LEVEL OF AWARENESS, ACCESS AND USE OF LONG LASTING INSECTICIDAL NETS (LLINs) IN FIVE PUBLIC HEALTH CENTRES WITHIN KADUNA METROPOLIS

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ABSTRACT
A cross sectional study designed to assess the difference in level of Awareness, Access and Use of Long Lasting Insecticidal Nets (LLINs) from consenting pregnant women aged between 15 to 40 years attending routine ante-natal clinic sessions at Kaduna State University (Barau Dikko) Teaching Hospital, General Hospital Kawo, Primary Health Care Badarawa, Primary Health Care Angwan Romi and General Hospital Sabon Tasha. A total of 360 questionnaires were distributed, but only 308 returned completed. Also, mosquito samples were collected in 30 randomly selected households of the consenting pregnant women that were within three kilometer radius range of the antenatal clinic for 12 weeks’ period. A one-way ANOVA was conducted using SPSS statistical package version 22. The result revealed that there was no significant difference (P> 0.05) in level of Awareness (92.53%), Access (75.32%) and Use (67.86%) of Long Lasting Insecticidal Nets (LLINs) among the pregnant women attending the various ante-natal hospitals/primary health care facilities. A total of 344 larvae samples were encountered and identified as Culex species 259(75.29%) and Aedes species 85(24.71%). Awareness, Access and Use of LLINs is relatively similar, while the mosquito species are vectors of Filariasis, Yellow fever, Dengue fever and can be prevented by the use of LLINs.

Keywords: Kaduna Metropolis, LLINs Awareness, Access and Use, Mosquito Preventive Measures.

INTRODUCTION
Long Lasting Insecticidal Nets (LLINs) are effective in the prevention of malaria, (WHO, 2005). Malaria is a life-threatening disease caused by protozoan, plasmodium parasite transmitted via an infected female Anopheles mosquito from one person to another (WHO, 2017). About 3.2 billion people were at risk of the disease in 97 countries, territories and areas in 2018, and an estimated 228 million cases occurred. Currently, the disease killed about 405, 000 people, mostly children aged under 5 years in sub-Saharan Africa, (WHO, 2019).

The disease remains endemic in all six WHO regions and the burden is heaviest in the African region, where an estimated 90% of all malaria deaths occur. Two countries – the Democratic Republic of the Congo and Nigeria – account for about 40% of estimated mortality due to malaria worldwide (WHO, 2019). Around the world, millions of people remain without access to malaria prevention and treatment, and most cases and deaths go unregistered and unreported. Given the projected growth in the size of the world’s population by 2030, more people will be living in countries where malaria is a risk, putting further strain on health systems and national malaria programme budgets, (WHO, 2016). Reports indicates that 578 million Insecticide-Treated Mosquito Nets (ITNs) also called Long Lasting Insecticidal Nets (LLINs) were distributed between 2016 and 2018 in the African region, with 10% of these nets in ante-natal care facilities, (WHO, 2019).

LLINs was introduced in Nigeria as an effective means of preventing mosquito bites, malaria infection and reducing associated morbidity and mortality, particularly in endemic areas, (Okoye and Isara, 2011). Nigeria, which has a tropical climate, with its high average annual rainfall provides ideal conditions for mosquito breeding and malaria transmission throughout the country, (NiMET, 2016). The country has the highest malaria burden in the world and the disease is one of the top causes of morbidity and mortality nationally thus; it led to the distribution of 24 million Insecticide-Treated Nets (ITNs) and nine million Artemisinin-based Combination Therapy (ACT) treatment courses distributed in 2016, (Global Fund, 2018). Presently there are reports that about 11 million pregnant women were exposed to malaria infections in 2019 due to non-use or improper use of insecticide-treated mosquito nets, (WHO, 2019).

According to a report in 2015, Kaduna state Archdiocesan Catholic Health Care Initiative (ACHI) in collaboration with Christian Aid Nigeria, distributed 15,000 LLINs to some communities in Kajuru local government area. The gesture was aimed at complementing the state government’s efforts towards eradicating malaria in the state, (ACHI, 2015). The Malaria Control Unit in Kaduna State stated that, “Malaria is preventable and curable; however, it is still a major cause of deaths in children under five years, pregnant women, HIV/AIDS patients and non-immune migrants, all of which are more susceptible to the disease” (MCU Kaduna, 2017).

The objectives of reducing the disease burden and eliminating malaria are in tandem to several of the sustainable development goals, (Anonymous, 2018). Pregnancy reduces a woman’s immunity, making pregnant women more susceptible to...
malaria infection and increasing the risk of illness, anaemia, severe disease and death, (Okeibunor et al., 2012). For the unborn child, maternal malaria increases the risk of spontaneous abortion, stillbirth, premature delivery and low birth weight – a leading cause of child mortality, (WHO, 2018). Evidence shows that in malaria-endemic areas, sleeping under mosquito nets treated with an insecticide is beneficial to the health of the pregnant woman, her fetus and the newborn infant, (Oyedeji et al., 2009; Adeogun et al., 2012; Ezeigbo et al., 2016). Long-Lasting Insecticidal Nets (LLINs) are designed to maintain their effectiveness against mosquitoes that carry malaria and other diseases for at least three years. They have been identified as a relatively cheap and acceptable method of reducing malaria cases but several individuals and regions have factors that determine compliance and effective use of these nets (WHO, 2018).

Although LLINs enables reduction in malaria cases and mortality; the problem of non-use, availability and mosquito insecticide resistance remains a major challenge to the fight against malaria, (Corbel et al., 2010; WHO, 2018). Household ownership of at least two LLINs, prevention and treatment of malaria in pregnancy is one of the three core interventions of National Malaria Control Strategic Plan which focuses on the objective of increasing LLIN use to 80%, (FMoH, 2014).

The ownership and utilization of LLINs vary among individuals and communities; hence the need to ascertain the level of awareness, ownership, maintenance and utilization of LLINs among susceptible population of pregnant women attending antenatal clinic in selected Primary Health Care Units and General Hospitals within Kaduna metropolis. This is with the view to increase possession and use of ITNs or long-lasting insecticidal nets (LLINs), especially among children under 5 years and pregnant women, thereby reducing malaria cases and mortality.

Thus, the study aimed at assessing compliance with the level of use of LLINs during pregnancy and also to encourage compliance or the use of LLINs in house-holds, thereby reducing malaria burdens and death in Kaduna metropolis.

MATERIAL AND METHODS

Study area.
The study was conducted at five selected government health care units across the three local government areas (Chukun, Kaduna North and Kaduna South) make Kaduna metropolis. The health facilities chosen were; Kaduna State University (Barau Dikko) Teaching Hospital (10.5102°N; 7.4405667°E), here referred to as KASU BDTH; General Hospital Kawo (10°58′21.052″N; 7°45′62.87″E), here referred to as GENH KAWO; Primary Health Care Badarawa; (10˚33′34.2N; 7˚27′13.32E), here referred to as PHC BADW; Primary Health Care Angwan Romi (10°92′56.5″N; 8.01900°) here referred to as PHC ROMI; and General Hospital Sabon Tasha (10.43479°; 7.41821°), here referred to as GENH SABO;  (Fig.1).

Kaduna metropolis is located in a tropical continental climate with distinct wet and dry seasons. The metropolitan vegetation comprising savannah grassland with scattered trees and woody shrubs, (Ndabula et al., 2014).

Fig.1. Kaduna Metropolis. (Source. 2018 www.linkbola.co; ganajosiah@gmail.com)
Sampling.
Sampling using designed cross sectional study questionnaires was conducted from February 2017 – November 2017. Each month 40 questionnaires were distributed to consenting pregnant women aged between 15 to 40 years who were attending routine ante-natal clinic sessions at any of the above health facilities. Also sampling of mosquito larvae according to (Adebote et al., 2006) was conducted randomly at five houses each within 3 kilometre radius of any of the health centre. The mosquito larvae were collected using plastic rubber soup ladle of 8cm in diameter, 30cm long from stagnant or standing waters in pools, gutters or house hold containers. The immature stages were separated into larvae and pupae, then poured through a fine sieve of 0.5mm mesh size to concentrate them. They were then preserved in 70% ethanol in covered labeled specimen tubes. (Service, 1976). All samples were carefully transported to the laboratory of Department of Biological Sciences Kaduna State University, Kaduna for identification. Identification of mosquito larvae was done to genus level only using the Olympus dissecting microscope with objective lens of 10X and 20X with the guide of the pictorial keys by Hopkins (1952) and Gillies & Coetzee (1987). The species identified and set at 0.05 level of significance using SPSS statistical package version 22 to reveal significant difference in level of Awareness, Access and Use of Long Lasting Insecticidal Nets (LLINs) among pregnant patients attending five health care facilities in Kaduna metropolis. Also, percentages shown in bar charts and a table were used to express the socio demographic information of the respondents.

Ethical consent.
All participants provided informed consent for participation in this research. The study was considered and approved by Students’ Project Committee, Department of Biological Sciences Kaduna State University and the Barau Dikko Teaching Hospital Health Research Ethics Committee (BDTH HREC); Kaduna State University on behalf of the Kaduna State Ministry of Health and Human Resources, (See attached as appendix A).

Statistical Analyses.
A one-way ANOVA was conducted at 0.05 level of significance using SPSS statistical package version 22 to reveal significant difference in level of Awareness, Access and Use of Long Lasting Insecticidal Nets (LLINs) among pregnant patients attending five health care facilities in Kaduna metropolis. Also, percentages shown in bar charts and a table were used to express the socio demographic information of the respondents.

RESULTS
A total of 360 questionnaires were distributed only 308(85.55%) returned completed, (Table 1). The socio-demographic characteristics revealed the highest (31.81%) number of the respondents to be in age bracket 20 to 24 years; while the least (9.09%) were aged between 35 to 40 years. Respondents’ level of education and occupational status varied across the five health facilities; with primary education level (38.96%) being prevalent followed by secondary education (31.82%). Pregnant women civil servants (21.75%) attended antenatal care more at KASU BDTH than any of the other facilities, (Table 1).

The mosquito larvae encountered and identified from the 30 house-holds of selected or consenting respondents who reside about 3 Km radius to the PHC facility or Hospital revealed only two species. Culex species (74.3%) was more prevalent than Aedes species (24.7%). Anopheles species which transmits malaria parasites was absent during the period of study, (Table 2).

The level of Awareness, Access and Use of LLINs by age groups and across the five health centres are expressed as shown in the figures below, (Figures 1 & 2).

Table 1. Socio-demographic characteristics of respondents in the five health centres within Kaduna metropolis.

<table>
<thead>
<tr>
<th>Age (Years)</th>
<th>KASU BDTH (%)</th>
<th>GEN KAWO (%)</th>
<th>H PHC BADW (%)</th>
<th>PHC ROMI (%)</th>
<th>GEN SABO (%)</th>
<th>H Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>15-19</td>
<td>05(6.41)</td>
<td>18(30.00)</td>
<td>08(14.81)</td>
<td>03(5.67)</td>
<td>05(7.94)</td>
<td>39(12.66)</td>
</tr>
<tr>
<td>20-24</td>
<td>19(24.36)</td>
<td>19(31.67)</td>
<td>21(38.89)</td>
<td>20(37.74)</td>
<td>22(34.92)</td>
<td>101(32.47)</td>
</tr>
<tr>
<td>25-29</td>
<td>18(23.08)</td>
<td>10(16.67)</td>
<td>10(18.52)</td>
<td>21(39.62)</td>
<td>18(28.57)</td>
<td>77(25.00)</td>
</tr>
<tr>
<td>30-34</td>
<td>26(33.33)</td>
<td>08(13.33)</td>
<td>11(20.37)</td>
<td>08(15.09)</td>
<td>14(22.22)</td>
<td>67(21.75)</td>
</tr>
<tr>
<td>35-40</td>
<td>10(12.82)</td>
<td>05(8.33)</td>
<td>04(07.41)</td>
<td>05(9.43)</td>
<td>04(6.35)</td>
<td>28(9.09)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Level of Education</th>
<th>KASU BDTH (%)</th>
<th>GEN KAWO (%)</th>
<th>H PHC BADW (%)</th>
<th>PHC ROMI (%)</th>
<th>GEN SABO (%)</th>
<th>H Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tertiary</td>
<td>09(11.54)</td>
<td>09(15.00)</td>
<td>04(07.41)</td>
<td>08(15.09)</td>
<td>17(26.94)</td>
<td>47(15.26)</td>
</tr>
<tr>
<td>Secondary</td>
<td>19(24.36)</td>
<td>03(05.00)</td>
<td>09(16.67)</td>
<td>36(57.92)</td>
<td>31(49.21)</td>
<td>98(31.82)</td>
</tr>
<tr>
<td>Primary</td>
<td>47(60.26)</td>
<td>35(58.33)</td>
<td>23(42.59)</td>
<td>06(11.32)</td>
<td>09(14.29)</td>
<td>120(38.96)</td>
</tr>
<tr>
<td>None</td>
<td>03(03.85)</td>
<td>13(21.67)</td>
<td>18(33.33)</td>
<td>03(05.66)</td>
<td>06(09.52)</td>
<td>43(13.96)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Occupation</th>
<th>KASU BDTH (%)</th>
<th>GEN KAWO (%)</th>
<th>H PHC BADW (%)</th>
<th>PHC ROMI (%)</th>
<th>GEN SABO (%)</th>
<th>H Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trader</td>
<td>14(17.95)</td>
<td>13(21.63)</td>
<td>05(09.26)</td>
<td>13(26.42)</td>
<td>20(31.75)</td>
<td>65(21.10)</td>
</tr>
<tr>
<td>Civil servant</td>
<td>32(41.03)</td>
<td>09(15.00)</td>
<td>15(27.78)</td>
<td>06(13.21)</td>
<td>05(07.94)</td>
<td>67(21.75)</td>
</tr>
<tr>
<td>House wife</td>
<td>17(21.79)</td>
<td>35(58.33)</td>
<td>30(55.56)</td>
<td>26(50.94)</td>
<td>34(53.97)</td>
<td>142(46.10)</td>
</tr>
<tr>
<td>Others</td>
<td>15(19.23)</td>
<td>03(05.00)</td>
<td>04(07.41)</td>
<td>08(16.98)</td>
<td>04(06.35)</td>
<td>34(11.04)</td>
</tr>
</tbody>
</table>
Table 2. Mosquitoes encountered within 30 house-holds around the five selected PHC within Kaduna metropolis

<table>
<thead>
<tr>
<th>Location / Area</th>
<th>Culex species</th>
<th>Anopheles species</th>
<th>Aedes species</th>
</tr>
</thead>
<tbody>
<tr>
<td>N=30</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>KASU BDTH</td>
<td>30 (11.6)</td>
<td>0</td>
<td>33 (38.8)</td>
</tr>
<tr>
<td>GENH KAWO</td>
<td>53 (20.5)</td>
<td>0</td>
<td>16 (18.8)</td>
</tr>
<tr>
<td>PHC BADW</td>
<td>47 (18.2)</td>
<td>0</td>
<td>17 (20.0)</td>
</tr>
<tr>
<td>PHC ROMI</td>
<td>65 (25.1)</td>
<td>0</td>
<td>9 (10.6)</td>
</tr>
<tr>
<td>GENH SABO</td>
<td>64 (24.7)</td>
<td>0</td>
<td>10 (11.8)</td>
</tr>
<tr>
<td>Total</td>
<td>259 (75.3)</td>
<td>Nil</td>
<td>85 (24.7)</td>
</tr>
</tbody>
</table>

Keys: KASU BDTH = Kaduna State University (Barau Dikko) Teaching Hospital, GENH KAWO = General Hospital Kowo, PHC BADW = Primary Health Care Badarawa, PHC ROMI = Primary Health Care Ang. Romi, GENH SABO = General Hospital Sabon Tasha, N=30 (30 house-holds from the five areas) Six consenting house-holds each which are at within 3-km radius of each of the PHC or hospital were sampled for both adult and larvae mosquito species.

Fig. 1: Age group of all respondents in relation to level of awareness, access and use of LLINs in the 5 government health centres.
Mosquito samples were collected in 30 randomly selected households of the consenting pregnant women that were within three kilometer radius range of any of the antenatal clinic for 12 weeks period, (Table 2). A total of 344 larvae samples were encountered and identified using taxonomic keys and guide of Hopkins; Gillies and Coetzee. *Aedes aegypti* (24.7%) occurred in 27 house-hold, while *Culex quinquefasciatus* (75.3%) was encountered in all the 30 households.

**DISCUSSION**

The majority of the respondents overall awareness level observed in the study shows that most of the pregnant women attending antenatal care in all the five health centres have been adequately informed of the function and importance of LLINs during pregnancy. Talipouo et al., (2019) reported similar (94%) result in a study conducted at Yaounde, Cameroun. The result from the current study shows an improvement over the 82.6% awareness level reported in the study of LLINs among pregnant women in 18 Nigerian states; Ezire et al., (2015). It is also similar to the awareness level of 92% observed in the study of LLINs use among pregnant women attending ANC at Imo State University Teaching Hospital (IMSUTH) Orlu, Imo State by Eberendu & Ozims, (2014). The high awareness level could be attributed to the education level of the respondents where 86% are literate. This was the case as reported by Nwoke et al., (2017) where awareness and use of insecticide treated nets (ITNs) in Imo state was influenced by the high education level. Though when awareness and educational status were compared using one way ANOVA, there was no significant difference (P>0.05). It had been emphasized that in northern Nigeria, low education level amongst other factors contributes highly to non-use of LLINs. The most important determinants for use of ITNs include literacy level, socio-economic status (SES), family size and structure, (Oyekale et al., (2013) and Onah et al., (2017). According to National Malaria Indicator Survey (NMIS) conducted between October to December 2010 at Sokoto by Kilian et al., failure to use available nets and lack of knowledge about malaria prevention are important determinants of malaria risk. Despite the ownership of LLIN in households, NMIS reported that only 49% of people used them the night before the survey and the use extended to only 50% of children, (Kilian et al., (2010). When asked about various ways to avoid getting malaria, only 17% of women answered “using ITN or LLIN” while 80% of women cited “using insecticide spray” and “eliminating stagnant water around living areas”, respectively.

The general level of access to LLINs (75.32 %,) by the respondents across the five health centres implies that LLINs are available in majority of Primary Health Centres within kaduna metropolis for access by pregnant women. This, by extension should help reduce malaria burden if used correctly. Also, a study in Lagos State, Nigeria by Umeh et al., (2012) reported access level to be 91.0%; their research suggests that the success to high level of access to LLINs was due to the routine national LLINs distribution and implementation coverage Okeibunor, et al., (2012). The updated National Malaria Strategic Plan (NMSP) advices on access and ownership of at least two LLINs per house-hold; thus increasing LLINs use in Nigeria to 80%, (FMoH, 2014). In this present study, the p-value for access to LLINs is 0.944 (p > 0.05), this indicates that there is no significant difference in access to LLINs among pregnant women attending the health care facilities.

The relative average level (67.86%) of use of LLINs in this
study suggests that though awareness and access are high; it does not culminate to use by the owners to reduce or prevent malaria. There are factors which owners suggest that are responsible for non-use or low use of LLINs. Therefore, as speculated by some studies; the level of Usage as compared with Awareness or Access can be attributed to the non-challant attitude of humans generally, (Obol et al., 2013). A very low (27.6%) level of use was reported by Awosan et al., (2013) in Sokoto and 39.1% in Enugu by Ugwu et al., (2013). There was a dramatic difference in “Knowing or being Aware of the importance of LLINs and the Use”; Ezeigbo et al., (2016) reported on ITNs Ownership and Use in control of Malaria in Abia state; that out of the 77% which affirmed they have knowledge of LLINs only 38.6% actually owned and used the ITNs at least 4-5 times a week. This was also revealed by Ikealo et al., (2017) from Akwa, Anambra state where 99.1% know about the importance and use of LLINs, only 80.4% own a LLINs and only 49.6% use nets once in 2 or 3 days, giving several reasons for non-use. LLINs can reduce malaria transmission by at least 60% and child deaths by 20% (Wagbasoma & Aigbe, 2010; Okoye and Isara, 2011). The use of LLINs in some research carried out in Uganda shows that when compared with a situation when no net was used, there was increase in mean birth and placental parasitemia (Mbonye et al., 2006). Analysis revealed that, average level of use of LLINs has the p-value of 0.463 (p > 0.05); thus no significant difference in the use of LLINs by pregnant women attending the health care facilities.

The major reason for non-use was discomfort caused by net use ranging from excessive heat or weather condition, chemical smell, color of net, mystical taboo, stress of use, torn nets and others, (Binka & Adonge, 1997; Olajide et al., 2011 and Patel et al., 2012). There is need for health education to encourage pregnant women and dispelled their fears of chemicals used in treating nets (Ugwu et al., 2013; Obembe et al., 2014).

Of all the mosquitoes collected 75.3% were identified to be of the Culex genus and 24.7% were of genus Aedes, (Table 2). The presence of Culex and Aedes species in and around each of these PHCs agrees with the report of the presence of these two genera in various areas of the state, (Suleiman, 2012; Yayock et al., 2014). Culex genera (75.3%) suggest that residents are exposed to diseases such as Lymphatic filariasis and possibly yellow fever transmitted by Aedes species.

CONCLUSIONS
The study found out that majority of the respondents (92.53%) are aware and have been adequately informed of the functions and importance of LLINs during pregnancy in reducing malaria disease. The access to LLINs by the respondents across the five health centres was quite appreciable (75.32 %), meeting the WHO standard of 75% and above for access to nets. The respondents that were encountered who actually use LLINs were 67.86%. This study found no relationship between the age of pregnant women, educational level, level of awareness, access or use of LLINs; all the aforementioned factors are not contributing to the increase or decrease to one or another. Mosquito species encountered were Culex (75.3%) and Aedes species (24.7%) in and around all the five study areas where the research was conducted.

RECOMMENDATIONS
1. The State should ensure accessibility to free or subsidized Long Lasting Insecticidal Nets (LLINs) in the Primary Health Care centers and malaria drugs must be guaranteed.
2. There is need for implementing additional sensitization approaches especially the social media (Facebook, WhatsApp, YouTube, Text messages) to reach more people.

REFERENCES
LEVEL OF AWARENESS...


