Original Research Article

Attitudes and Practices of Insecticide treated Bed Nets Usage among Rural Dwellers in Oyo State, Nigeria

ABSTRACT

Aim: Malaria, a life-threatening disease transmitted to humans by the bites of infected female Anopheles mosquitoes, continues to be a significant public health issue, particularly in sub-Saharan Africa. This study was aimed at understanding the attitudes and practices regarding the use of insecticide-treated bed nets (ITNs) among rural dwellers in Oyo state, Nigeria.

Methodology: The study adopted a cross-sectional design. The questionnaire was developed based on the objectives of the study. Sample size was calculated using the Fisher's formula. The minimum sample size was 278 and was adjusted to 306 to account for non-response rate of 10%. A multi-stage cluster sampling technique was employed to select the participants.

Results: The primary understanding of the purpose of ITNs was prevention of mosquito bites (59.67%), and prevention of malaria (40.33%). However, only 74% believed that ITNs could effectively prevent malaria and just 66% considered ITNs safe for use. The practice of ITN usage was quite high, with 93% of respondents possessing ITNs in their households. ITNs were obtained predominantly through free distribution (49%) or purchase (29.67%). Use of ITNs varied among participants, with 28.67% always using it, 41% often using it, and 7% never using it. The reasons for not always using ITNs included discomfort sleeping under it (49%) and perceptions of heat (30%). An analysis of the factors affecting the usage of ITNs indicated a significant association with the age, marital status, level of education, knowledge of ITNs, and beliefs about ITN's effectiveness and safety. The usage of ITNs was particularly low among younger respondents, those who were single or widowed/divorced/separated, those with no formal education or primary education, and those who were unaware of ITNs or did not believe in their effectiveness or safety.

Conclusion: This study reveals a gap between knowledge and practice in ITN use, with significant barriers being discomfort and a lack of belief in the effectiveness of ITNs. While ownership rates are high, usage rates, especially consistent usage, is low. This was due to misconceptions, especially around the efficacy and safety of ITNs. Moreover, maintenance practices are suboptimal.

Keywords: Insecticide-treated bed nets, Knowledge and Attitude, Practice and utilization

1. INTRODUCTION

Malaria, a life-threatening disease transmitted to humans by the bites of infected female Anopheles mosquitoes, continues to be a significant public health issue, particularly in sub-Saharan Africa. Nigeria, with its warm climate, copious rainfall, and vast mosquito population, bears a significant proportion of the global malaria burden. According to the World Health Organization (WHO), Nigeria accounted for approximately 23% of the global malaria cases and 19% of the deaths in 2020 [1]. As such, measures aimed at controlling and eliminating malaria need to be both effective and efficiently utilized.

Insecticide Treated Bed Nets (ITNs) have been identified as one of the most effective and cost-efficient measures for controlling malaria. Numerous studies, such as Bhatt *et al*. [2], attest to the efficacy of ITNs in reducing malaria incidence and prevalence. ITNs not only offer personal protection for users but also, when coverage is high enough, can result in a mass effect, reducing the mosquito population and thus indirectly protecting those not sleeping under a net.

The Nigerian Government, through the National Malaria Elimination Programme (NMEP), has made the universal coverage of ITNs one of its primary strategies for malaria control. This has involved mass ITN distributions, free or highly subsidized ITNs through antenatal clinics, schools, and other platforms. As of 2021, more than 200 million ITNs have been distributed nationwide, with Oyo State receiving a significant share [3].

However, while the distribution of ITNs has been extensive, the actual use of ITNs has been less encouraging. The WHO [1] reported that in sub-Saharan Africa, less than 50% of people at risk of malaria slept under an ITN. Similarly, the Nigeria Malaria Indicator Survey [4] noted that while ITN ownership in Oyo State was relatively high at 80%, actual usage was much lower, at around 40%. These findings suggest a gap between ITN ownership and usage, indicating that owning an ITN does not necessarily translate into its proper and consistent use.

The disparity between ITN ownership and usage has sparked interest in understanding the factors that influence individuals' attitudes and practices towards ITN use. Studies such as Pulford *et al*. [5] have identified factors such as knowledge about malaria and ITNs, perceived effectiveness of ITNs, comfort, and convenience, as influencing ITN usage. However, these studies were conducted in urban areas or in states with relatively low ITN distribution rates. Few studies have focused on the attitudes and practices of ITN use among rural dwellers in states like Oyo with high ITN distribution rates.

The rural context presents unique challenges and opportunities that may affect attitudes and practices towards ITN use. Factors such as literacy levels, health-seeking behaviours, socioeconomic status, and cultural beliefs may be different in rural areas and significantly influence ITN usage [6]. Understanding these factors is crucial for designing interventions that will increase ITN usage and thus enhance malaria control.

2. **RESEARCH METHODOLOGY**

2.1 Research Design

The research design adopted in this study was a descriptive cross-sectional study, which allowed for the collection of data at a specific point in time from a defined population [7]. This design was chosen to provide a snapshot of the attitudes and practices surrounding insecticide-treated bed net use within the target population. The target population for this study was individuals aged 18 years and above residing in Surulere local government area of Oyo State, Nigeria. The questionnaire was developed based on the objectives of the study. It consisted of closed-ended questions, which were easy to understand and answer. A pilot study was carried out in a non-selected community to test the questionnaire for clarity, understanding, and time to complete. Necessary adjustments were made based on the feedback from the pilot study before the actual data collection.

2.2 Sample Size Determination

Sample size was calculated using the formula by Fisher *et al*. [8]

$$n = \frac{\mathbf{Z^2(Pq)}}{\mathbf{e^2}}$$

where n = minimum sample size

Z = 1.96 at 95% confidence, so that $Z^2 = 3.8416$

P = known usage of ITNs = 76.2%

e = error margin tolerated at 5%= 0.05

q = 1 - p

Usage of ITNs of 76.2% was obtained from a cross sectional survey in southern Nigeria [9].

P= 76.2% = 0.762

q = 1-p

= 1-0.762

= 0.238

e = error margin tolerated at 5% = 0.05

e^2 = 0.0025

n = (1.96 X 1.96 / 0.05 X 0.05) (0.762 X 1 - 0.762)

n = 278

The minimum sample size was 278 and was adjusted to 306 to account for non-response rate of 10%.

2.3 Collection of Data

A multi-stage cluster sampling technique was employed to select the participants. Firstly, a random selection of rural communities in Surulere LGA was conducted, followed by a systematic sampling of households within those communities, and one eligible adult per household was invited to participate in the study. Trained enumerators visited the selected households to administer the questionnaires. The enumerators ensured that all questions were answered and provided clarification when needed. Data collection was carried out between January and June 2023, and enumerators were closely supervised to ensure data quality.

2.4 Data Analysis

Data collected was coded and entered into the Statistical Package for the Social Sciences (SPSS) version 26 for analysis. Descriptive statistics (frequencies and percentages) were used to summarize the data. Chi-square tests were conducted to determine the association between categorical variables. A significance level of 0.05 was used for all statistical tests.

3. RESULTS

A total of three hundred and six (306) questionnaires were administered to respondents and they were all retrieved. Out of these, three hundred (300) were valid. This was due to irregular, incomplete and inappropriate responses to some questionnaires. These 300 questionnaires were cleansed for analysis. The results showed that most respondents are in the 30-39 age group (44.33%), are married (73.33%), and have secondary level education (52.33%). The majority are farmers by occupation (32.33%), and follow Islam as a religion (46.67%). The largest group of respondents live in a household with 7-9 people (47.67%) as presented in table 1.

The results showed that all respondents are aware of malaria, with most learning about it from family or friends (32.53%) and school (31.72%). Almost all know the cause of malaria (98.66%) and correctly identify mosquitoes as the cause (91.80%). Almost all respondents are aware of ITNs (97.67%), with most learning about them from family or friends (43.36%) and health workers (23.86%). The majority understand that the purpose of ITNs is for the prevention of mosquito bites (59.67%) and malaria (40.33%). Most respondents believe that ITNs can help prevent malaria (74.00%) and think they are safe to use (66.00%) as presented in table 2.

A significant majority have an ITN in their house (93.00%), with most owning 2 ITNs (37.28%). Among those who don't have any ITNs, the main reasons are that they don't think it's necessary (42.86%) and they don't believe in its effectiveness (33.33%). Regarding the source of their ITNs, most received them through free distribution (49.00%) or bought them (29.67%). As for usage, most use their ITN often (40.67%). The ITN is mostly used by everyone in the household (44.00%). The main reasons for

not always using the ITN are that it's too hot (30.00%) and uncomfortable to sleep under (49.00%). Most respondents have noticed a reduction in mosquito bites or malaria incidence since they started using ITNs (90.33%) and would recommend ITNs to others (90.67%). However, most respondents rarely wash their ITN (51.33%) and replace it once every 5 years (53.33%). A majority have received some form of education or information about ITN use and maintenance (68.67%).

The chi-square test of independence (Table 4) showed that age significantly affected usage, with older people (30-39, 40-49, 50-59, 60 and above) using ITNs more frequently than younger ones. Marital status also had an impact, with married people using ITNs more frequently than single or separated/divorced/widowed individuals. Level of education influenced usage, with those with secondary or tertiary education using ITNs more frequently than those with no formal education or primary education. The number of people living in the household also influenced ITN usage, with households having 1-3 people using ITNs more frequently than larger households. Awareness of ITNs was significant, with those who had heard of ITNs using them more frequently. Belief in the preventive power of ITNs against malaria had a significant effect, with believers using ITNs more frequently. Perceptions of ITN safety also significantly affected usage, with those believing in their safety using them more frequently. In contrast, occupation and religion were not found to significantly affect ITN usage (p-values > 0.05), suggesting that these factors are less likely to influence ITN usage.

Table 1: Demographic Distribution of Respondents

Demographic Information	Frequency (n = 300)	Percentage (%)
Age (in years)		
Below 20	11	3.67
20-29	34	11.33
30-39	133	44.33
40 – 49	80	26.67
50 – 59	25	8.33
60 and Above	17	5.67
Marital Status		
Single	16	5.33
Married	220	73.33
Separated/Divorced/Widowed	64	21.33
Level of Education		
No formal education	8	2.67
Primary	56	18.67
Secondary	157	52.33
Tertiary	79	26.33
Occupation		
Students	17	5.67

Farmer	97	32.33
Trader	68	22.67
Artisan	75	25.00
Civil servant	37	12.33
Unemployed	6	2.00
Religion		
Islam	140	46.67
Christianity	129	43.00
Others	31	10.33
How many people live in your household?		
1 – 3	11	3.67
4 – 6	85	28.33
7 – 9	143	47.67
10 and above	61	20.33

Table 2: Knowledge and Attitude about Malaria and Insecticide Treated Bed Nets

Variable	**Frequency (n = 300)**	**Percentage (%)**
Do you know about malaria?		
Yes	300	100.00
No	00	0.00
***If yes, how did you learn about malaria? (Select all that apply to you) (n = 372*)**		
Family or Friends	121	32.53
School	118	31.72
Health Workers	78	20.97
Media (TV, radio, newspapers, internet)	44	11.83
Others	11	2.96
Do you know the cause of malaria?		
Yes	296	98.66
No	4	1.33
***What do know that causes malaria? (Select all that apply) (n = 317*)**		

Virus	00	0.00
Mosquitoes	291	91.80
Stress	23	7.26
Housefly	2	0.63
I don't know	1	0.32
Have you heard of insecticide-treated bed nets (ITNs)?		
Yes	293	97.67
No	7	2.33
***If yes, how did you learn about ITNs? (Select all that apply to you) (n = 482)**		
Family or Friends	209	43.36
School	84	17.43
Health Workers	115	23.86
Media (TV, radio, newspapers, internet)	74	15.35
Others	00	0.00
What is your understanding about the purpose of ITNs?		
Prevention of mosquito bites	179	59.67
Prevention of malaria	121	40.33
Just for comfort	00	0.00
I don't know	00	0.00
Do you believe that ITNs can help prevent malaria?		
Yes	222	74.00
No	43	14.33
Not sure	35	11.67
Do you think ITNs are safe for use?		
Yes	198	66.00
No	61	20.33
Not sure	41	13.67

* = multiple Responses

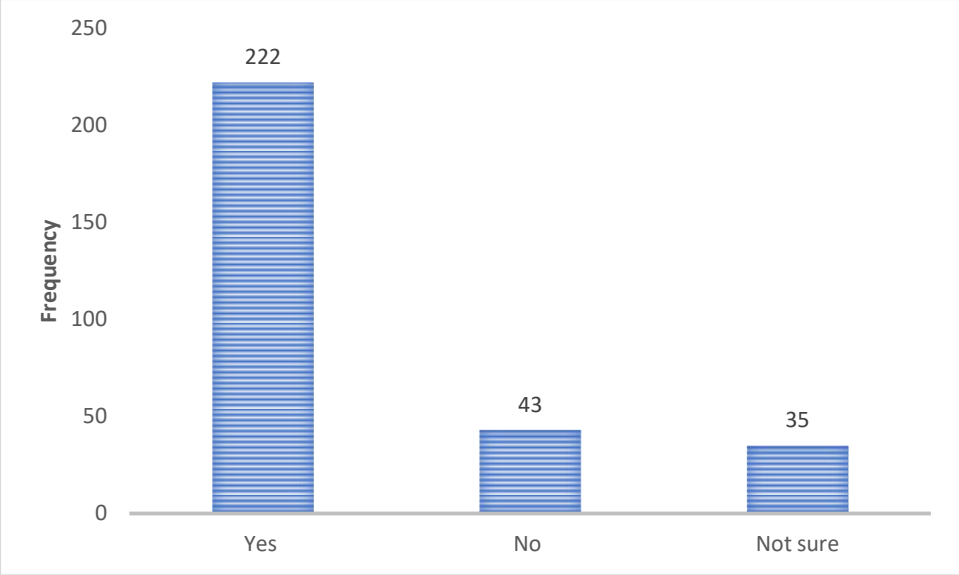

Figure 1: Knowledge of ITNs in the prevention of Mosquitoes

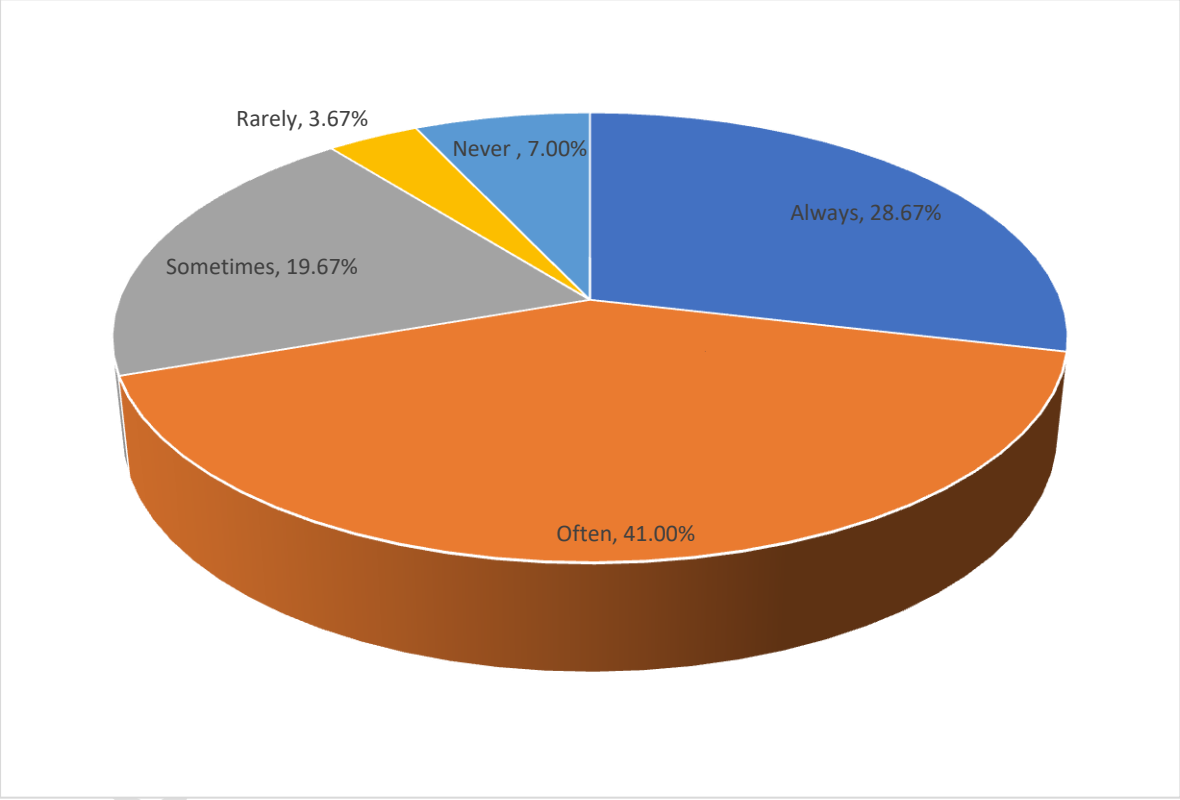

Figure 2: Usage of Insecticide Treated Bed Nets

Table 3: Practice and Utilization of Insecticide Treated Bed Nets

Variable	Frequency (n = 300)	Percentage (%)
Do you have insecticide-treated bed net in your house?		
Yes	279	93.00

No	21	7.00
If yes, how many?		
1	38	13.62
2	104	37.28
3	82	29.39
4	36	12.90
5 and above	19	6.81
If no, why do you not have any?		
I don't think it's necessary	9	42.86
Not affordable	3	14.29
Not available	2	9.52
Do not believe in its effectiveness	7	33.33
How did you get your ITN?		
I bought it	89	29.67
Free Distribution	147	49.00
From Family and Friends	64	21.33
How often do you use the insecticide-treated bed net?		
Always	86	28.67
Often	123	41.00
Sometimes	59	19.67
Rarely	11	3.67
Never	21	7.00
Who in your household uses the ITNs?		
Everyone	132	44.00
Only Children	47	15.67
Only Adults	36	12.00
Only Elderly	64	21.33
No one	21	7.00
***If you do not always use ITNs, what are your reasons? (Select all that apply to you)**		
Too Hot	90	30.00
Uncomfortable to sleep under	147	49.00

Don't believe in its effectiveness	34	11.33
Not available in my area	19	6.33
Others	4	1.33
Have you noticed any reduction in mosquito bites or malaria incidence since you started using ITNs?		
Yes	271	90.33
No	00	0.00
Not sure	8	2.67
I don’t use it	21	7.00
Would you recommend ITNs to others?		
Yes	272	90.67
No	2	0.67
Not sure	26	8.67
How often do you wash your ITN?		
Always	00	0.00
Often	00	0.00
Sometimes	114	38.00
Rarely	154	51.33
Never	32	10.67
How often do you replace your ITBN?		
Once in 6 months	00	0.00
Once in a year	4	1.33
Once in 2 years	69	23.00
Once in 5 years	160	53.33
Less than once in 5 years	46	15.33
I don’t use it	21	7.00
Have you ever received any form of education or information about ITN use and maintenance?		
Yes	206	68.67
No	37	12.33
Not sure	57	19.00

* = multiple Responses

Table 4: Factors affecting the usage of Insecticide Treated Bed Nets

Risk Factors	How often do you use the insecticide-treated bed net?					X^2	P-value
	Always	Often	Sometimes	Rarely	Never		
Age (in years)						8.173	0.038*
Below 20	0 (0.00)	0 (0.00)	5 (45.45)	2 (18.18)	4 (36.36)		
20-29	3 (8.82)	10 (29.41)	8 (23.53)	5 (14.71)	8 (23.53)		
30-39	31 (23.31)	68 (51.13)	22 (16.54)	3 (2.26)	9 (6.77)		
40 – 49	33 (41.25)	30 (37.50)	16 (20.00)	1 (1.25)	0 (0.00)		
50 – 59	10 (40.00)	8 (32.00)	7 (28.00)	0 (0.00)	0 (0.00)		
60 and above	9 (52.94)	7 (41.18)	1 (5.88)	0 (0.00)	0 (0.00)		
Marital Status						7.896	0.019*
Single	0 (0.00)	0 (0.00)	1 (6.25)	3 (18.75)	12 (75.00)		
Married	80 (36.36)	87 (39.55)	49 (22.27)	3 (1.36)	1 (0.45)		
Separated/Divorced/Widowed	6 (9.38)	36 (56.25)	9 (14.06)	5 (7.81)	8 (12.50)		
Level of Education						8.014	0.023*
No Formal Education	0 (0.00)	0 (0.00)	1 (12.50)	3 (37.50)	4 (50.00)		
Primary	8 (14.29)	12 (21.43)	13 (23.21)	8 (14.29)	15 (26.79)		
Secondary	55 (35.03)	70 (44.59)	30 (19.11)	0 (0.00)	2 (1.27)		
Tertiary	23 (29.11)	41 (51.90)	15 (18.99)	0 (0.00)	0 (0.00)		

Occupation						2.965	0.497
Students	5 (29.41)	7 (41.18)	4 (23.53)	1 (5.88)	0 (0.00)		
Farmer	13 (13.40)	62 (63.92)	12 (12.37)	4 (4.12)	6 (6.19)		
Trader	11 (16.18)	34 (50.00)	15 (22.06)	3 (4.41)	5 (7.35)		
Artisan	42 (56.00)	3 (4.00)	20 (26.67)	2 (2.67)	8 (10.67)		
Civil servant	14 (37.84)	15 (40.54)	6 (16.22)	0 (0.00)	2 (5.41)		
Unemployed	1 (16.67)	2 (33.33)	2 (33.33)	1 (16.67)	0 (0.00)		
Religion						3.046	2.013
Islam	49 (35.00)	45 (32.14)	31 (22.14)	5 (3.57)	10 (7.14)		
Christianity	34 (26.36)	60 (46.51)	21 (16.28)	4 (3.10)	10 (7.75)		
Others	3 (9.68)	18 (58.06)	7 (22.58)	2 (6.45)	1 (3.23)		
How many people live in your household?						7.382	0.039*
1 – 3	7 (63.64)	3 (27.27)	1 (9.09)	0 (0.00)	0 (0.00)		
4 – 6	29 (34.12)	33 (38.82)	17 (20.00)	2 (2.35)	4 (4.71)		
7 – 9	41 (28.67)	66 (46.15)	22 (15.38)	4 (2.80)	10 (6.99)		
10 and above	9 (14.75)	21 (34.43)	19 (31.15)	5 (8.20)	7 (11.48)		
Have you heard of insecticide-treated bed nets (ITNs)?						16.865	0.000*
Yes	86 (29.35)	123 (41.98)	59 (20.14)	11 (3.75)	14 (4.78)		
No	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	7 (100.00)		

Do you believe that ITNs can help prevent malaria?						9.854	0.000*
Yes	86 (38.74)	123 (55.41)	13 (5.86)	0 (0.00)	0 (0.00)		
No	0 (0.00)	0 (0.00)	14 (32.56)	10 (23.26)	19 (44.19)		
Not sure	0 (0.00)	0 (0.00)	32 (91.43)	1 (2.86)	2 (5.71)		
Do you think ITNs are safe for use?						9.156	0.000*
Yes	86 (43.43)	107 (54.04)	5 (2.53)	0 (0.00)	0 (0.00)		
No	0 (0.00)	0 (0.00)	33 (54.10)	11 (18.03)	17 (27.87)		
Not sure	0 (0.00)	16 (39.02)	21 (51.22)	0 (0.00)	4 (9.76)		

4. DISCUSSION

The research provides an informative study focusing on understanding the attitudes and practices towards the use of insecticide-treated bed nets (ITNs) to control malaria. ITNs are an essential public health tool to prevent mosquito bites, which are a common cause of diseases such as malaria, especially in Sub-Saharan African countries, including Nigeria [10]. The demographic information analyzed in this study (presented in table 1) aids in elucidating the various factors that might be influencing the attitudes and practices towards ITN usage. A person's age, marital status, level of education, occupation, religion, and the size of their household may all influence their attitudes and practices towards ITNs use. For instance, level of education may impact the understanding of malaria prevention and control measures and the importance of ITNs [11]. Occupation, particularly farming, might influence exposure to mosquitoes and thus, the perceived need for ITNs.

The largest age group represented was 30-39 years (44.33%), followed by 40-49 years (26.67%). This age group is significant as they represent the active workforce in society who likely bear the responsibility for acquiring and deploying ITNs in their households [12]. The younger and older age groups were less represented, with the under 20 and over 60 categories making up just 3.67% and 5.67% respectively.

Marital status distribution reveals that a majority of the respondents were married (73.33%), potentially reflecting households where decisions about ITN use could be influenced by marital dynamics and partnership communication [13].

Regarding the level of education, over half of the respondents (52.33%) had secondary education, followed by tertiary education holders (26.33%). A smaller proportion of respondents (18.67%) had primary education, while those without formal education were least represented (2.67%). The high percentage of respondents with at least secondary level education (78.66%) suggests an audience capable of understanding health promotion messages about ITN usage [14].

From an occupational perspective, farmers (32.33%) were the most represented group in the study. This finding might indicate a higher exposure to outdoor night-time activities, which could increase the risk of mosquito bites and malaria infection, thereby necessitating the need for proper ITN usage [15].

The majority of respondents practiced either Islam (46.67%) or Christianity (43.00%), indicating the potential role of religious institutions in malaria prevention messaging. Previous studies suggest that faith-based institutions can serve as effective platforms for health promotion and disease prevention initiatives [16]. The religious breakdown is also critical as certain beliefs or misconceptions within these groups could potentially influence the uptake and consistent use of ITNs [17]. For instance, religious leaders can play an influential role in promoting ITN use if they are engaged effectively in malaria control programs.

In terms of household size, the majority of respondents lived in households with 7-9 individuals (47.67%), followed by those with 4-6 individuals (28.33%). Households with 10 or more individuals made up 20.33% of the respondent population. Household size can have implications for ITN use. A study conducted in Ethiopia noted that larger household sizes often correlate with lower use of ITNs due to limited availability of nets [18]. Similarly, marital status might also play a role as married individuals might perceive a higher risk to their family and thus, a greater need for preventative measures like ITNs.

Knowledge about malaria is universal among the respondents, with all of them being aware of the disease (Table 2). This might be attributed to the high prevalence of the disease in the country, with Nigeria contributing a substantial proportion of the global burden of malaria [10]. This also shows the effective penetration of basic health education in the rural area [19]. This high knowledge level aligns with Astatkie *et al*. [20], who found similarly high levels of awareness about malaria in other malaria-endemic regions.

Regarding sources of information about malaria, family and friends, and schools were identified as the leading sources, followed by health workers and media. This widespread knowledge dissemination emphasizes the roles of social networks, educational institutions, healthcare providers, and media in

health education. This finding is somewhat contrasting with a study done elsewhere where health workers were identified as the main source of information [21]. The difference could be due to the cultural context and health systems in different settings.

The vast majority of respondents identified mosquitoes as the cause of malaria, showing an impressive understanding of the etiology of the disease. This is encouraging because it indicates that efforts to educate the public about the disease have been largely successful [22]. However, it is important to note that a few individuals mistakenly associate the disease with stress (7.26%) and houseflies (0.63%). This indicates a need for refined messaging around the exact causes of malaria, emphasizing the role of mosquitoes in its transmission, and debunking myths associated with stress or houseflies [23].

As for knowledge about ITNs, a significant percentage of respondents knew about them. This finding aligns with the results of a similar study conducted in Tanzania, which found a high level of awareness about ITNs among rural dwellers [24]. Family or friends and health workers were the primary sources of information about ITNs, reinforcing the importance of social networks and healthcare services in disseminating knowledge about malaria prevention strategies.

The research also delves into people's understanding of the purpose of ITNs. Over half of the respondents recognized the purpose of ITNs as a preventive measure against mosquito bites. The understanding that ITNs help to prevent malaria was also significant among the respondents. This knowledge could be due to the high level of education on malaria and ITNs, and the relatively low misconceptions indicate that the information shared is largely accurate [25]. This correlates with findings by Olapeju *et al*. [26], where understanding the role of ITNs in malaria prevention was a significant predictor of ITN use.

When respondents were asked whether they believed that ITNs could help prevent malaria, the majority agreed. This belief aligns with empirical evidence showing that ITNs are a potent tool for reducing the burden of malaria in endemic areas [27]. Nevertheless, a noteworthy proportion of respondents expressed uncertainty or disagreement with this statement, suggesting that there is room for improvement in malaria education programs.

The study highlights respondents' perceptions of the safety of ITNs. Although the majority believe that ITNs are safe for use, a significant proportion are unsure or do not believe in their safety. This lack of confidence could hinder the uptake and consistent use of ITNs, a trend that has been identified in another research [28]. This presents a significant barrier to ITN use as health interventions require not only knowledge but also trust and belief in their safety and effectiveness [5]. Health education efforts should, therefore, focus not only on spreading knowledge but also on assuaging fears and addressing skepticism towards these interventions.

This study found a significantly high prevalence of ITN ownership among respondents, with 93% of the study participants acknowledging that they have at least one ITN in their household. The high level of ownership observed in this study could be attributed to the intensified effort of government and non-government organizations to distribute ITNs freely or at subsidized rates, which is consistent with the findings of a study by Bennett *et al*. [29], who identified such interventions as a major factor driving high ITN ownership. These results also align with other studies conducted in Sub-Saharan Africa, which have found high ITN ownership rates in rural communities [30].

In this study, a majority of the participants had obtained their ITNs through free distribution programs (49%), substantiating the notion that such initiatives play a crucial role in promoting ITN accessibility. This supports previous research showing that free or subsidized ITN distribution programs have substantially increased ownership rates in African countries [31]. An additional 29.67% had bought their ITNs, and 21.33% had received theirs from family and friends. These numbers indicate a broad engagement with different avenues for acquiring ITNs, suggesting their widespread availability in the community [32].

Despite the high prevalence of ITN ownership, the actual usage was less consistent. Only 28.67% of respondents reported always using their ITNs, while 40.67% used them often, and 30.67% used them sometimes, rarely, or not at all. This discrepancy between ITN ownership and usage has been a recurring challenge in malaria prevention efforts [33]. This disparity between ownership and use has

been noted in previous studies, such as that by Pulford *et al*. [5], which attributed this gap to behavioural factors and physical discomfort.

Indeed, the leading reasons reported for inconsistent ITN use in this study were physical discomfort (49%), including finding the nets too hot (30%), and disbelief in their effectiveness (11.33%). This highlights the need for improved public health education about ITNs, their effectiveness, and their proper use to address misconceptions and promote consistent use [34].

ITN use varied within households, with the highest use among all household members (44%), followed by the elderly (21.33%), children (15.67%), and adults (12%). The high usage among elderly and children might be due to the perceived vulnerability of these groups to malaria [35]. However, for optimal malaria control, it's essential for all members of the household to use ITNs consistently [10].

Furthermore, the study revealed a lack of proper maintenance of ITNs, with 51.33% of the respondents rarely washing their nets, 38% doing so sometimes, and 10.67% never washing their nets. Similar observations were made regarding replacement practices, with 53.33% replacing their nets once in five years. These findings are in line with a study by Ankomah *et al*. [36], which also found suboptimal net care behaviours among a sample of Nigerian households. Frequent washing and delayed replacement may compromise the effectiveness of ITNs due to the removal or degradation of insecticides [37].

On a positive note, 90.33% of participants had observed a reduction in mosquito bites or malaria incidence since they started using ITNs, and 90.67% would recommend ITNs to others. These findings support the effectiveness of ITNs and demonstrate their acceptance within the community [38]. However, although 68.67% of respondents had received some form of education or information about ITN use and maintenance, a considerable proportion of respondents (19%) were uncertain about this, suggesting the need for improved health communication strategies.

The age of the respondents shows a significant impact on the usage of ITNs (X^2=8.173, p=0.038*) as presented in table 4. Consistent ITN usage tends to increase with age, with the age group 60 and above showing the highest use, followed by 40-49 and 50-59 age groups. This can be attributed to a heightened awareness of malaria's risks and the benefits of ITN use in older age groups [39]. The age group below 20, however, demonstrates the lowest ITN usage, indicating a potential knowledge gap or lack of access to ITNs for these individuals. A study by Aderaw and Gedefaw [28] in Ethiopia revealed a similar trend where older individuals were more likely to use ITNs. This could be attributed to the increased vulnerability to malaria in older age, hence, the increased usage of ITNs for prevention.

Marital status also plays a significant role in ITN usage (X^2=7.896, p=0.019*). Married individuals exhibited higher usage rates compared to single and separated/divorced/widowed individuals. This could be due to a stronger motivation to protect family members or greater household resources that can be allocated for health [40]. This is congruent with a study by Ahorlu *et al*. [41], which found that married individuals are more likely to use ITNs, as they often have the responsibility of caring for their families, prompting a higher level of preventive practices.

Education level significantly affects ITN usage as well (X^2=8.014, p=0.023*). Individuals with secondary and tertiary education showed higher usage rates compared to those with primary or no formal education. This is in line with researches by Koenker *et al*. [30] and Kateera *et al*. [42] which asserts that education increases awareness and the perceived benefits of ITNs, leading to higher usage rates.

The size of the household also significantly affects the use of ITNs (X^2 = 7.382, p = 0.039). Smaller households (1-3 people) use ITNs more frequently than larger ones (10 and above). This is consistent with a study by Ahorlu *et al*. [43], which found that the use of ITNs decreases as the household size increases, possibly due to limited resources or availability of ITNs.

The research further showed that occupation does not significantly affect ITN usage, contradicting the findings of Atieli *et al*. [6], who suggested that certain occupations, such as farming, expose individuals to higher mosquito bites, thus influencing their use of ITNs.

Religion did not seem to significantly influence ITN usage, hinting at the universality of malaria threat and preventive measures across religious boundaries. Although Christians reported higher rates of ITN usage than Muslims and other religious groups.

Awareness about ITNs was found to have a significant effect on their usage (X^2=16.865, p=0.000*). Those who had heard about ITNs were more likely to use them compared to those who hadn't. This emphasizes the importance of information dissemination in public health interventions [44].

Beliefs about the effectiveness of ITNs in preventing malaria (X^2=9.854, p=0.000*) and perceived safety of ITN usage (X^2=9.156, p=0.000*) were also found to significantly influence usage. This highlights the importance of health belief models in influencing health behaviours and the need for correct health information to promote preventive practices [45]. Those who had heard of ITNs and believed in their efficacy and safety reported higher usage. This supports the findings of Kimbi *et al*. [46], who stated that health education is crucial in improving ITN utilization.

5. CONCLUSION

The study reveals a gap between knowledge and practice in ITN use, with significant barriers being discomfort and a lack of belief in the effectiveness of ITNs. While ownership rates are high, usage rates, especially consistent usage, is low. The was due to misconceptions, especially around the efficacy and safety of ITNs. Moreover, maintenance practices are suboptimal.

Consent

The research was conducted in accordance with informed consent, confidentiality, and data protection. Participants were informed of the purpose of the research and had the option to withdraw at any time without any consequences.

Limitations of Study

The study is limited by the sample size, which may not be representative of the entire population. The study is also limited by the self-reporting nature of the questionnaire, which may be subject to social desirability bias.

RECOMMENDATIOS

Based on the results of this study, here are some recommendations:

a. **Awareness and Education**: There's high awareness of malaria and insecticide-treated bed nets (ITNs) among the population. However, the study reveals a gap in knowledge about the effectiveness and safety of ITNs. Hence, it is recommended to boost efforts in educating the community about the benefits of ITNs, their role in malaria prevention, and their safety profile. This education could be done via local health workers, schools, and media channels which were shown to be primary sources of health-related information.
b. **Use of ITNs**: The study reveals that not all households use the ITNs they possess. It's necessary to understand the barriers to consistent use, such as comfort and belief in effectiveness, and to address these issues. For instance, proper guidelines could be given on how to hang and use ITNs to avoid discomfort and increase its acceptability. Interventions should also be developed to emphasize the importance of consistent use.
c. **Accessibility and Affordability**: For the households without ITNs, efforts should be made to improve access and affordability. Though the number is relatively small, the reasons provided for not having ITNs include unavailability and unaffordability. Authorities could increase distribution programs, offering ITNs at subsidized costs or free of charge, especially for low-income households.
d. **Maintenance of ITNs**: The study indicates that the washing and replacement of ITNs is not consistent. It's recommended to conduct regular educational sessions on the proper care and maintenance of ITNs, including when and how to replace them.
e. **Target Demographics**: This study reveals that age, marital status, and education level significantly affect the usage of ITNs. Programs should take this into consideration and tailor their campaigns to address the needs of these specific demographics, particularly the younger population, those who are single, and those with lower levels of education.

f. **Monitor and Evaluate**: Regular follow-up surveys should be conducted to monitor and evaluate the progress of malaria control efforts, ensuring that awareness, accessibility, usage, and maintenance of ITNs are improving over time.
g. **Collaborative Effort**: It is vital to work in collaboration with community leaders, health workers, educators, and even religious leaders, to ensure that the importance of using ITNs in the prevention of malaria is consistently and effectively communicated to all members of the community.
h. **Research**: Further research is recommended to explore why certain groups in the community (those under 20, single, and those without formal education) are not utilizing ITNs, despite their availability. The outcomes of such research could provide more specific and targeted interventions to ensure maximum ITN use across all demographics.

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