Knowledge and Associated Factors Influencing Insecticide-Treated Net Usage among Pregnant Women in Selected Health Facilities in Ekiti State

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K. A. Sunmola[1]

Abstract

Malaria is one of the leading causes of maternal mortality in sub-Saharan Africa, Nigeria inclusive. This study assessed knowledge of Insecticide-Treated Net (ITN) as well as socio-demographic factors associated with ITN utilisation among 1,285 pregnant women of childbearing age, who attended antenatal care, pooled from selected health facilities across the 16 Local Government Areas of Ekiti. Data were analysed descriptively using frequency counts and percentages, while the Chi-square test and binary logistic regression were employed at the bivariate and multivariate stages, respectively. Findings revealed that awareness and overall usage of ITNs were high. Education was a strong and very significant

1. Department of Gender and Development Studies, Ekiti State University, Ado-Ekiti, Nigeria; Department of Demography and Social Statistics, Federal University Oye-Ekiti, Nigeria; adebayo.sunmola@eksu.edu.ng; https://orcid.org/0000-0003-4314-6619

predictor of ITN use ($p < 0.05$ for all groups). Specifically, respondents who had primary school education were 81% less likely to use ITNs (OR = 0.19, 95% CI: 0.78–0.45), secondary education were less likely (OR = 0.99, 95% CI: 0.45–0.22), and tertiary education were even less likely (OR = 0.11, 95% CI: 0.50–0.25). The study concludes that Universal ITN coverage and utilisation will not be achieved through distribution campaigns alone but through focused, context-specific interventions that interact with the psychological, cultural, and economic forces controlling women's health behaviour.

Keywords: Pregnant Women, Associated Factors, Insecticide-Treated Nets, Health Facilities, Reproductive Age

Introduction

Malaria remains one of the highest public health burdens in sub-Saharan Africa, particularly in pregnant women, who are exposed to increased risks of maternal and neonatal morbidity. The Organisation (2024) states that more than 30 million African women become pregnant each year in malaria-endemic settings, and an estimated 10,000 maternal and 200,000 neonatal deaths are due to malaria infection annually. Nigeria alone accounts for about 27% of the global burden of malaria, making it one of the most malaria-burdened countries. Pregnant women are even more vulnerable, since pregnancy makes one more susceptible to malaria infection and its adverse effects, such as anaemia, stillbirth, spontaneous abortion, and low birth weight because of compromised immunity (Organisation, 2024).

One of the strategies to control this menace is through the use of Insecticide-Treated Nets (ITNs), particularly Long-lasting Insecticidal Nets (LLINs), which are promoted globally as effective means for the prevention of malaria. The National Malaria Elimination Programme (NMEP) in Nigeria has implemented various mass distributions that targeted the entire country, ensuring increased access to ITNs by pregnant women and children under-five years of age.

Although ITN is widely available, yet pregnant women's utilisation is still subpar. Only 34% of pregnant women reported sleeping under an ITN the night before the survey, despite 63% of households owning at least one, according to the Nigeria Demographic and Health Survey (Commission, 2019). The discrepancy between ownership and use emphasises how crucial it is to comprehend the contextual and behavioural factors that influence ITN use.

Evidence has established that ownership of ITNs does not necessarily guarantee their utilisation. Ekeleme et al. (2023) established that although there was significant knowledge among the rural families in Oyo State, the majority of the respondents did not utilise ITNs on a regular basis due to heat, discomfort, and misconceptions about the safety of the insecticide. In a similar vein, Sina (n.d) found that while more than 80% of families in Ekiti State had ITNs, less than half of the respondents, particularly pregnant women used them nightly. These results demonstrate that the best use of ITNs is still hampered by sociocultural and perceptual issues.

The existence of such trends is supported by further data from across Nigeria. Researchers such as Okoronkwo and Okoye (2016) verified that pregnant women's use of ITNs was significantly impacted by their income, education, and prenatal attendance in Anambra State. Women who attended regular prenatal care appointments and had higher levels of education were more likely to understand the risks of malaria and take preventative measures. In a related study, Onyinyechi (2017) observed that pregnant women's compliance rose as a result of focused prenatal health education that improved their understanding and perception of the efficacy of ITN. However, some of these cultural ideas persist, such as the notion that ITNs contain hazardous chemicals or cause suffocation, which discourages regular use (Sina).

Even while these studies provide useful information on ITN usage trends in Nigeria, there is a dearth of empirical data from Ekiti State, despite the state's more advanced healthcare system and high literacy rates. Despite several net distribution programmes, the state Ministry of Health stressed that malaria continues to be a major reason why pregnant women seek outpatient care. The gap between ITN ownership and utilisation, therefore, highlights a major problem: awareness campaigns may increase

access, but knowledge and behaviour change remain insufficient to ensure regular use.

It is therefore important to assess both the knowledge and the determinants of ITN use among pregnant women in Ekiti State. A comprehension of how education, cultural beliefs, health-seeking habits, and antenatal exposure to malaria-prevention messages interact will provide pragmatic information to policymakers and health providers. This information is important to the realisation of Sustainable Development Goal (SDG) 3 that focuses on ensuring healthy lives and well-being for all, and to achieving Nigeria's national malaria elimination targets.

Literature Review

Knowledge of Insecticide-Treated Nets among Women

Okafor and Ogbonnaya (2020) conducted a cross-sectional study to assess the knowledge, accessibility and utilisation of ITN by 140 pregnant women in Enugu South-East, Nigeria, during pregnancy. The women know about ITNs in the study. Furthermore, most women had one or more ITN(s) and the predominant source was government free house-to-house distribution. Moreover, ITNs were accessible to over two-thirds of women. Furthermore, Uhuo et al. (2022) assessed the awareness and predictors of ITNs utilisation among inhabitants of Ivo Local Government Area (LGA) of Ebonyi State. Respondents of the study area had good knowledge about ITNs, as reported by their investigation. There was a correlation between respondents' level of education, age, occupation and ITNs' knowledge. The result showed that level of education, level of education of rural dwellers, and age were significantly associated with their knowledge of ITNs in Ivo LGA.

Despite the growing body of literature, very few have directly examined how various sociodemographic and economic determinants influence each other in the formation of ITN utilisation among pregnant women, a group highly vulnerable to malaria. The majority of previous studies were on general female reproductive populations or regional-level factors, hence failing to capture individual-level socioeconomic processes specific to pregnant women. Moreover, there is sparse empirical work that explores the use behaviour of ITN based on a behavioural theory model, such as the Health Belief Model (HBM). Past studies largely provided descriptive or

statistical associations but failed to link findings with perceived susceptibility, perceived benefits, or barriers that affect preventive health behaviour.

The present study addresses this gap by employing a multivariate analytical approach.

Using this framework, it identifies key socioeconomic determinants, including education, occupation, and income. These determinants are subsequently interpreted within the context of the Health Belief Model. The analysis offers both empirical and theoretical insights into the determinants of ITN use behaviour among pregnant women in sub-Saharan Africa.

Factors Influencing the Use of Insecticide-Treated Nets among Women

A critical review of existing research reveals that most of the earlier studies on the utilisation of insecticide-treated nets in the sub-Saharan region have covered general female populations or context-specific groups and have tended to exclude pregnant women and other vulnerable subgroups. Even though several studies (Ameyaw et al., 2020; Barrow et al., 2025; Ogidan et al., 2025; Solanke et al., 2023) have explored socioeconomic, demographic, and geographic determinants of ITN usage, they have centred on region- and community-level determinants rather than on individual behavioural predictors within theoretical models. This leaves conceptual space to consider how and why some of the individual or psychosocial parameters are translated into preventive health action.

Furthermore, while Ofili and Nwogueze (2024) did facilitate learning about ITN awareness among medical students, they were most directly interested in knowledge and perception within a relatively educated population, rather than behavioural use among high-risk populations such as pregnant women or low-income rural dwellers. Their research points out that, even among better-educated individuals, institutional barriers and behavioural barriers (such as unpredictable distribution by health personnel) can impinge on ITN use. But this research stops short of linking such barriers to established behavioural models explaining motivation and decision-making, such as the Health Belief Model (HBM) or the Theory of Planned Behaviour (TPB).

Another influential gap is that of integrating theoretical models. Most of the existing studies employ descriptive or multivariate statistical modelling

without interpreting their results based on behavioural theory. Thus, still little is known regarding how perceived susceptibility towards malaria, perceived benefits of ITN adoption, and perceived barriers influence adoption behaviour, particularly among pregnant women, who face unique socioeconomic and health-related challenges. This undermines the explanatory and predictive power of existing literature.

Theoretical Consideration

Describing the determinants of use of insecticide-treated nets (ITNs) among pregnant women requires a theoretical model that explains how knowledge, perceptions, and attitudes are translated into preventive health action. Two behaviour models provide sound guidance to this study: the Health Belief Model (HBM) and the Theory of Planned Behaviour (TPB). They both outline the interplay between individual cognition, social influence, and perceived control that determines whether or not pregnant women use ITNs consistently.

The Health Belief Model, initially developed by Rosenstock (1974), predicts that people's acceptance of a health behaviour is a function of their own beliefs about disease threat and the perceived advantages of prevention. The model has six main constructs: perceived susceptibility, perceived severity, perceived benefits, perceived barriers, cues to action, and self-efficacy. As used in malaria prevention, these constructs reveal why some pregnant women in Ekiti State will use ITNs consistently and others will not. For instance, perceived susceptibility reveals whether a woman believes she is at risk of contracting malaria in pregnancy; the more susceptible they are, the more they will use ITNs consistently.

Perceived severity is regarding how serious malaria is and the impact it has on maternal and foetal health. When pregnant women are helped to realise that malaria can cause anaemia, miscarriage, or low-birth-weight babies, they are likely to adopt preventive behaviour. The idea that sleeping beneath an ITN will shield you from insect bites and illness is one of the perceived benefits. However, frequent use is often discouraged by perceived constraints such as discomfort from heat, fear of insecticides, or cultural beliefs (Ekeleme et al., 2023; Sina, n.d). The use of ITNs is reinforced by cues to action, such as media advertisements and health discussions during

prenatal visits, whereas self-efficacy refers to a woman's belief in her capacity to use the internet regularly and successfully.

Although the main focus of HBM is on individual perceptions, Ajzen's (1991) theory of Planned Behaviour (TPB) expands the paradigm to include social and environmental influences on behavioural intentions. According to TPB, three factors, including attitude toward the behaviour, subjective norms, and perceived behavioural control, influence a person's desire to engage in a behaviour. Attitude toward ITN use is formed by a woman's perceptions of the benefits and drawbacks of net usage. She will have a positive attitude if she believes ITNs are useful and easy to use, which will increase the likelihood of use. Subjective norms refer to pressure from influential others**,** husband, family members, and health workers, whose opinions may encourage or dissuade ITN use.

Studies in Nigeria have shown that pregnant women who have spousal support and encouragement from health workers are far more likely to use ITNs consistently (Ekeleme et al., 2023; Onyinyechi, 2017). Perceived behavioural control is finally the perceived ease or difficulty of the performance of the behaviour, depending on net availability, proper installation, and sleeping arrangements. Even with strong intentions, limited control over these determinants may deter consistent ITN use. The TPB, therefore, complements the HBM in emphasising the role of social environment and perceived capability in the prediction of behaviour.

In Ekiti State, where there are highly diverse cultural beliefs and household contexts, the theory accounts for why knowledge does not always result in preventive action. Pregnant women may be aware of the benefits of ITN use but may not act if they lack support, face household constraints, or find the nets uncomfortable. Together, the Health Belief Model and the Theory of Planned Behaviour offer a comprehensive model for investigating ITN use among pregnant women.

The HBM describes how perceptions of risk, benefit, and barriers influence motivation at the individual level, and the TPB incorporates the social and environmental influences that determine whether intention is put into action. The application of both models enables this study to capture the multidimensionality of ITN use in Ekiti State, linking knowledge, beliefs, and external factors to actual health behaviour.

Methods

Research Design

The study adopted a cross-sectional descriptive design to establish the knowledge of ITN and also to identify the sociodemographic determinants of the utilisation of insecticide-treated nets (ITNs) among pregnant women. The design was appropriate as it allowed data collection from a large number of respondents at one time, thereby getting their information on knowledge and determinants (such as age, marriage status, education, and income, among others) of ITNs usage.

Study Population

The population of this study are all pregnant women, aged 15-49 years, who attended antenatal clinics in health facilities of Ekiti State.

Sample and Sampling Techniques

A sample size of 1,600 pregnant women (100 pregnant women each from 16 Local Government Areas) was proposed for the study. Out of which the researcher was able to retrieve information from 1,285 pregnant women from primary and secondary health facilities across the sixteen Local Government Areas (LGAs) for data analysis. The sixteen LGAs are: Ado-Ekiti, Aiyekire (Gbonyin), Ekiti East, Ekiti SouthWest, Ekiti West, Efon, Emure, Ido-Osi, Ijero, Ikere, Ikole, Ilejemeje, Irepodun/Ifelodun, Ise/Orun, Moba and Oye. A multi-stage sampling technique was employed during the selection of pregnant women.

The first stage involves random selection of Ekiti State out of six Southwest Nigeria. Stage two involved purposive selection of pregnant women from across the 16 LGAs to reflect a state coverage. Third stage includes accidental selection of pregnant women who are available and willing to participate from the selected health facilities in both rural and urban centres. In each of the LGAs, fifty pregnant women were gathered from rural and urban centres. The rural facilities in this context are facilities with lesser patronage of pregnant women, commonly located in the villages or sparsely populated areas, while the urban facilities are densely populated facilities, commonly located in major towns within the LGAs.

Data Sources

Data was sourced primarily using a structured questionnaire, which was encrypted in Survey CTO. The rationale for using Survey CTO was to minimise field errors from the research assistants and consequently enhance data quality.

Method of Data Collection

All the questions on the questionnaire were encrypted in the Survey CTO. The researcher engaged 16 research assistants (one research assistant per LGA) who have had similar experience in the past using Survey CTO. A day training was organised for the research assistants so that they could have a good understanding of the study objectives and the entire project.

Ethical Consideration

An approval was obtained from Ekiti State Primary Healthcare Development Agency (EKPHCDA) to conduct the study in selected health facilities. The respondents' information provided during the study was treated confidentially. Only the pregnant women who were willing to participate in the study were interviewed.

Measurement of Variable

Two important variables "dependent variable" and "independent variables" were measured in this study. The dependent variable, which is also referred to as the outcome variable is Insecticide-Treated Net usage. Insecticide Treated Net usage has a dichotomous response: 1 for "those who used" and 0 for "None use".

Data Analysis

Statistical Package for Social Scientist (SPSS version 27) was used to analyse quantitative data at the three levels. At the univariate analysis level, it involved the use of frequency counts and percentages showing the distribution of pregnant women with knowledge of ITN. The inferential statistics was performed using a Chi-square test at the bivariate level and binary logistic regression statistical techniques at the multivariate stage to

establish the relationship between the associated factors and ITN usage among the pregnant women.

Results

Table 1 Socio-Demographic Characteristics of Respondents

Variable	Category	Frequency (1,285)	Percent (%)
Age	15-19 years	78	6.07
Mean = 26.97	20-24 years	364	28.33
Std. dev = 5.41	25-29 years	457	35.56
	30-34 years	246	19.14
	35-39 years	114	8.87
	40-45 years	24	1.87
	45-49 years	2	0.16
Education	No formal education	126	9.81
	Primary	100	7.78
	Secondary	752	58.52
	Tertiary	285	22.18
	Other	22	1.71
Marital status	Single	60	4.67
	Married	1,211	94.24
	Separated	14	1.09
Religion	Christianity	1,034	80.47
	Islam	239	18.60
	Traditional	11	0.86
	Other	1	0.08
Ethnicity	Yoruba	985	76.65
	Igbo	89	6.93
	Hausa	66	5.14
	Others	145	11.28

Occupation	Civil/public service	78	6.07
	Artisan	644	50.12
	Self-employed	433	33.70
	Private employed	130	10.12
Average monthly income (#)	Below #10,000	266	20.70
	Within #10,000-#100,000	997	77.59
	Above #100,000	22	1.71
Type of facility	Pry Health Facility	937	72.92
	Secondary Health Facility	348	27.08

Field survey, 2024

The sociodemographic profile of the participants reveals a young population with a mean age of 26.97 ± 5.41 years. The majority (36%) was in the age group of 25–29 years, followed by 20–24 years (28%) and 30–34 years (19%). This indicates that most of the participants were young adults in their reproductive and economically productive period. The study population was heavily concentrated among young people, as only 2% of the respondents were 40 years of age or older.

In terms of education, the majority of respondents (59%) had only a secondary education, 22% had a tertiary education, 10% were uneducated, and 8% primary school education. This distribution indicates that most respondents were well-educated, which can raise their awareness and knowledge levels on health-related issues and positively influence their health-seeking behaviours. In terms of marital status, the majority of respondents (94%) were married, 5% were unmarried, and 1% were separated. The results show that the population is primarily made up of married couples, which means that spousal relationships may play a significant role in their decision-making, especially when it comes to health, family, and the economy.

The majority of respondents (80%) identified as Christian, followed by Muslims (19%), while only 1% belonged to traditional or other religions. The study area's social and cultural structure may be reflected in the religious composition, which may be a Christian-majority group with distinct values

and health beliefs. The Yoruba ethnic group made up the biggest percentage (77%), followed by the Igbo (7%), Hausa (5%), and other ethnic groups (11%). This indicates that the study was carried out in a region that was dominated by Yoruba people, in southwest Nigeria. An ethnic group's concentration in a society will inevitably have an impact on its language, cultural customs, and social interaction patterns.

According to the occupational distribution, 34% of the respondents were self-employed, and 50% of the respondents were artisans. Just 10% worked for commercial companies, while 6% were in the public or civil service. This suggests that the majority of respondents make their living through manual or small-scale labour, placing them in the informal economy. Lower and more erratic revenue levels are frequently associated with this kind of arrangement. This was supported by the respondents' low average monthly income of #26,058.60. Just 2% of the respondents earned more than #100,000 per month, while 21% earned less than #10,000 and 78% earned between #10,000 and #100,000. This pattern indicates a population that is primarily low- to middle-income, which may have an impact on access to health care and affordability, among other socioeconomic factors of living conditions.

Lastly, when it comes to healthcare utilisation, the majority of respondents (73%) sought care at primary health facilities, whereas 27% sought care at secondary health facilities. The importance of strengthening primary healthcare systems to reach lower-income, primarily informal-sector populations is underscored by the fact that most respondents preferred primary healthcare centres because they are more accessible, affordable, and trusted by the public.

Objective One: Knowledge of Insecticide-Treated Nets (ITN) among Pregnant Women

Table 2: Knowledge of Insecticide-Treated Nets (ITN) among Pregnant Women

Variable	Category	Frequency (1,285)	Percent (%)
Are you aware of ITN/Mosquito nets	No	193	15.02
	Yes	1,092	84.98
What was your source of information/knowledge	Social media	315	28.85
	Television	445	40.75
	Radio	603	55.22
	Newspaper	212	19.41
	Friend/Neighbour/	783	71.70
	Relatives		
	Others	64	5.86
When did you hear about ITN	<3 months	173	15.84
	3-5 months	117	10.71
	6-11 months	278	25.46
	1+ years	524	47.99
ITNs prevent malaria transmission	Strongly disagree		
	Disagree	13	1.19
	Undecided	33	3.02
	Agree	1,046	95.79
	Strongly agree		
What are the mode(s) of malaria prevention	By avoiding mosquito bites	1,179	91.75
	By avoiding any insect bite	639	49.73
	By cutting bushes in the surrounding	659	51.28
	By avoiding dust and dirt	760	59.14

	By other means	225	17.51
	Do not know	33	2.57
	Refused to answer	12	0.93
Are you aware of indoor residual spraying for malaria prevention	No	309	24.05
	Yes	976	75.95
What is/are your source of information/knowledge of indoor residual spraying	Social media	345	35.35
	Television	500	51.23
	Radio	586	60.04
	Newspaper	291	29.82
	Friend/Neighbour/	682	69.88
	Relatives		
	Others	22	2.25
Are you aware of Long-Lasting Insecticides (LLIN) for malaria prevention	No	243	18.91
	Yes	1,042	81.09
Do you use LLIN	No	290	27.83
	Yes	752	71.17
What is/are your source of information/knowledge of LLIN	Social media	291	27.93
	Television	471	45.20
	Radio	586	56.24
	Newspaper	248	23.80
	Friend/Neighbour/ Relatives	792	76.01
	Others	33	3.17

Field survey, 2024

Findings presented in Table 2 reveal that the majority of respondents (85%) were aware of Insecticide-Treated Nets (ITNs) or mosquito nets, while only 15% were unaware. Pregnant women's high degree of awareness also suggests that community-level sensitisation and malaria prevention activities have been successful. When asked where they got their knowledge or information on ITNs, the participants most commonly mentioned friends,

neighbours, or family (72%), followed by radio (55%) and television (41%). Newspapers (19%) and social media (29%) were also mentioned as information sources. However, just 6% of respondents said they got their information from other sources. This highlights the critical role that human contact, particularly radio, and the mass media play in delivering health messages to expectant mothers.

Regarding the respondents' initial exposure to ITNs, over half (48%) reported they had known about them for more than a year, 25% for 6 to 11 months, 11% for 3 to 5 months, and 16% for the previous three months. The results show that ITN campaigns have been in place for a long time, which suggests that the population has been exposed to and continues to receive information about malaria prevention. Regarding the perceived efficacy of ITNs, 96% of respondents agreed that they prevent the spread of malaria, compared to 3% who were unaware and 1% who disagreed. There was no respondent who strongly disagreed, showing very high positive perception of ITNs by pregnant women. This level of agreement confirms fairly good knowledge about the role of ITNs in malaria prevention.

Upon being asked about malaria prevention, nine out of ten (92%) of them appropriately identified avoiding mosquito bites. The remaining ones cited avoiding dust and dirt (59%), cutting bushes around the house (51%), and avoiding any insect bite (50%). Another 18% gave other preventive measures, 3% did not know, and 1% refused to respond. Although the majority of respondents correctly associated mosquito bites with the transmission of malaria, the mention of dust and other flies as possible causes suggests that a small proportion of respondents still hold minor misconceptions about the causes and prevention of malaria.

Knowledge of indoor residual spraying (IRS) as a malaria control was also indicated to be high at 76%, with the rest of 24% reporting otherwise. Radio (60%), television (51%), and friends or relatives (70%) were again reported to be the key sources of information on IRS, followed by social media (35%) and newspapers (30%). This finding upholds the influential position of mass media and social networks in communication strategies for malaria prevention. Similarly, 81% of the participants were aware of Long-Lasting Insecticidal Nets (LLINs), and 19% were unaware. However, 71% of respondents reported actually utilising LLINs, while 28% reported not using them, indicating that practice lagged only below knowledge levels.

This disparity between use and awareness raises the possibility that, even in cases where pregnant women have a high level of knowledge, regular use of LLINs may be influenced by behavioural or practical constraints, including heat distress, perceived inconvenience, or unavailability. ITN and IRS awareness also served as a model for LLIN's information sources, which were most commonly stated to be neighbours, friends, and family (76%), followed by radio (56%), television (45%), social media (28%), and newspapers (24%). Only a small percentage of people reported the remaining 3 percent of channels. The trend's similarities highlight the value of community engagement and reliable communication channels in educating women about malaria prevention.

Objective Two: Factors Influencing Insecticide Treated Net Usage among Pregnant Women

Table 3: Relationship between Sociodemographic characteristics and the use of ITN

Sociodemographic characteristics			χ^2	p-value
Age	No	Yes		
15-19 years	30 (34.46%)	48 (61.54%)	13.7840	0.032
20-24 years	134 (36.81%)	230 (63.19%)		
25-29 years	130 (28.45%)	327 (71.55%)		
30-34 years	62 (25.20%)	184 (74.80%)		
35-39 years	36 (31.58%)	78 (68.42%)		
40-45 years	6 (25.0%)	18 (75.0%)		
45-49 years	1 (50.0%)	1 (50.0%)		
Education				
No education	8 (6.35%)	118 (93.65%)	49.5545	0.000
Primary	27 (27.00%)	73 (73.00%)		
Secondary	275 (36.57%)	477 (63.43%)		
Tertiary	80 (28.07%)	205 (71.93%)		
Other	9 (40.91%)	13 (59.09%)		

Marital Status				
Single	28 (46.67%)	32 (53.33%)	8.2145	0.016
Married	365 (30.14%)	846 (69.86%)		
Separated	6 (42.86%)	8 (57.14%)		
Ethnicity				
Yoruba	294 (29.85%)	691 (70.15%)	20.2948	0.000
Igbo	19 (21.35%)	70 (78.65%)		
Hausa	19 (28.79%)	47 (71.21%)		
Others	67 (46.21%)	78 (53.79%)		
Location of health faculties				
Rural	211 (32.07%)	447 (67.93%)	0.6506	0.420
Urban	188 (29.98%)	437 (70.02%)		
Occupation type				
Civil /public service	11 (14.10%)	67 (85.90%)	12.8252	0.005
Artisan	206 (31.99%)	438 (68.01%)		
Self-employed	134 (30.95%)	299 (69.05%)		
Private-employed	48 (36.92%)	82 (63.08%)		
Income level				
Below 10,000	124 (46.62%)	142 (53.38%)	41.3269	0.000
Btw 10,000-100,000	273 (27.38%)	724 (72.62%)		
Above 100,000	2 (9.09%)	20 (90.91%)		
Religion				
Christianity	309 (29.88%)	725 (70.12%)	5.8167	0.121
Islam	84 (35.15%)	155 (64.85%)		
Traditional	5 (45.45%)	6 (54.55%)		
Other religion	1 (100%)	0 (0.00%)		

Field survey, 2024

Relationship Between Socio-Demographic Characteristics and the Use of Insecticide-Treated Nets (ITNs)

The chi-square test was used to establish the nexus between respondents' sociodemographic characteristics and their use of insecticide-treated nets

(ITNs). The results show a number of significant associations, suggesting that socioeconomic and personal factors are important in determining pregnant women's behaviour regarding malaria prevention. There was a statistically significant correlation between age and ITN use (χ^2 = 13.784, p = 0.032). Up until the age group of 30 to 34, the percentage of respondents who reported using ITNs increased with age. About 62% of the youngest respondents, those between the ages of 15 and 19, reported using ITNs, while the percentage steadily increased to 75% of those between the ages of 30 and 34. This trend suggests that older women are either more likely to have access to maternal health facilities where ITNs are provided or are usually more health-conscious. The outcome also shows that women's dedication to preventive measures increases as they gain knowledge and awareness of the risks of malaria during pregnancy.

Additionally, there was a high and statistically significant correlation between ITN use and educational achievement (χ^2 = 49.554, p = 0.000). According to the findings, almost all respondents (94%) who had no formal education reported using ITNs, followed by those who had basic education (72%) and university education (72%). It is interesting to see that secondary-educated women used it less frequently (63%). Although mass health campaigns may potentially be successful in reaching even the less educated through community health workers and antenatal care programmes, the finding suggests that exposure to education generally enhances awareness and understanding of malaria prevention.

Another important factor affecting ITN use was marital status (χ^2 = 8.214, p = 0.016). Compared to women who were single (53%) and separated (57%), married women (70%) were more likely to use ITNs. This might be a result of married women having access to more social support and stability, as well as more prenatal visits that expose them to health information. Additionally, marriage may promote more responsible health-seeking behaviours that protect the mother and foetus. Additionally, ITN usage was significantly influenced by ethnicity (χ^2 = 20.295, p = 0.000). The Igbo respondents had the greatest ITN usage rate (79%) among the major ethnic groups, followed by the Hausa (71%) and Yoruba (70%), while the "other" ethnic group had the lowest percentage (54%). These discrepancies could be attributed to regional disparities in malaria awareness

efforts, cultural differences in health-seeking behaviour, or availability to preventive resources. However, the overall trend indicates that ITN use is widespread across major ethnic groups, indicating widespread national acceptance of malaria prevention messaging.

There was no significant correlation between ITN use and the location of health institutions (rural versus urban) ($\chi^2 = 0.651$, $p = 0.420$). Between rural and urban areas, ITN use was nearly equal, with 68% and 70%, respectively. This conclusion implies that the conventional gap in access to malaria control interventions has been closed as a result of the successful implementation of ITN distribution initiatives and malaria prevention programmes in both rural and urban regions.

Additionally, there was a significant relationship between ITN use and occupation type ($\chi^2 = 12.825$, $p = 0.005$). Employees in the commercial sector used ITN at the lowest percentage (63%), while civil and public workers used it the most (86%), followed by self-employed individuals (69%) and artisans (68%). Better health education and a more stable income may be associated with the comparatively high utilisation among government servants. This could make it easier for them to acquire high-quality healthcare services and encourage them to adopt preventative behaviours.

Similarly, there was a substantial and significant relationship between ITN use and income level ($\chi^2 = 41.327$, $p = 0.000$). According to the data, ITN usage increased as income levels did. The highest rate of ITN use was reported by respondents earning over #100,000 per month (91%), followed by those making between #10,000 and #100,000 (73%). On the other hand, the lowest usage rate (53%) was found among individuals making less than #10,000. This suggests that income has a significant impact on preventive health behaviour; households with greater financial stability are more likely to buy or keep mosquito nets, whereas people in poverty may rely only on free distributions, which are not always adequate or long-lasting. However, there was no statistically significant relationship between religion and ITN use ($\chi^2 = 5.817$, $p = 0.121$). Traditionalists indicated a usage rate of 55%, whereas Christians and Muslims reported similar rates of 70% and 65%, respectively. The homogeneity across religious groups implies that other social and educational variables, rather than religious convictions, influence ITN use.

Table 4: Binary Logistic Regression showing the Relationship between Sociodemographic Characteristic on the Use of Insecticide Treated Net

				Lower	Upper
Variables	**Odds ratio**	**Std. error**	**p-value**	**95% conf. interval (C.I)**	**95% conf. interval (C.I)**
Age					
15-19 years **RC**	1.00				
20-24 years	0.99	0.28	0.97	0.57	1.73
25-29 years	1.35	0.40	0.31	0.76	2.40
30-34 years	1.44	0.45	0.25	0.78	2.67
35-39 years	0.85	0.30	0.65	0.42	1.71
40-45 years	1.15	0.67	0.81	0.37	3.60
45-49 years	0.20	0.32	0.31	0.01	4.65
Marital status					
Single **RC**	1.00				
Married	1.41	0.43	0.25	0.78	2.55
Separated	0.88	0.56	0.84	0.26	3.05
Education					
No education **RC**	1.00				
Primary	0.19	0.84	0.00**	0.78	0.45
Secondary	0.99	0.40	0.00**	0.45	0.22
Tertiary	0.11	0.47	0.00**	0.50	0.25
Other	0.06	0.04	0.00**	0.02	0.19
Ethnicity					
Yoruba RC	1.00				
Igbo	1.44	0.41	0.20	0.83	2.51
Hausa	0.58	0.19	0.10	0.31	1.10
Others	0.52	0.10	0.00**	0.35	0.75
Occupation					
Civil/public service RC	1.00				
Artisan	0.37	0.13	0.01**	0.18	0.75

Self-employed	0.35	0.13	0.00**	0.17	0.71
Private employed	0.38	0.13	0.01**	0.17	0.82
Average monthly income					
Below 10,000 RC	1.00				
Within 10,000-100,000	2.20	0.33	0.00**	1.63	3.00
Above 100,000	8.46	6.48	0.01**	1.89	37.93
Cons	17.29	10.67	0.00**	5.16	57.95

Field survey, 2024

RC-Reference Category. ** = Significant at 0.05

Binary Logistic Regression Analysis of Sociodemographic Predictors of ITN Use

To further understand the determinants of the use of Insecticide-Treated Nets (ITNs) by pregnant women, a binary logistic regression model was employed. The model examined the combined influence of key sociodemographic characteristics on the use of ITN, whose results are shown in Table 4. The dependent variable was ITN use (coded "1" for use and "0" for non-use), while explanatory variables were age, marital status, education, ethnicity, occupation, and income.

Overall, the regression model identified education, occupation, and income level as the most consistent predictors of ITN use, with no statistically significant impact of age, marital status, and ethnicity when other variables were held constant. This indicates that socioeconomic variables play a far larger role than demographic variables in the determination of ITN use behaviour in the respondents.

Age was not a significant predictor of ITN use. Although respondents aged 25–34 years had slightly higher odds of using ITNs compared to the reference group (15–19 years), none of the age groups recorded statistically significant p-values. For instance, respondents aged 30–34 years were 1.44 times more likely to use ITNs than those aged 15–19 years, but this was not significant ($p = 0.25$). This would mean that while ITN use rises with age, possibly due to greater health awareness and experience of pregnancy, the difference is not strong enough to identify age as an independent predictor of ITN use. The odds of ITN use were higher in married respondents (OR = 1.41) compared to single women, but the relationship was not significant

($p = 0.25$). Similarly, separated respondents also had slightly lower odds of ITN use (OR = 0.88, $p = 0.84$). In addition, the trend agrees with the former chi-square results showing higher ITN use by married women, but, in the multivariate model, when other socioeconomic variables were controlled, marital status was no longer predictive. It could therefore be concluded that marital status indirectly influences ITN use through economic and educational channels rather than being an independent factor.

Education was a strong and very significant predictor of ITN use ($p < 0.05$ for all groups). Somewhat surprisingly, the odds ratios were less than unity for all education levels compared to those with no formal education, indicating a negative correlation between higher education and ITN use. Specifically, respondents who had a primary education were 81% less likely to use ITNs (OR = 0.19, 95% CI: 0.78–0.45), while those with secondary education were less likely (OR = 0.99, 95% CI: 0.45–0.22), and with tertiary education were even less likely (OR = 0.11, 95% CI: 0.50–0.25). This inverse correlation would suggest that the uneducated may be more reliant on public health programmes such as free ITN distribution during antenatal care, while the educated may be either less so or may use different mechanisms of malaria prevention. However, the importance of education suggests that it plays a crucial role in influencing health-related behaviour and knowledge.

Although there was considerable variation in ethnicity as well, the "others" category was the only one with a statistically significant impact. Igbo women were marginally more likely to utilise ITNs (OR = 1.44), while Hausa respondents were less likely (OR = 0.58), however, neither difference was statistically significant when Yoruba respondents were used as the reference group. In comparison, those from "other" ethnic groups were significantly less likely to use ITNs (OR = 0.52, $p < 0.05$). This would suggest that minority ethnic groups may have poorer access to ITN distribution schemes or health promotion campaigns, reflecting inequalities that could be addressed by culturally appropriate public health measures.

Occupation type was another variable that was a significant predictor of ITN usage ($p < 0.05$). Compared to civil/public servants (the reference group), artisans (OR = 0.37), the self-employed (OR = 0.35), and private employees (OR = 0.38) were all significantly less likely to use ITNs. This

indicates that those in formal, secure employment are more likely to use preventive interventions than those in informal groups. Public sector workers would also be subject to more health promotion programmes and formal workplace health promotion programmes, and hence have higher awareness and higher levels of use. The findings identify occupational class as a key socioeconomic determinant of health behaviour.

Income was the strongest predictor of ITN use. Relative to those who earn less than #10,000 a month, respondents who earn between #10,000–#100,000 were 2.2 times as likely to use ITNs (OR = 2.20, 95% CI: 1.63–3.00), and those who earn more than #100,000 were 8.46 times as likely (95% CI: 1.89–37.93, p = 0.01). This dramatic trend clearly indicates that economic capacity has a direct influence on access to malaria prevention measures and general health behaviour. While low-income families remain vulnerable due to limited financial resources and reliance on government distribution, higher-income households are more likely to purchase, maintain, and value health protection from mosquito nets.

Discussion

Knowledge of Insecticide-Treated Nets (ITN) among Pregnant Women

The results of the present study revealed that there was high awareness among pregnant women (85%) about insecticide-treated nets (ITNs), while 15% were unaware. The high level of awareness confirms the strong penetration of malaria prevention campaigns at the community level. The outcome is consistent with Okafor and Ogbonnaya (2020) in Enugu, South-East Nigeria, who reported that all pregnant women who were interviewed had ITN knowledge and that most of them possessed one or more nets obtained from government-led distribution initiatives. Similarly, Uhuo et al. (2022) concluded that the inhabitants of Ivo Local Government Area in Ebonyi State were well aware of ITNs, which implies that there has been widespread awareness across different regions of Nigeria. Overall, these studies reinforce the reality that ongoing health education and government distribution have contributed to increased awareness of ITNs among women of reproductive age, including pregnant women.

Despite this overall consciousness, the present study also noted a disconnection between consciousness and consistent usage in that 71% of

the respondents reported use of Long-Lasting Insecticidal Nets (LLINs) compared to 81% who were aware of them. This finding is consistent with the patterns found in earlier studies, which also acknowledged that awareness does not necessarily translate into constant usage. Meanwhile, Okafor and Ogbonnaya (2020) reported high ownership and access to ITNs by pregnant women; they did not examine a broad spectrum of behavioural or perceptual barriers to regular use. Likewise, Uhuo et al. (2022) highlighted the role of education, age, and occupation on ITN knowledge but examined very little how these interact with respondents' perceptions or behavioural incentives to use ITNs. The current research thus contributes to the literature by demonstrating that, despite high levels of knowledge, utilisation may fall behind due to perceptual and behavioural constraints such as perception of inconvenience due to sleeping under bed nets.

Describing these findings through the Health Belief Model (HBM) provides a conceptual model for understanding the observed patterns. The extremely high degree of knowledge about ITNs and LLINs among the respondents reflects a high perceived severity and perceived susceptibility. Pregnant women appear to recognise that malaria poses a serious risk to the health of the mother and the child. Their high consensus (96%) that ITNs protect against malaria reflects a high perceived benefit, a key predictor of preventive behaviour in the HBM framework. Nevertheless, the awareness-regular use gap observed suggests the influence of perceived barriers, possibly physical discomfort because of heat, inconvenience in net hanging, or limited access in some households. These barriers might mediate the association between knowledge and behaviour and decrease regular use despite the presence of positive attitudes towards ITNs.

The findings of the study on sources of information also deepen insight using the HBM's cues to action framework. The respondents mostly reported having acquired information about ITNs from relatives, neighbours, and friends, followed by television and radio. These are significant sources of information for the initiation and sustenance of preventive behaviours as external cues that trigger people into action. The influence of interpersonal networks shown in this study is in agreement with Uhuo et al. (2022) result, where education and community activity both had significant relations to ITN awareness. This suggests that community communication is still a

powerful stimulator of decision-making for health in rural or semi-urban communities where frequent formal health promotion might be less common.

Furthermore, the current findings address an observed gap in the existing literature: the lack of integration among descriptive knowledge assessments and models of behavioural theory. As noted, most earlier research, including Okafor and Ogbonnaya (2020) and Uhuo et al. (2022), provided statistical correlations between demographic variables and ITN awareness but did not necessarily employ models such as the Health Belief Model to provide explicit explanations regarding why individuals act or do not act in accordance with their awareness. By employing the HBM, this study contributes to the theoretical understanding of malaria preventive behaviour among pregnant women through an examination of how perceived benefits, perceived barriers, and cues to action interact.

Binary Logistic Regression Analysis of Sociodemographic Predictors of ITN Use

The predictors of use of insecticide-treated nets (ITNs) among pregnant women were evaluated in this study, with education, income, and occupation being independent predictors of use, but not age, marital status, and ethnicity. Explanation of these findings based on the Health Belief Model (HBM) helps to provide insight into the cognitive and behavioural determinants of ITN use among reproductive-aged women. For the HBM, health behaviour is determined by an individual's belief in disease susceptibility, severity of the disease consequences, reward of preventive measures, cues to action that trigger response, and barriers to adopting them. In this context, the use of ITNs can be seen as a preventive measure due to pregnant women's perceived susceptibility to malaria, their belief in the effectiveness of ITNs, and the social and structural determinants that enable or constrain their use.

The finding that income was the best predictor of ITN use supports the HBM's perceived barriers construct. The female respondents with higher economic resources had higher probabilities of using ITNs, which means that economic resources remove structural and psychological impediments to preventive behaviour. This is also in line with (Ogidan et al., 2025) and Barrow et al. (2025), who also found that higher socioeconomic status enhanced access to ITNs in Nigeria. Economic empowerment is thus a

facilitator, where economic self-efficacy is enhanced, and dependency on irregular government dispensation reduces.

Conversely, the inverse relationship between education and the use of ITNs presents a mixed perspective in terms of perceived advantages and action cues. Unlike Ameyaw et al. (2020), who observed higher ITN use among more educated Ugandan women regarding enhanced knowledge of malaria prevention, in the present study, less-educated women had higher odds of ITN use. This can be explained by increased reliance on public health cues, such as free ITN distribution during antenatal visits, which directly affect perceived susceptibility and compliance in less educated groups. Better-educated women would employ alternative preventive measures, which reflects a difference in internalisation of health messages and translation into action.

Occupation also works under the self-efficacy and cues to action components of the HBM. Women who work in the formal sector reported greater ITN use because, with the influence of health campaigns in workplaces, routine interventions, and formal exposure to health communication, confidence is boosted and good health behaviours are reinforced. These findings are in line with Solanke et al. (2023), who identified social and environmental determinants of use, that is household size and net availability as determinants of use, suggesting strongly contextualised cues to behaviour.

The limited impact of marital status and ethnicity in the present study also supports the argument that perceived barriers, rather than social identity per se, are to blame for ITN use. As Barrow et al. (2025) explained, regional and cultural differences generally reflect differences in programme reach and message relevance rather than inherent differences in health beliefs. Management of such differences may therefore include culturally adapted health communication interventions that enhance perceived susceptibility and benefit among all ethnic groups.

In general, results support that ITN use behaviour is mostly controlled by socioeconomic and perceptual aspects, as suggested by the HBM. Whether or not pregnant women use ITNs is not just a function of knowledge or demographic status but also whether or not they balance perceived benefits against obstruction in social and economic spheres. Therefore, interventions

to promote ITN use need to integrate behavioural education with structural empowerment so that not only do women know the benefits of ITNs but also they have the resources and incentives to use them regularly.

Policy Implications

The findings have several implications for malaria control and maternal health interventions. First, while awareness is admirable, the persistence of non-use indicates that policy needs to go from merely disseminating and providing information to addressing contextual and behavioural impediments. Campaigns for public health must highlight the importance of individualised risk perception and show that it is still relevant for people living in urban or modernised settings. Consistent ITN use will be encouraged and awareness will be maintained by including malaria teaching into community health initiatives and prenatal care services. With the use of strong monitoring systems to keep tabs on usage and replacement rates, it is imperative that all expectant mothers receive a long-lasting insecticidal net (LLIN) throughout ANC visits. More fair coverage would be ensured by combining ITN distribution and education with routine prenatal care and occupational health initiatives.

Conclusion

This study reiterates that malaria prevention during pregnancy is both a socio-economic and behavioural challenge. Universal adoption and use of ITN will be achieved not only through information campaigns but also through targeted and context-specific interventions that address the psychological, cultural, and economic forces that control women's health behaviour.

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