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# Post distribution assessment of ownership and usage of long lasting insecticide treated nets in households in Anambra East LGA in Nigeria

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## KeyWords

*Long Lasting Insecticide treated nets, households, Anambra East LGA, Malaria,*

## ABSTRACT

To achieve universal coverage and usage of Long-Lasting Insecticide-treated Nets (LLIN) as a vector control intervention for malaria elimination, the Government of Anambra State distributed free LLIN in the State during the net distribution campaign in 2014. The aim of this study was to determine the level of ownership and usage of LLIN in households after the distribution campaign in Anambra East Local Government Area. A cross-sectional descriptive study in which a modified WHO cluster sampling technique was used to select 358 households across the seven communities in Anambra East Local Government Area for the study. Data was collected through a semi structured questionnaire and the data were analyzed using SPSS 20.0 and presented in frequencies and percentages while Chi-square statistics was used to test the null hypothesis at 0.05 level of significance. A total of 325 (90.8%) households received at least one LLIN from the distribution campaign and 115 (35.4%) households used the LLIN the night before the study. Among the respondents that slept under the LLIN the previous night, 20% were children under 5 years while 13.9% were pregnant women and other general populations were 66.1%. There is an association between LLIN ownership and usage ( $P<0.05$ ). Age and educational level of respondents have no association with ownership of LLIN ( $P>0.05$ ) but educational level contributes to the association between LLIN usage in the previous night ( $P<0.05$ ). This shows that the distribution campaign contributed to the increasing percentage of LLIN ownership and usage in Anambra East LGA.

## MAIN PAPER STARTS HERE...

### INTRODUCTION

Long Lasting Insecticide Treated Net (LLIN) is a factory treated net impregnated with an insecticide that is cleverly bound within the fibers that make up the netting and is 'slow released' over a 4 – 5 year period hence 'long lasting'.<sup>9</sup> Over the past decade, valiant efforts have been made to control malaria through recommended vector control interventions LLINs which are critical for reducing malaria transmission, morbidity and mortality.<sup>7</sup> LLINs are used to prevent mosquitoes from transmitting malaria while having a blood meal due to its high knock out effect and strong excito-repellant effects on anopheles. In Nigeria, the Insecticide Treated Nets (ITNs) program precedes the LLINs but unlike the LLINs, ITNs are re-treated every year with insecticides.<sup>20</sup> and its currently considered the most cost-effective method of malaria prevention in highly endemic areas and the main method of malaria prevention employed in Nigeria.<sup>9</sup>

According to the World malaria report 2017, the global burden of malaria mortality is dominated by countries in sub-Saharan Africa, with Nigeria accounting for the highest proportion of cases globally (27%), followed by the Democratic Republic of the Congo (10%).<sup>2</sup> Malaria accounts for about 60% of outpatient visits and 30% of hospitalizations in Nigeria.<sup>11</sup> It is estimated that about half the population of Nigerian adults suffer from at least one episode of malaria annually while children under five years usually experience as many as three or four episodes every year and malaria exacts a heavy burden on the poorest and most vulnerable communities.<sup>12</sup> However, children under five years of age and pregnant women are the most vulnerable to illness and death from malaria infection in Nigeria.<sup>6</sup> Among children, malaria has high rates of mortality and even when not fatal, it can affect nutrition and growth. Among pregnant women, the disease adversely affects birth outcomes and can lead to spontaneous abortion, pre-term labour, low birth weight, and stillbirth. This has contributed to an estimated 11% of maternal mortality, 25% of infant mortality, and 20% of under-five mortality.<sup>11</sup> Pregnant women and children are populations of particular interest to reduce the burden of malaria and preventing malaria among pregnant women and children is a key step in reducing malaria-related morbidity and mortality.<sup>10</sup> Available evidence suggests that in addition to its direct health impact, malaria imposes a heavy social and economic burden on Nigerians, amounting to a loss of about US \$55 billion per annum, or 12.0% of gross domestic product.<sup>14</sup> Since the adoption of the universal distribution campaign in 2009, over 58 million LLINs have been distributed through the universal distribution campaign to protect an estimated 29 million households in Nigeria.<sup>2,6</sup> Previous studies by Kilian A.<sup>15</sup> and Egbuche et.al.<sup>16</sup> in Anambra State have shown that the percentage of net retention and usage decreases over time. The Anambra State evaluation of the distribution campaign of long lasting insecticide-treated nets in 2009 by Kilian A. showed that 76.1% of households owned at least one net, only 41.9% used the nets the previous night.<sup>15</sup> Also, a study by Egbuche et al<sup>16</sup> in 2013 on malaria prevalence and use of Insecticide-Treated Net among community members in Aguleri showed that 74% of households owned at least one net while only 19.9% of households used the net the previous night. According to the Nigerian National Demographic Health Survey (NDHS) 2013, Anambra has 45.4% of households with at least one net which is below the 100% National Malaria Elimination Programme (NMEP) universal target of LLIN ownership in Nigeria. The average number of net per household is 0.7% and percentage of households with at least one net for every two persons who stayed in the household is 17.7%.<sup>17</sup>

The use of long lasting insecticide-treated nets is currently considered the most cost-effective method of malaria prevention in highly endemic areas and it is the main method of malaria prevention employed in Nigeria.<sup>9</sup> In Anambra State, the long lasting insecticide-treated net distribution campaign was done from the 29<sup>th</sup> October 2014 with over 3.4 million Long Lasting Insecticide-treated Nets (LLINs) distributed to various households in the State and scale up the National Malaria Elimination Programme mixed model for continuous distribution to supplement campaigns and maintain universal coverage for replacement of the LLINs that were distributed in 2009 since the life span of every LLIN is 4 – 5 years.<sup>11,18</sup> Previous studies before the distribution campaign in 2014 have shown that although net ownership is increasing, LLIN coverage is below the 100% universal coverage target and there is very low percentage usage of the net in Anambra State.<sup>6,15-17</sup> After the 2014 LLIN distribution campaign in Anambra State, the Nigeria Malaria Indicator Survey 2015 showed that there is an increase in the percentage of households ownership of LLIN and its usage among household members especially children under 5 years and pregnant women when compared with the Nigeria Demographic Health Survey 2013 which was carried out before the distribution campaign. Since the percentage of net retention and usage decreases over time and the life span of the LLIN is 4–5 years depending on the number of washing, the objectives of this study was to determine the proportion of LLIN ownership and its level of usage among household members after 3 years of the distribution campaign in Anambra East LGA of Anambra State. Also, the study was to identify the factors affecting LLIN usage and the reasons for non-adherence to the use of LLIN in Anambra East LGA that has a high malaria prevalence of 67%.<sup>16</sup>

**Null hypothesis:** There is no association between the proportion of LLIN ownership and the factors that affect its usage in Anambra East LGA, Anambra State, Nigeria.

**Alternate hypothesis:** There is an association between the proportion of LLIN ownership and the factors that affect its usage in Anambra East LGA, Anambra State, Nigeria.

## MATERIALS AND METHODS

**Study area:** The study was conducted in Anambra East LGA, Anambra State, Nigeria. Anambra East LGA is one of the 21 Local Government Areas in Anambra State and its located in Latitude 6°21'N and Longitude 6°53'E with its headquarters in Otuocho. Anambra East LGA has a projected population of 216,051 consisting of 29,852 males and 28, 725 females using a growth rate of 3.5 percent in 2017.<sup>29</sup> The climatic condition of the area is characterized by two distinct seasons, the wet and the dry seasons, the former takes place between April and October, while the latter occurs from November to March. The LGA is bounded by Ayamelum and Awka North LGAs to the north, Onitsha North LGA to the south, Oyi LGA to the east and Anambra West LGA to the west.<sup>29</sup> The area has major water bodies and the majority of the inhabitants are farmers and petty traders, with few civil servants, students, and other professionals.

**Study design:** This was a cross-sectional descriptive study of ownership and usage of Long Lasting Insecticide Nets (LLIN) in households in Anambra East LGA three years after the distribution campaign in Anambra State.

**Study population:** The study population was comprised of households living in all the seven communities in Anambra East Local Government Area of Anambra State i.e. Aguleri, Igbariam, Nando, Nsugbe, Otuocho, Umueri and Umuoba Anam communities.

**Inclusion criteria:** Households in which members resided in the communities during the distribution of LLIN in 2014 and in which the household head consented to the study.

**Exclusion criteria:** Households with less than 2 persons because of the National Malaria Strategic Plan 2014 – 2020 which defined universal coverage as one LLIN for every two persons.<sup>6</sup>

**Sample size determination:** The sample size was determined according to Cochran<sup>30</sup> using the formula:  $n = \frac{z^2pq}{d^2}$  where the population size is >10,000 at 95% confidence limits and a prevalence of 67% based on previous study.<sup>16</sup>

$$\text{Therefore, } n = \frac{1.96^2 \times 0.67 \times 0.33}{0.05^2} = \frac{0.8494}{0.0025} = 339.76 \approx 340$$

Addition of 10% attrition rate of the sample size (34), a total of **374 respondents/households** were selected from the communities for the study.

**Sampling technique:** A modified WHO cluster sampling technique was used to select households in all the 7 communities in Anambra East LGA of Anambra State in Nigeria. A bottle was spun at the center of the cluster of households and the direction of the bottle-neck when it stopped spinning was where the household interview started. Households that met the inclusion criteria were selected consecutively until the sample size for each cluster was achieved. The household head was interviewed and in the absence of the household head, an adult caregiver was interviewed.

**Data collection methods:** A pre-tested semi-structured interviewer-administered questionnaire adapted from the Evaluation of the distribution campaign of Long Lasting Insecticide Nets in August 2009, Anambra State, Nigeria<sup>15</sup> was used in this study. The composite questionnaire collected information on socio-demographic characteristics, household characteristics, LLIN ownership, and LLIN usage

**Ethical consideration:** The research protocol was reviewed and approved by the Ethics Committee of Nnamdi Azikiwe University Teaching Hospital, Nnewi, Anambra State. All respondents were notified about their right to participate and/or withdraw at any point they wish during the study without explanation and their consents were duly obtained.

## RESULTS

**Table 1: Demographic Characteristics of Respondents**

Variable	Frequency	Percent (%)
<b>Age</b>		
21 - 30 Years	19	5.3
31 - 40 Years	62	17.3
41 - 50 Years	103	28.8
51 – 60 Years	174	48.6
<b>Sex</b>		
Male	231	64.5
Female	127	35.5
<b>Ethnic group</b>		
Igbo	357	99.7
Others	1	0.3
<b>Religion</b>		
Christianity	310	86.6
Others	48	13.4

The mean age of the respondents is  $48 \pm 8.9$  years with a higher percentage of 48.6% of the respondents above 50 years. 99.7% of the respondents are Igbo while 86.6% are Christian.

**Table 2: Education level of Respondents**

Variable	Frequency	Percent
<b>Household head ever attended school</b>		
Yes	307	85.8
No	51	14.2
<b>Highest level of education</b>		
Primary	140	45.6
Secondary	108	35.2
Tertiary	59	19.2

The table above showed that 85.8% of the respondent has ever attended school and 14.2% did not attend formal education. Among the respondents that have ever attended formal education, 45.6% attained primary education while 35.2% attained secondary education and 19.2% attained tertiary education.

**Table 3: LLIN distribution and Ownership pattern**

Variable	Frequency	Percent
<b>Household received LLIN at the distribution point during the campaign</b>		
Yes	325	90.8

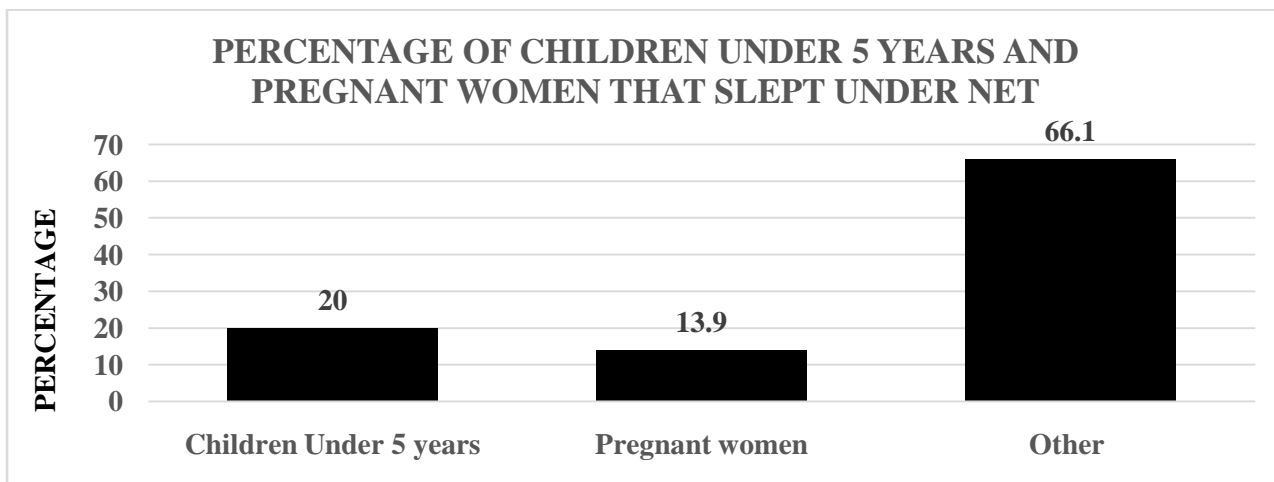
No	33	9.2
<b>Number of LLIN received from the campaign</b>		
1	62	19.1
2 – 3	193	59.4
> 3	70	21.5

The average number of LLIN per household = 2.59.

**Table 4: LLIN usage**

Variable	Frequency	Percent
<b>Household member slept under the net the previous night</b>		
Yes	115	35.4
No	210	64.6
<b>LLIN usage per community</b>		
Nando	10	8.7
Umuoba Anam	15	13.0
Aguleri	25	21.7
Umueri	15	13.0
Otuocha	17	14.8
Igbariam	12	10.4
Nsugbe	21	18.3

From the table above, 35.4% of the respondents slept under the net the previous night which is below the NMEP target of 80%. However, among the 7 communities under study, Aguleri has the highest percentage of LLIN usage (21.7) the previous night and Nsugbe has 18.3% while Nando has 8.7% usage of LLIN the previous night.



**Figure 1: Percentage of children under 5 years and pregnant women who slept under the net the previous night**

The above figure shows that of the 115 persons that slept under the LLIN the previous night, 23 (20%) were children under 5 years, 16 (13.9%) were pregnant women while 76 (66.1%) were other members of the household that are neither under 5 years nor pregnant.

**Table 5: Association between LLIN Usage and Ownership, Age, Education Level, and Duration before handing**

Variable	LLIN Usage		X <sup>2</sup>	P-Value
	YES	NO		
<b>Household ownership of LLIN</b>				
Yes	115	210	17.203	0.001*
No	0	33		
<b>Age</b>				
21 - 30 Years	3	12	6.698	0.82
31 - 40 Years	23	36		
41 - 50 Years	41	52		
51 – 60 Years	48	110		
<b>Household head ever attended school and received LLIN</b>				
Yes	109	171		
No	6	39	11.108	0.001*
<b>Highest level of education attained</b>				
Primary	55	71	6.763	0.034*
Secondary	30	73		
Tertiary	24	27		
<b>Duration of LLIN in the household before hanging</b>				
Less than 1 week	115	196	8.012	0.018*
1 week - 1 month	0	13		
Have not hung the net yet	0	1		

\* = Significant

Table 5 above shows that there is a statistically significant association between net ownership and its usage ( $X^2 = 17.203$ ,  $P = 0.001$ ). Also, out of the 280 respondents that ever attended school and received LLIN, 109 respondents used the LLIN the previous night and there is a statistically significant association between the net usage and school attendance ( $X^2 = 11.108$ ,  $P = 0.001$ ) and the highest level of education attended by the respondent ( $X^2 = 6.763$ ,  $P = 0.034$ ). Lastly, there is a statistically significant association between net usage and the duration before hanging ( $X^2 = 8.012$ ,  $P = 0.018$ ) as most respondents that hung their net initially made use of the nets. However, the table shows that there is no statistically significant association between the age of the respondent and net usage ( $X^2 = 6.698$ ,  $P = 0.82$ ).

**Table 6: Reasons for non-adherence to net usage**

Variable	Frequency	Percent
<b>Reason for non-adherence to use of LLIN</b>		
No mosquito	37	17.6
Too hot	123	58.6
Net too old or torn	47	22.4
Too tired	3	1.4

The table above shows that the major reasons for non-adherence to LLIN usage are due to the climate condition which caused the nets too hot during usage (58.6%). Other reasons for non-adherence to net usage include the physical integrity of the net (22.4%), perception of no mosquito in the house (17.6%) and respondents were too tired (1.4%) to hang the LLIN the previous night.

## DISCUSSION

The study showed that the education level of the study population has 85.5% of respondents with formal education which is similar with the NDHS 2013 that showed high percentage of school attendance in the southeast geopolitical zone in Nigeria compared with the Northern region.<sup>17</sup> and the study of Ifezulike CC. in 2015 showed that majority the respondents in Aguleri attained secondary levels.<sup>31</sup> The registration rate for the distribution campaign was high which led to the 90.8% registration of respondents which is close to other distribution campaigns in Anambra and Nasarawa States that recorded 80% and 72.4% respectively.<sup>15,24</sup>

The free distribution campaign has contributed significantly to the coverage and ownership of LLIN in the households and has led to equity in ownership of nets for the range of 1–5 nets per household.<sup>32</sup> The increase in the percentage of household with at least one LLIN from 45.4% in NDHS 2013 to 90.8% in the study population negates the Global Malaria Action Plan of rapid scale-up to universal population coverage for all people at risk for malaria.<sup>5,18</sup> Although ownership of LLIN in the study population was below the National Malaria Elimination Programme target of 100% which is similar to the findings of the World malaria report<sup>2</sup> and the NDHS 2013<sup>17</sup> which showed that Nigeria and Anambra State have 47% and 45.4% LLIN ownership respectively. However, when this study is compared to the previous evaluation of the LLIN distribution campaign in Anambra State<sup>15</sup>; it showed an improvement in household ownership of at least one LLIN from 84.9% to 90.8% and this can be attributed to the free distribution campaign was done for all the general population. Also, the study showed that there was an average of 2.59 LLIN per household, which was an increase compared with the average of 0.7 LLIN per household in Anambra State and an average of 1 LLIN per household according to NDHS 2013.<sup>17</sup> These findings are in line with Aderibigbe et.al.<sup>3</sup> where there was a statistically significant difference in the proportion of households with two or more LLIN post-campaign. The retention of the long lasting insecticide-treated nets in Anambra East LGA remains as high as 84% three years after distribution campaign. This was determined by the number of nets that were observed in the households and it is in line with previous post-distribution surveys in Nigeria which reported a high retention rate of LLIN in households.

The hanging rate of LLIN showed that 95.7% of households hung at least one LLIN from the campaign within one week of receiving it and 55.6% of campaign nets were found hanging over the beds at the time of the study. This trend of depreciation in hanging rates over time is similar to the Evaluation of the Distribution Campaign of Long-Lasting Insecticidal Nets in August 2009, Anambra State, Nigeria. by Kilian et.al.<sup>15</sup> which reported that 77% of households LLINs were hung within one week of distribution and a reduction in the proportion of LLINs found hung during the survey to 61.1%.

The study results indicate that 35.4% of the respondents slept under the LLIN the previous night before the study. This is less the universal utilization target of 80% as reported in studies carried out in Anambra, Abia and Cross River States and Ethiopia.<sup>16,28,33,34</sup> Other surveys that show a low utilization rate in line with this study include NDHS 2013 (9.5%) and WHO and NMSP reports (13%)<sup>6,7,16</sup>. However, the utilization rate of 35.4% from the index study was much higher than that reported in the NDHS 2013 for Anambra State (9.5%) and the World Malaria report (13%).

The previous study shows that malaria in pregnancy is still a major health issue in Nigeria, accounting for about 33% of the cause of maternal death<sup>25</sup>. Among the pregnant women in the study area, 13.9% of pregnant women slept under the LLIN the previous night which is similar to the NDHS 2013 report that 13.8% of pregnant women in Anambra State used LLIN the previous night. Despite the free distribution of LLIN during antenatal clinics, the 13.9% usage of LLIN among pregnant women is less compared with the 16% and 19.2% usage among pregnant women as reported by the World malaria report<sup>2</sup> and Ezire et.al.<sup>25</sup> respectively. However, when compared with the study by Aribodor DN<sup>35</sup> in Onitsha which reported 79.4% usage among pregnant women, the difference could be attributed to the public enlightenment on the use of LLIN during ANC visit.

Furthermore, the study showed that 64.6% of respondents that received LLIN did not use it the previous night before the study and 58.6% of such respondents reported that the reason for non-adherence to usage was because the net was too hot to sleep under. This is similar to the reason for 44.7% non-adherence to LLIN usage.<sup>28</sup> Also, 22.4% said that the net was too old and torn while 17.6% did not sleep under the net because they believed there were no mosquitoes in their homes. The proportion of respondents that stated that the nets were too hot to sleep in were much higher in this study (58.6%) compared to a similar study by Ezeigbo O. in Abia State in 2016 which showed 44.7% stated that the nets were too hot. This could be attributed to the duration of the study as the index study was done during the dry seasons which are generally hotter.

Education level of the respondents and the duration of LLIN in the households before hanging are some of the potential factors that have statistical significant association ( $P < 0.05$ ) with the usage of LLIN in the study area which is in line with the Evaluation report in 2009.<sup>15</sup> This correlates with Ifezulike C. 2015<sup>31</sup> study that 85% of their studied group in Anambra East LGA used nets because of the positive influence of their educational level. Also, a statistically significant association was found between increasing levels of educa-

tion and adequate utilization of the ITN among caregivers of children under 5 years in Kuje Area council of the Federal Capital Territory Abuja, Nigeria.<sup>36</sup>

Finally, there is a statistically significant association between net ownership and usage in the study is contrary to the report by Ezire et.al<sup>25</sup> that owning more than one LLIN per household was not significant in the use of an LLIN by pregnant women due to the low utilization rate among pregnant women.

## Conclusion

It is evident that the long lasting insecticide-treated net distribution campaign in 2014 contributed significantly to the increase in proportion of households that own LLIN in Anambra East LGA and the LLIN usage have statistically significant association ( $P < 0.05$ ) with LLIN ownership despite the decrease in the level of its usage among households members after 3 years distribution campaign. The factors that affect the LLIN usage among households in Anambra East LGA especially children under 5 years and pregnant women include the LLIN ownership, education level of household head and caregivers and the duration of LLIN in households before hanging. Finally, lack of motivation, climate condition, the physical integrity of the LLIN and perception of the respondents that there is no mosquito at night are reasons for non-use or inconsistent use of LLIN among households in Anambra East LGA.

It is recommended that LLIN should be readily available in all health facilities and distributed free of charge as this is likely to encourage the large population to own and use it. This is evident by the fact that usage of LLIN in the study area was dependent on LLIN ownership ( $P < 0.05$ ) and there is need for continuous sensitization and awareness of the general population through behavioural change and communication on the anti-malarial significance of LLIN and its usage of LLIN during the wet season and dry season respectively. There is an urgent need for further research and more studies especially the community-based content on the barriers to sustained use and acceptability of LLIN by households in various parts of the country and the quality control over the durability of the LLIN.

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