitudes were about 5 times more likely to utilize LLINs compared to their counterparts with negative attitudes.

The predictors of utilization of LLINs among the rural respondents were the number of children in the households and the attitudes of the caregivers. Respondents with one child under five years have increased odds of utilizing LLNIs as compared with those with more than two children. In the same vein, those who have a positive attitude towards LLINs are about 5 times more likely to use it as compared with those with a negative attitude.

CONCLUSION

The ownership of LLINs among under-five caregivers was very low in both settlements, but the utilization was a little bit higher in rural settlements than in urban settlements. The predictors of LLIN ownership and utilization in both settlements have been highlighted and discussed.

Recommendations:

1. Social Behavioral Change Communication (SBCC) intervention is necessary. This can be achieved through different sources of information. SBCC will help to overcome all the complaints itemized by the under-five caregivers.
2. The number of under-five children in households should be determined before issuing out LLINs.
3. Attitudes about LLINs should be improved. It has been proved that LLINs are one of the safest and cheapest means of protecting against mosquito bites at home.

Conflict of interest: Non declared

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Table 1: Sociodemographic characteristics of respondents by place of residence. (n = 800)

Variable	Urban n=400 (%)	Rural n=400 (%)	Total N=800 (%)	χ^2	*p*-value
Age (years)					
= 20	11 (2.8)	20 (5.0)	31 (3.9)	7.228	0.124
21 – 30	168 (42.0)	147 (36.8)	315 (39.4)		
31 – 40	137 (34.3)	162 (40.5)	299 (37.4)		
41 – 50	58 (14.5)	50 (12.5)	108 (13.5)		
> 50	26 (6.5)	21 (5.3)	47 (5.9)		
Gender					
Male	83 (20.8)	64 (16.0)	147(18.4)	3.009	0.083
Female	317 (79.3)	336 (84.0)	653(81.6)		
Marital Status					
Single	16 (4.0)	13 (3.3)	29 (3.6)	0.929	0.819
Married	356 (89.0)	364 (91.0)	720 (90.0)		
Widow/Widower	19 (4.8)	15 (3.8)	34 (4.3)		
Separated/Divorced	9 (2.3)	8 (2.0)	17 (2.1)		
Relationship to the child					
Father	64 (1 6.0)	60 (15.0)	124 (15.5)	6.619[F]	0.147
Mother	314 (78.5)	329 (82.3)	643 (80.4)		
Uncle	6 (1.5)	1 (0.3)	7 (0.9)		
Aunty	3 (0.8)	4 (1.0)	7 (0.9)		
Others	13 (3.3)	6 (1.5)	19 (2.4)		
Mother	314 (78.5)	329 (82.3)	643 (80.4)		
Uncle	6 (1.5)	1 (0.3)	7 (0.9)		
Aunty	3 (0.8)	4 (1.0)	7 (0.9)		
Others	13 (3.3)	6 (1.5)	19 (2.4)		
Do you feel the heat at home?					
Yes	334 (83.5)	362 (90.5)	696 (87.0)	8.665	**0.003***
No	66 (16.5)	38 (9.5)	104 (13.0)		
Maintenance of cross ventilation					
Cross Ventilation	198 (49.5)	281 (70.3)	479 (59.9)	45.359	**<0.001***
Fan	191 (47.8)	101 (25.3)	292 (36.5)		
Air Conditioner	2 (0.5)	1 (0.3)	3 (0.4)		
Others	9 (2.3)	17 (4.3)	26 (3.3)		
Sources of lighting**					
Kerosene Lamp	49 (12.3)	62 (15.5)	111 (13.9)	1.768	0.184
Candle	18 (4.5)	26 (6.5)	44 (5.5)	1.539	0.215
Recharge lamp	303 (75.8)	265 (66.3)	568 (71.0)	8.766	**0.003***
Electricity/Solar	334 (83.5)	218 (54.5)	552 (69.0)	78.635	**<0.001***
Occupational status					
Farmer	37 (9.3)	53 (13.3)	90 (11.3)	12.733	**0.025***
Trader	183 (45.8)	175 (43.8)	358 (44.8)		
Artisan	100 (25.0)	108 (27.0)	208 (26.0)		
Civil servant	46 (11.5)	25 (6.3)	71 (8.9)		
Others	34 (8.5)	39 (9.8)	73 (9.1)		
Total monthly income (naira)					
= 30000	327 (81.8)	359 (89.8)	686 (85.8)		
>30000 – 40000	35 (8.8)	26 (6.5)	61 (7.6)	12.881	**0.005***
>40000 – 50000	27 (6.8)	10 (2.5)	37 (4.6)		
>50000	11 (2.8)	5 (1.3)	16 (2.0)		

Table 2: Overall ownership of LLINs among respondents, Respondents' number of LLINs possessed, reasons for non-ownership (N=800)

Variable	Urban n=400(%)	Rural n=400(%)	Total N=800(%)	χ^2	*p*-value
Ownership of LLINs for under-five children					
Yes	129 (32.3)	132 (33.0)	261 (32.6)	0.051	0.821
No	271 (67.8)	268 (67.0)	539 (67.4)		
Number of LLINs possessed (n=261)					
1	76 (58.9)	66 (50.0)	142 (54.4)	7.980	**0.019***
2 – 3	37 (28.7)	58 (43.9)	95 (36.4)		
> 3	16 (12.4)	8 (6.1)	24 (9.2)		
Possessions of LLINs for all your U-5 children (n=261)					
Yes	90 (69.8)	115 (87.1)	205 (78.5)	11.659	**0.001***
No	39 (30.2)	17 (12.9)	56 (21.5)		
The reason your household does not have LLINs**					
I just don't like it	17 (6.3)	14 (5.2)	31 (5.8)	0.274	0.601
It is too expensive	17 (6.3)	17 (6.3)	34 (6.3)	0.001	0.973
It is not available	194 (71.6)	212 (79.1)	406 (75.3)	4.097	**0.043***
No mosquito in the house	8 (3.0)	8 (3.0)	16 (3.0)	0.001	1.000
I missed it during public health campaign	29 (10.7)	40 (14.9)	69 (12.8)	2.154	0.142

χ^2: Chi-square test;

Table 3: Utilization of LLINs and reasons for not utilizing LLINs among respondents

Variable	Urban n=129(%)	Rural n=132 (%)	Total N=261 (%)	χ^2	*p*-value
Ever hang LLIN over the under-5 children last night					
Yes	79 (61.2)	103 (78.0)	182 (69.7)	8.714	**0.003***
No	50 (38.8)	29 (22.0)	79 (30.3)		
Inspection of LLINs					
Not seen	73 (56.6)	67 (50.7)	140 (53.7)	14.571	**0.002***
Seen, hanged	45 (34.9)	50 (37.9)	95 (36.4)		
Seen, not hanged	11 (8.5)	15 (11.4)	26 (10.0)		
Frequency of use of LLIN					
Once in a week	34 (26.4)	5 (3.8)	39 (14.9)		
Twice a week	3 (2.3)	2 (1.5)	5 (1.9)	30.493^F	**<0.001***
Irregularly	24 (18.6)	23 (17.4)	47 (18.0)		
Every night	68 (52.7)	102 (77.3)	170 (65.1)		
Reasons for non-use**					
I noticed that it produces heat	30 (49.2)	19 (63.3)	49 (53.8)		
I forgot to use it	14 (23.0)	2 (6.7)	16 (17.6)	1.621	0.203
It is not comfortable	43 (70.5)	14 (46.7)	57 (62.6)	3.680	0.055
It smells chemical	23 (37.7)	4 (13.3)	27 (29.7)	4.878	**0.027***
Ever inspect the LLINs regularly for effectiveness				5.724	**0.017***
Yes	76 (58.9)	97 (73.5)	173 (66.3)		
No	53 (41.1)	35 (26.5)	88 (33.7)	6.197	**0.013***
Steps taken when holes were found					
NA	21 (16.3)	5 (3.8)	26 (10.0)		
I discard it	59 (45.7)	61 (46.2)	120 (46.0)	12.360	**0.002***
I sew it	49 (38.0)	66 (50.0)	115 (44.1)		
Frequency of washing LLIN					
I never washed it before	73 (56.6)	71 (53.8)	144 (55.2)		
Monthly	29 (22.5)	41 (31.1)	70 (26.8)	3.655	0.301
Bi-monthly	16 (12.4)	14 (10.6)	30 (11.5)		
Less frequently	11 (8.5)	6 (4.5)	17 (6.5)		

χ^2: Chi square test; F: Fisher's exact test; *: *p*-value <0.05; **: Multiple responses allowed

Table 4: Predictors of ownership of LLINs in Urban using binary logistic regression (multivariable analysis)

Variable	B	*p*-value	OR (95% CI)
Number of under-five children under the care			
1	0.380	0.120	1.462 (0.906 – 2.360)
2	-1.065	0.062	0.345 (0.113 – 1.055)
> 2 REF			1
Source of water			
River	21.676	0.999	1.700 (0.606 – 4.768)
Ever had about LLINs			
Yes	2.209	0.852	1.110 (0.153 – 3.537)
No REF			1
Source of information			
Health workers	0.812	**0.005***	2.252 (1.274 – 3.978)
Religious centre	1.107	0.058	3.026 (0.962 – 9.515)
Knowledge of LLINs			
Poor REF			1
Fair	0.234	0.805	1.263 (0.199 – 8.033)
Good	0.040	0.874	1.041 (0.633 – 1.713)

B: Coefficient of Binary logistic regression; OR: Odds ratio;
95% CI: 95% Confidence Interval Predictive value: 78.8%; R^2: 0.371

Table 5: Predictors of ownership of LLINs in rural using binary logistic regression (multivariable analysis)

Variable	B	*p*-value	OR (95% CI)
Age			
= 20	0.832	0.261	2.297 (0.538 – 9.808)
21 – 30	-0.038	0.945	0.963 (0.328 – 2.822)
31 – 30	0.751	0.169	2.120 (0.728 – 6.177)
41 – 50	0.596	0.327	1.814 (0.552 – 5.963)
> 50 REF			1
Ever have a separate kitchen in the room you sleep			
Yes	-1.298	**0.003***	0.273 (0.116 – 0.642)
No REF			1
Source of information			
Friends	-0.608	**0.034***	0.544 (0.310 – 0.954)
Ever heard about LLINs			
Yes	1.506	**0.003***	4.509 (1.679 – 12.105)
No REF			
Knowledge of LLINs			
Poor REF			1
Fair	1.175	0.184	3.239 (0.573 – 18.322)
Good	1.751	**0.042***	5.759 (1.062 – 31.240)
Attitude to LLINs			
Positive	0.783	**0.006***	2.188 (1.256 – 3.811)
Negative REF			1

B: Coefficient of Binary logistic regression; OR: Odds ratio;
95% CI: 95% Confidence Interval Predictive value: 67.1%; R^2: 0.156

Table 6: Predictors of utilization of LLINs in Urban using binary logistic regression (multivariable analysis)

Variable	B	*p*-value	OR (95% CI)
Knowledge of LLNIs			
Poor [REF]			1
Good	0.987	0.068	2.682 (0.929 – 7.745)
Attitude to LLINs			
Positive	1.596	**0.039***	4.935 (1.088 – 22.389)
Negative [REF]			1

B: Coefficient of Binary logistic regression; OR: Odds ratio; 95% CI: 95% Confidence Interval Predictive value: 90.9%; R^2: 0.246

Table 7: Predictors of utilization of LLINs in rural using binary logistic regression (multivariable analysis)

Variable	B	*p*-value	OR (95% CI)
Age			
= 20	2.826	0.129	1.871 (0.439 – 4.309)
21 – 30	0.295	0.846	1.343 (0.068 – 2.370)
31 – 30	-0.671	0.655	0.511 (0.027 – 9.696)
41 – 50	-0.327	0.840	0.721 (0.030 – 1.436)
> 50 [REF]			1
Number of under-five children under the care			
1	0.218	**0.021***	1.296 (0.105 – 8.030)
2	-0.723	0.556	0.486 (0.044 – 5.369)
> 2 [REF]			1
Educational status			
No formal education	0.138	0.804	1.148 (0.387 – 3.405)
Primary	-20.161	0.999	0.933 (0.294 – 2.957)
Secondary	-0.588	0.355	0.555 (0.160 – 1.930)
Higher institution [REF]			1
Knowledge of LLINs			
Poor [REF]			1
Fair	19.411	0.998	1.692 (0.243 – 3.489)
Good	20.822	0.999	1.103 (0.898 – 3.060)
Attitude to LLINs			
Positive	1.526	**0.049***	4.598 (1.008 – 10.969)
Negative [REF]			1

B: Coefficient of Binary logistic regression; OR: Odds ratio; 95% CI: 95% Confidence Interval Predictive value: 80.6%; R^2: 0.416