



Evaluating the Relationship between Socio-Demographic Factors, Knowledge, Ownership and Usage of Long- Lasting Insecticide- Treated Bed Nets among Pregnant Mothers in Rivers State University Teaching Hospital

**Felix C. Clement Wekere^{1*}, Dango G. B. Kalio¹, Paul L. Kua¹
and Rose S. Iwo-Amah¹**

¹*Department of Obstetrics and Gynaecology, Rivers State University Teaching Hospital (RSUTH), Port Harcourt, Nigeria.*

Authors' contributions

This work was carried out in collaboration among all authors. Author FCCW designed the study, wrote the protocol, took part in data collection, performed the statistical analysis, managed the literature search and wrote the first draft of the manuscript. Authors PLK, DGBK and RSIA took part in collection of data and supervision. All authors read and approved the final manuscript.

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ABSTRACT

Background: Malaria is associated with increased morbidity and mortality and of public health concern. Long- lasting insecticide- treated bed nets (LLINs) is an effective method of prevention and control of malaria.

Aim: To determine the relationship between socio-demographic characteristics of antenatal clinic attendees and their knowledge, ownership and utilization of LLINs.

Methods: This was a secondary data analysis of a cross sectional study of 384 pregnant mothers receiving antenatal care in RSUTH over a 3-month period. Data were sorted, coded and analyzed

*Corresponding author: E-mail: fccwekere@yahoo.com;

using IBM Statistical Package for Social Sciences (SPSS) version 25.0. The association between socio-demographic characteristics, and knowledge, ownership and utilization of LLINs was carried out using Pearson Chi-square test and Fisher exact test where appropriate, at a statistical significance level of $P < .05$.

Results: Data of 384 pregnant women that participated in the study were analyzed. The strong predictors of knowledge of LLINs were participants' educational status and religion ($P < .001$ and $P < .001$) respectively; followed by age [$P = .010$ (95%CI: .012, .016)] and occupation [$P = .017$ (95%CI: .020, .026)]. There was no significant association between 'knowledge', and parity [$P = .37$ (95% CI: .34, .36)], and gestational age [$P = .35$ (95% CI: .34, .36)] of the participants. The strong predictors of ownership and utilization of LLINs were the participants' age ($P < .001$) and occupation ($P < .001$); other statistically significant factors found were parity, educational status, and religion ($P = .002$, $P = .015$, $P = .044$) and ($P = .007$, $P = .002$, $P = .024$) respectively. Overall, there was no evidence of association between ownership and utilization of LLINs and gestational age [$P = .212$ (95% CI: .177, .192) and $P = .392$ (95% CI: .391, .410)] respectively.

Conclusion: Socio-demographic factors such as age, occupation, educational status and religion are predictors of knowledge, ownership and utilization of LLINs. As such, they are pertinent when planning enlightenment/ education programmes on the use of LLINs for malaria prevention and control.

Keywords: Malaria; long- lasting insecticide treated nets; pregnant women; predictors; public health; RSUTH.

1. INTRODUCTION

Malaria is a major cause of morbidity and mortality globally, and of public health concern [1-3]. There are over 227 million cases of malaria worldwide [4]. It is endemic in World Health Organisation (WHO) African region; and the burden has remained high in this region, compared to other WHO regions [4,5].

From the recent WHO malaria report, six countries accounted for more than half of all cases of malaria worldwide with Nigeria ranking first. These countries are: Nigeria (25%), the Democratic Republic of Congo (12%), Uganda (5%), Co'te d'Ivoire, Niger and Mozambique 4% each [4]. Pregnant women and children under – five years are the most vulnerable group to malaria infestation. In Africa malaria is the leading cause of under-5 mortality, accounting for 40% of public health expenditure as well as 30-50% and 50% of inpatient admissions and outpatient visits respectively [6].

Malaria in pregnancy has adverse effects such as anaemia, low birth weight (LBW), intrauterine growth restriction, preterm contractions and miscarriages [3]. According to 2019 World Health Organisation's malaria report, 11 million pregnant women exposed to malaria infestation, delivered about 872000 children with low birth weight (about 16% of all children with low birth weight in these countries), with West African sub-region

having the highest prevalence of LBW from malaria in pregnancy [5]. Of the estimated 2.4 million children with malaria in 2018, 1.8 million of them were likely to have had severe malaria [5].

Generally, there are two types of mosquito nets - untreated and treated nets. The insecticide-treated bed nets (ITNs) are further sub-classified into (i) conventionally treated nets and (ii) the long-lasting insecticide- treated bed nets (LLINs). The use of long-lasting insecticide- treated bed nets (LLINs) is one of the three-strategies for malaria prevention and control [3,7]. While the conventional ITN is treated by dipping into insecticides recommended by WHO, LLINs are factory treated nets made with netting material impregnated with insecticide such as pyrethroid [1,8,9]. There are five types of LLINs namely, Netprotect, PermaNet, Olyset, DuraNet and Interceptor [9]. These insecticide- treated bed nets have been found to be very effective method of preventing malaria transmission in the community.

It is known, that the effectiveness of LLINs can be retained with at least 20 WHO recommended washings under standard laboratory conditions or 3 years of recommended use under field conditions [2]. As such, it is long –lasting; repels, and kills insects that come in contact with it. Therefore, studies have shown that, it is very effective in prevention and control of malaria [7,9,10].

There is paucity of literature on the association between the knowledge, ownership and usage, and socio-demographic characteristics of antenatal clinic attendees in our setting. Additionally, the determinants of knowledge, ownership and use of LLINs has not been studied in our centre. Therefore, this study is aimed at evaluating the relationship between the socio-demographic factors of women attending antenatal clinic in RSUTH, and knowledge, ownership and utilization of LLINs.

2. MATERIALS AND METHODS

This study was conducted at the Rivers State University Teaching Hospital (RSUTH), Port Harcourt, among pregnant women attending antenatal clinic for care. RSUTH is a newly established Teaching Hospital of the College of Health Sciences, Rivers State University. It is owned and funded by the Rivers State Government of Nigeria. It is situated in the heart of Port Harcourt, the capital of Rivers State which has a population of 5,198,716 from last census conducted in census 2006; the 6th most populous state in Nigeria [11]. The hospital is a tertiary health facility, and receives referrals from both public and private hospitals in Port Harcourt and its environs with high prevalence rate of malaria.

This was a secondary data analysis of a descriptive cross-sectional study [12] which utilized an interviewer-administered semi-structured pretested questionnaire to pregnant women attending antenatal clinic for care in RSUTH from 2nd June to 31st August, 2019. The questionnaire assessed the socio-demographic characteristics of the respondents such as age, parity, educational status, occupation, religion; awareness/knowledge, ownership and utilization of long-lasting insecticide treated bed nets; reasons for non-utilization, and the sources of information. The respondents were not required to write their name as coding with numbers was used for identification.

The sample size was obtained using the formula $N = (Z^2 \times p \times q) / d^2$ where Z = is the standard normal variant at 95% confidence interval which was set at 1.96, p is rate of utilization of LLINs from previous study in the country given as 35% [13], and ' d ' is the precision of the study, set at 5% margin of error. A sample size of 349 was obtained and adjusted to compensate for attrition rate of 10%; the final minimum sample size was

approximately three hundred and eighty- four (384). Simple random sampling method was used to select the study population. Booked pregnant women attending antenatal clinic in RSUTH who gave consent were included in the study. The data of the 384 study participants were used for analysis.

The data was analyzed using IBM Statistical Package for Social Sciences (SPSS) version 25.0 (Armonk, NY). Qualitative variables were summarized using frequencies and percentages, while quantitative variables were summarized using mean and standard deviation. The results were presented in tables and charts as appropriate. The association between socio-demographic characteristics, and knowledge, ownership and utilization of LLINs, was carried out using the Pearson Chi-square test and Fisher exact test where appropriate at a statistical significance level of $P < .05$.

Ethical clearance for the study was obtained from the Ethics Committee, and informed consent was obtained from the study participants before administering the questionnaire.

3. RESULTS

3.1 Socio-demographic Characteristics

Data of three hundred and eighty-four pregnant women recruited for the study [12] were used for analysis. The retrieval rate of questionnaire was 100%. The mean age of the respondents was 31.1 SD 4.5 years, range 21- 43 years. Parity ranges from 0 to 7 with the modal parity being para-1. Majority [382 (99.5%)] of the participants had formal education while [2 (0.5%)] had no formal education. Concerning gestational age, 65.9% of the respondents were in third trimester, 27.9% were in second and 6.2% were in first trimester of pregnancy. Table 1, shows the socio-demographic characteristics of the study participants.

Three hundred and eighty (99%) of the respondents were Christians and [4 (1%)] Islam (Fig. 1).

Fig. 2, shows the occupation of the respondents. One hundred and twenty-seven (33.1%) of the respondents were civil servants. This was followed by house wives which accounted for 28.4% of the respondents (Fig. 2).

Table 1. Socio-demographic characteristics of the participants

| Variable | No. of Respondents (n = 384) | Percentage |
|--------------------------------|------------------------------|----------------|
| Age (years) | | |
| 21-25 | 43 | 11.1 |
| 26-30 | 149 | 38.8 |
| 31-35 | 130 | 33.9 |
| 36-40 | 56 | 14.6 |
| ≥41 | 6 | 1.6 |
| Mean age | SD* | 95% CI# |
| 31.1 | 4.5 | 30.6, 31.1 |
| Gestational age (weeks) | | |
| 0-13 | 24 | 6.2 |
| 14-26 | 107 | 27.9 |
| 27-42 | 253 | 65.9 |
| Parity | | |
| 0 | 116 | 30.2 |
| 1 | 124 | 32.3 |
| 2 | 77 | 20.1 |
| 3 | 35 | 9.1 |
| 4 | 21 | 5.5 |
| ≥5 | 13 | 2.9 |
| Educational Status | | |
| No formal Education | 2 | 0.5 |
| Primary | 10 | 2.6 |
| Secondary | 165 | 43.0 |
| Tertiary | 207 | 53.9 |

* SD-Standard deviation # CI- 95% Confidence interval, Source of data: Wekere et al. [12]

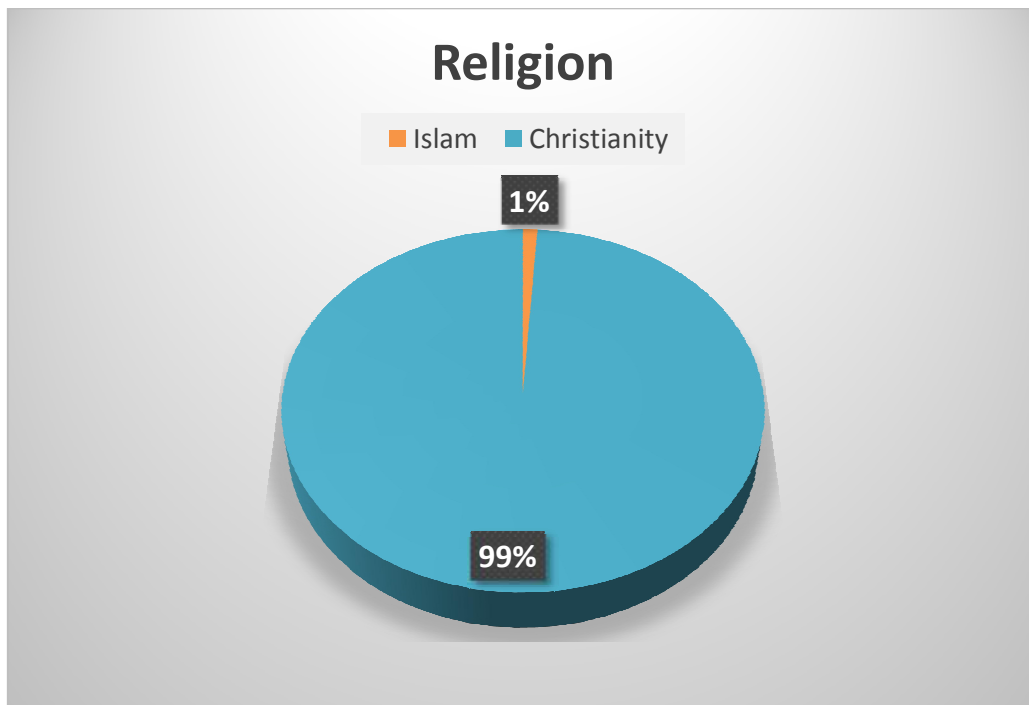


Fig. 1. Religion of the study participants

Source of data: Wekere et al. [12]

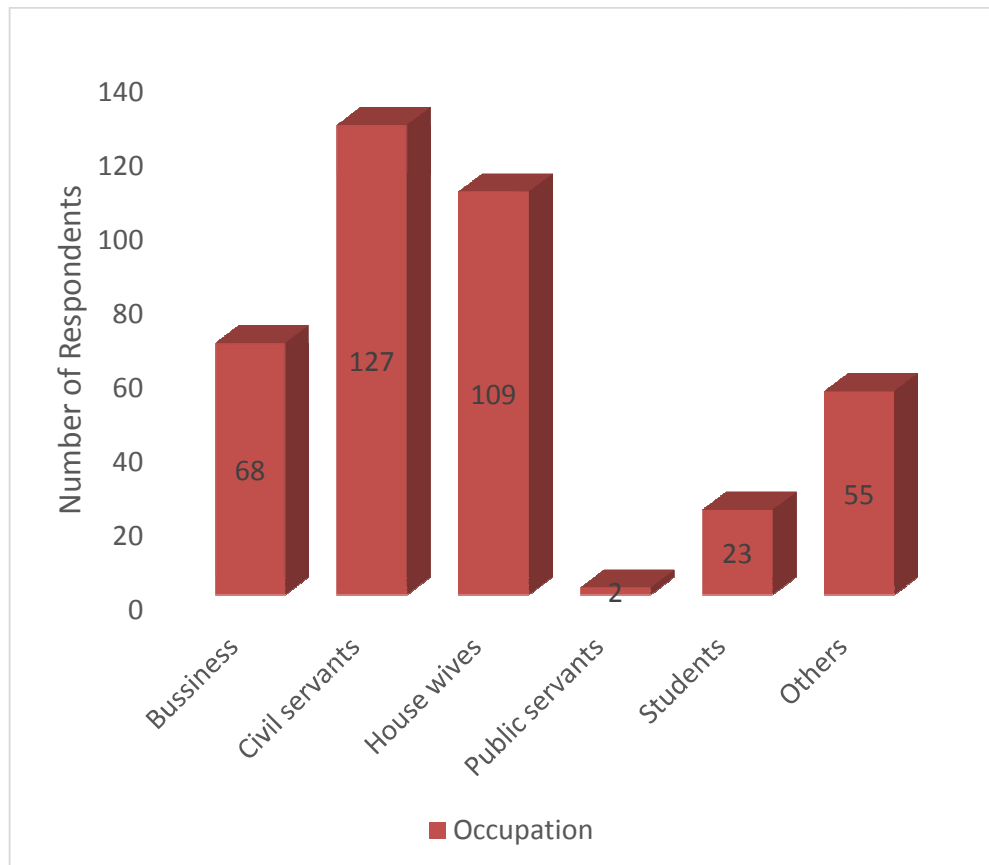


Fig. 2. Occupation of study participants

Source of data: Wekere et al. [12]

3.2 Association between Knowledge of LLINs and Socio-demographic Factors

Table 2, shows the association of socio-demographic factors of the participants and their knowledge of LLINs. Of the factors assessed, the following had a significant association with ‘knowledge of LLINs’:- age ($X^2 = 13.25$; d.f. = 4, $P = .010$), religion ($X^2 = 27.30$; d.f. = 1, $P < .001$) [Fisher exact test], educational status ($X^2 = 50.46$; d.f. = 3, $P < .001$), occupation ($X^2 = 13.83$; d.f. = 5, $P = .017$). There was no significant association between Knowledge of LLINs and the parity of participants, ($X^2 = 3.71.01$; d.f. = 3, $P = .37$) and gestational age ($X^2 = 2.11$; d.f. = 2, $P = .35$).

Women with secondary and tertiary level education were 89.1% and 94.2% more likely to have knowledge of LLINs respectively, compared to those with no formal education.

3.3 Association between Ownership of LLINs and Socio-demographic Characteristics

While most [207 (54%)] of the respondents owned LLINs, [177 (46%)] did not own LLINs. None of the study participants received any free LLINs. The significant factors associated with ownership of LLINs were age ($X^2 = 22.46$, $P < .001$), occupation ($X^2 = 89.75$, $P < .001$), parity ($X^2 = 14.61$, $P = .002$), educational status ($X^2 = 10.44$, $P = .015$) and religion ($X^2 = 4.73$, $P = .044$). Conversely, gestational age was not statistically significant to the ownership of LLINs ($X^2 = 3.10$, $P = .21$) [Table 3].

3.4 Association between Utilization of LLINs and Socio-demographic Characteristics

Overall, the utilization rate of LLINs was 50%. While [57 (14.8%)] used ordinary nets

Table 2. Association of knowledge of LLINs to socio-demographic factors

| Variable | Knowledge of LLINs N= 384 (%) | | Total | X ² (d.f. [†]) | P- value (95% CI ^{**}) |
|--------------------------------|----------------------------------|-----------|-----------|-------------------------------------|-------------------------------------|
| | Yes (n=346) | No (n=38) | | | |
| Age (years) | | | | | |
| 21-25 | 35 (81.4) | 8 (18.6) | 43 (100) | 13.25 (4) | .010* |
| 26-30 | 129 (86.6) | 20 (13.4) | 149 (100) | | (.012, .016) |
| 31-35 | 120 (92.3) | 10 (7.7) | 130 (100) | | |
| 36-40 | 56 (100) | 0 (0) | 56 (100) | | |
| ≥41 | 6 (100) | 0 (0) | 6 (100) | | |
| Gestational age (weeks) | | | | | |
| 0-13 | 22 (91.7) | 2 (8.3) | 24 (100) | 2.11 (2) | .35 (.34, .36) |
| 14-26 | 100 (93.5) | 7 (6.5) | 107 (100) | | |
| 27-42 | 224 (88.5) | 29 (11.5) | 253 (100) | | |
| Parity | | | | | |
| Nullipara | 102 (87.9) | 14 (12.1) | 116 (100) | 3.17 (3) | .37 (.34, .36) |
| Primipara | 116 (93.5) | 8 (6.5) | 124 (100) | | |
| Multipara | 119 (89.5) | 14 (10.5) | 133 (100) | | |
| Grand multipara | 9 (81.8) | 2 (18.2) | 13 (100) | | |
| Educational Status | | | | | |
| No formal Education | 0 (0) | 2 (100) | 2 (100) | 50.46 (3) | P <.001* |
| Primary | 4 (40) | 6 (60) | 10 (100) | | (.001, .001) |
| Secondary | 147 (89.1) | 18 (10.9) | 165 (100) | | |
| Tertiary | 195 (94.2) | 12 (5.8) | 207 (100) | | |
| Religion | | | | | |
| Christianity | 346 (91.1) | 34 (8.9) | 380 (99) | 27.301 (1) | P <.001 [#] |
| Islam | 0 (0) | 4 (100) | 4 (1) | | |
| Occupation | | | | | |
| Business | 56 (82.4) | 12 (17.6) | 68 (17.7) | 13.830 (5) | .017* |
| Civil servant | 118 (92.9) | 9 (7.1) | 127(33.1) | | (.020,.026) |
| House wife | 94 (86.2) | 15 (13.8) | 109(28.4) | | |
| Public servant | 2 (100) | 0 (0) | 2 (0.5) | | |
| Students | 21 (91.3) | 2 (8.7) | 23 (6.0) | | |
| Others | 55 (100) | 0 (0) | 55 (14.3) | | |

Level of significance < .05, [†]d.f. - degree of freedom, ^{**}CI - 95% Confidence interval, * Significant values, [#] Fisher exact test, Source of data: Wekere et al. [12]

and [153 (35.2%)] of the participants did not use any net at all. Assessment of the association between LLINs and respondents' socio-demographic characteristics revealed that age ($\chi^2=30.57$, d.f. = 8, $p < .001$), occupation ($\chi^2 = 34.24$, d.f. = 10, $P <.001$), level of education ($\chi^2 = 20.95$, d.f. = 6, $P = .002$), parity ($\chi^2 = 17.86$, d.f. = 6, $P = .007$), and religion ($\chi^2 = 7.46$, d.f. = 2, $P = .024$) were significantly associated with the use of LLINs. While gestational age according to the trimesters was not associated with the use of LLINs ($\chi^2 = 4.106$, d.f. = 2, $P = 0.392$). The 95% confidence intervals around the P- values are as presented in Table 4.

4. DISCUSSION

The analysis was done with data of 384 participants. There were no missing data. The major findings are as discussed below.

4.1 Socio-demographic Factors and Knowledge of LLINs

Socio-demographic factors were evaluated to determine its association to the knowledge of LLINs among the respondents (pregnant mothers). The study revealed that there was a strong evidence of association between knowledge of LLINs, and respondents' educational status [$P < .001$, (95% CI: .012, .016)] and religion ($P < .001$); such that the rate of awareness of LLINs was more, among pregnant women with secondary level education and above, compared to those with no formal education. This may be due to the fact that educated mothers stand a better chance of understanding the different enlightenment programmes, in addition to their ability to read print media messages on malaria prevention and control. The narrow confidence interval

buttresses the strong association of the above demographic factors and knowledge of LLINs.

With regard to the respondents' religion, Christians had a higher rate of awareness of LLINs (99%) compared to other religion. This finding is not surprising since the study was carried out in the South- South geopolitical zone of Nigeria where majority of the population are Christians. Majority of the pregnant women might have heard

of the LLINs in their various religious settings.

Although not as strong as the aforementioned factors, age and occupation of the participants were also associated with 'knowledge of LLINs' [$P = .010$ (95% CI: .012, .016)] and [$P = .017$ (95% CI: .020, .026)] respectively; such that there was increased awareness rate among older age groups (31 years and above), compared to younger age group (21-30 years). Additionally, the narrow confidence interval

Table 3. Association between ownership of long- lasting insecticide - treated nets (LLINs) and socio-demographic factors

| Variable | Ownership of LLINs [N= 384 (%)] | | Total | X ² (d.f. ⁺) | P- value (95% CI ^{**}) |
|--------------------------------|------------------------------------|-------------------|------------------|-------------------------------------|-------------------------------------|
| | Yes | No | | | |
| Age (years) | | | | | |
| 21-25 | 16 (37.2) | 27 (62.8) | 43 (100) | 22.46 (4) | $P < .001^*$ (.001,.001) |
| 26-30 | 68 (45.6) | 81 (54.4) | 149 (100) | | |
| 31-35 | 77 (59.2) | 53 (40.8) | 130 (100) | | |
| 36-40 | 40 (71.4) | 16 (28.6) | 56 (100) | | |
| ≥41 | 6 (100) | 0 (0) | 6 (100) | | |
| Total | 207 (53.9) | 177 (46.1) | 384 (100) | | |
| Gestational age (weeks) | | | | | |
| 0-13 | 14 (58.3) | 1 (41.7) | 24 (100) | 3.10 (2) | .21 (.18, .19) |
| 14-26 | 50 (46.7) | 57 (53.3) | 107 (100) | | |
| 27-42 | 143 (56.5) | 110 (43.5) | 253 (100) | | |
| Total | 207 (53.9) | 177 (46.1) | 384 (100) | | |
| Parity | | | | | |
| Nullipara | 47 (40.5) | 69 (59.5) | 116 (100) | 14.61 (3) | .002* (.001, .002) |
| Primipara | 74 (59.7) | 50 (40.3) | 124 (100) | | |
| Multipara | 82 (61.7) | 51 (38.3) | 133 (100) | | |
| Grand multipara | 4 (3.6) | 7 (63.6) | 11 (100) | | |
| Total | 207 (53.9) | 177 (46.1) | 384 (100) | | |
| Educational Status | | | | | |
| No formal Education | 0 (0) | 2 (100) | 2 (100) | 10.44 (3) | .015* (.001, .001) |
| Primary | 1 (10) | 9 (90) | 10 (100) | | |
| Secondary | 92 (55.8) | 73 (44.2) | 165 (100) | | |
| Tertiary | 114 (55.1) | 93 (44.9) | 207 (100) | | |
| Total | 207 (53.9) | 177 (46.1) | 384 (100) | | |
| Religion | | | | | |
| Christianity | 207 (54.5) | 173 (45.5) | 380 (100) | 4.727 (1) | .044 ^{**} |
| Islam | 0 (0) | 4 (100) | 4 (100) | | |
| Total | 207 (53.9) | 177 | 384 (100) | | |
| Occupation | | | | | |
| Business | 13 (19.1) | 55 (80.9) | 68 (100) | 89.751 (5) | $P < .001^*$ (.000, .000) |
| Civil servant | 98 (77.2) | 29 (22.8) | 127 (100) | | |
| House wife | 72 (66.1) | 37 (33.9) | 109 (100) | | |
| Public servant | 2 (100) | 0 (0) | 2 (100) | | |
| Students | 6 (26.1) | 17 (73.9) | 23 (100) | | |
| Others | 16 (29.1) | 39 (70.9) | 55 (100) | | |
| Total | 207 (53.9) | 177 (46.1) | 384 (100) | | |

Level of significance $P < 0.05$, * Significant value ⁺d.f. – degree of freedom, ^{**} CI- 95% Confidence interval # Fisher exact test

buttresses the evidence of association of these socio-demographic factors to knowledge of LLINs. The study also revealed that civil / public servants, and students were more likely to have knowledge of LLINs than house wives. Of the factors assessed, parity and gestational age were found not to have any effect on the knowledge of LLIN [P = .37 (95%CI: .34, .36)] and [P = .35 (95% CI: .34, .36)] respectively. To the best of our knowledge this appears to be one

of the first study on association between socio-demographic factors and the knowledge of LLINs.

4.2 Socio-demographic Factors and Ownership of LLINs

Although lower than utilization rate of 50%, ownership rate of LLINs was 54%. It is important to note that none of the respondents reported to

Table 4. Association between utilization of long -lasting insecticide-treated bed nets and socio-demographic factors

| Variable | Which net do you use? | | | Total (N=384) | X ² (d.f. [†]) | P- value (95% CI ^{**}) |
|--------------------------------|-----------------------|-------------------|------------------|------------------|-------------------------------------|----------------------------------|
| | LLIN | No Net | Ordinary Net | | | |
| Age (years) | | | | | | |
| 21-25 | 20 (46.5) | 19 (44.2) | 4 (9.3) | 43 (100) | 30.57 (8) | P < .001* (.000,.001) |
| 26-30 | 57 (38.3) | 65 (43.6) | 27 (18) | 149 (100) | | |
| 31-35 | 71 (54.6) | 41 (31.5) | 18 (13.8) | 130 (100) | | |
| 36-40 | 41 (75.2) | 10 (17.9) | 5 (8.9) | 56 (100) | | |
| ≥41 | 3 (50.0) | 0 (0) | 3 (50.0) | 6 (100) | | |
| Total | 192 (50.0) | 135 (35.2) | 57 (14.8) | 384 (100) | | |
| Parity | | | | | | |
| Nullipara | 44 (37.9) | 56 (48.3) | 16 (13.8) | 116 (100) | 17.86 (6) | .007* (.005,.012) |
| Primipara | 67 (54.0) | 36 (29.0) | 21 (16.9) | 124 (100) | | |
| Multipara | 78 (58.6) | 38 (28.6) | 17 (12.8) | 133 (100) | | |
| Grand multipara | 3 (27.3) | 5 (45.5) | 3 (27.3) | 11 (100) | | |
| Total | 192 (50.0) | 135 (35.2) | 57 (14.8) | 384 (100) | | |
| Educational status | | | | | | |
| No formal Education | 0 (0) | 2 (100) | 0 (0) | 2 (100) | 20.98 (6) | .002* (.001,.003) |
| Primary | 2 (20) | 8 (80) | 0 (0) | 10 (100) | | |
| Secondary | 89 (53.9) | 44 (26.7) | 32 (19.4) | 165 (100) | | |
| Tertiary | 101 (48.8) | 81 (39.1) | 25 (12.1) | 207 (100) | | |
| Total | 192 (50.0) | 135 (35.2) | 57 (14.8) | 384 (100) | | |
| Gestational age (weeks) | | | | | | |
| 0-13 | 12 (50) | 7 (29.2) | 5 (20.8) | 24 (100) | 4.11 (4) | .39 (.39, .41) |
| 14-26 | 50 (46.7) | 45 (42.1) | 12 (11.2) | 107 (100) | | |
| 27-42 | 130 (51.4) | 83 (32.8) | 40 (15.8) | 253 (100) | | |
| Total | 192 (50.0) | 135 (35.2) | 37 (14.8) | 384 (100) | | |
| Religion | | | | | | |
| Christianity | 192 (50.5) | 131 (34.5) | 57 (15.0) | 380 (99) | 7.46 (2) | .024* (.025, .031) |
| Islam | 0 (0) | 4 (100) | 0 (0) | 4 (1) | | |
| Total | 192 (50.0) | 135 (35.2) | 57 (14.8) | 384 (100) | | |
| Occupation | | | | | | |
| Business | 22 (32.4) | 32 (47.1) | 14 (20.6) | 68 (100) | 34.24 (10) | P < .001* (.000,.000) |
| Civil servant | 64 (50.4) | 34 (26.8) | 29 (22.8) | 127 (100) | | |
| House wife | 65 (59.6) | 34 (31.2) | 10 (9.2) | 109 (100) | | |
| Public servant | 0 (0) | 2 (100) | 0 (0) | 2 (100) | | |
| Students | 10 (43.5) | 13 (56.5) | 0 (0) | 23 (100) | | |
| Others | 31 (56.4) | 20 (36.4) | 4 (7.3) | 55 (100) | | |
| Total | 192 (50.0) | 135 (35.2) | 57 (14.8) | 384 (100) | | |

Level of significance P < 0.05 * Significant value †d.f. – degree of freedom ** CI- 95% Confidence interval
Source of Data: Wekere et al. [12]

have received any free LLINs. This is not surprising because there was no time LLINs were distributed free of charge in the hospital till date. The study revealed a strong evidence of association between ownership of LLINs and age ($P < .001$), and occupation ($P < .001$). This finding corroborates that of other studies [7,10]. There was an increasing trend in the ownership of LLINs with increasing age of the pregnant mothers. Overall, older pregnant women were more likely to own LLINs compared to younger age group 21-25. As regards occupation, 'civil servants' and 'house wives' were more likely to own mosquito nets compared to business women.

Other determinants of ownership from the study, were respondents' parity ($P = .002$), educational status ($P = .015$) and religion ($P = .044$). This finding is similar to that of previous studies [14,15,16]. Primiparous and multiparous women were more likely to own LLINs (60% and 62% respectively) than grand multiparous women (4.6%). Pregnant women with formal education had higher rate of ownership of LLINs compared to those with no formal education. On the other hand, there was no evidence of association between ownership of mosquito net and gestational ages of the participants ($P = .212$).

4.3 Socio-demographic Factors and Utilization of LLINs

From the binary analysis done to determine the effect of socio-demographic factors on the use of LLINs, respondents' level of education was found to have a statistically significant effect on the use of long-lasting insecticide treated bed nets [$P = .002$ (95% CI: .001, .002)]. The higher the educational level of respondents, the more likely they are to use long-lasting insecticide treated nets. This finding corroborates that of other studies among pregnant women in Ibadan [17] Western Nigeria, Enugu, Eastern Nigeria [18], and Southern part of Rwanda [16]; but not consistent with other studies [6,19]. This may be due to the variations in the study designs across studies.

The study also revealed that age of participants is strongly associated with utilization of LLINs ($P < .001$), such that pregnant mothers aged 31 years and above were more likely to use LLINs for malaria prevention compared to younger age group 21-30 years. This corroborates the findings of previous studies

[8,16]; but contrary to the finding of Musa et al. [6] in Northern Nigeria and Okoye [19] in Asaba, Delta state of Southern Nigeria. This finding is also contrary to the finding of a study carried out in Ethiopia where older women (30 years and above), were less likely to use nets compared to younger women (less than 30 years) [20]; though there was a slight disparity in the lower limit of age group.

The region of the study participants was found to be associated with utilization of LLINs [$P = .024$, (95% CI: .025, .031)]. This finding is similar to that of previous study carried out in Kenya [21]. Most of the study participants were Christians. And they might have heard of the benefits of LLINs from their religious groups.

The parity of participants has a statistically significant association with the use of LLINs [$P = .007$ (95% CI: .005, .012)]; such that primipara (women that have carried at least 1 pregnancy up to period of foetal viability irrespective of the pregnancy outcome), and multiparas (more than 1 pregnancy up to period of foetal viability irrespective of the pregnancy outcome) are more likely to use LLINs compared to nulliparous women. This corroborates the findings from another study [22]. Although this finding is in contrast to the finding from a study carried out in Delta State of Nigeria [19], the sample size of present study was helpful in the present finding. Pregnant mothers with higher parity are more likely to use LLINs than nulliparous women. Multiparous women might have experienced the scourge of malaria in pregnancy; as such, would want to use mosquito nets for prevention of malaria in subsequent pregnancies.

From this study, the participants' occupation has a strong evidence of association with the use of long-lasting insecticide treated bed nets ($P < .001$). Pregnant women in government employment and house wives were more likely to use LLINs compared to unemployed women. This corroborates the findings of other studies [8,17,21].

Conversely, the study showed that the gestational age according to the three trimesters was not associated with the use of long-lasting insecticide-treated bed nets [$P = .39$ (95% CI: .39, .41)]. To the best of our knowledge this appears to be the first study to determine the association between gestational age of antenatal

clinic attendees and utilization of LLINs. A cross-sectional study conducted in Malawi has also revealed that educational status, age group and occupation are determinants of utilization of LLINs [23,24]. Although our study is on LLINs, the above finding is not in keeping with the finding of Musa et al. [6], who reported that age, educational level and parity had no significant effect on ITN use.

Also, it is pertinent to note that there was no evidence of association between knowledge, ownership of long-lasting mosquito nets and gestational age of the respondents. Therefore, gestational age was the only factor found not to have any effect on the knowledge, ownership and usage of LLINs. Although our study is hospital based, it provides a significant literature on the knowledge, ownership and usage of LLINs among pregnant women; and would be helpful in making policy concerning the use of long-lasting insecticide treated bed nets in prevention of malaria transmission.

5. CONCLUSION

The determinants of ownership and utilization of long-lasting insecticide-treated bed nets among pregnant women in our centre are level of education, age, occupation and religion. The socio-demographic factors associated with knowledge of LLINs are level of education, religion, occupation and age. Gestational age of pregnant mothers is the only factor that had no effect on knowledge, ownership and utilization of LLINs.

Although creating awareness /education on the benefits of LLINs is pertinent in increasing the rate of utilization of mosquito nets, taking cognizance of the aforementioned factors would be helpful to public health physicians and/or clinician as well as Governmental and Non-governmental agencies during such enlightenment programmes/ sessions. The findings of this study will be made available to the National Malaria Programme to help in the prevention and control of malaria.

DISCLAIMER

The products used for this research are commonly and predominantly use products in our area of research and country. There is absolutely no conflict of interest between the authors and producers of the products because we do not

intend to use these products as an avenue for any litigation but for the advancement of knowledge. Also, the research was not funded by the producing company rather it was funded by personal efforts of the authors.

CONSENT

Authors declare that informed consent was obtained from the study participants before interviewing them.

ETHICAL APPROVAL

Ethical approval for the study was given by the Ethics Committee.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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