*Original Research Article*

Perception and Practice of Sleeping Under Long-Lasting Insecticidal Net Among Undergraduates of the College of Health Sciences, Benue State University Makurdi

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ABSTRACT

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| --- |
| **Background:** Malaria remains a significant public health concern in Nigeria, with LLINs playing a crucial role in malaria prevention efforts. However, the perception and practice of sleeping under LLINs among specific populations, such as medical students, remain understudied.Undergraduate medical students represent the future healthcare workforce in Nigeria. Understanding their perception and practice of sleeping under LLINs is crucial as it directly impacts their own health and well-being as well as their ability to educate and counsel patients on malaria prevention strategies in the future. Research findings from this work can guide the development of educational programs and interventions tailored to this group, ensuring that they serve as role models and advocates for LLIN usage.Furthermore, studying LLIN usage among undergraduate students of College of Health Sciences, Benue State University Makurdi, can provide a unique perspective on the challenges and opportunities associated with malaria prevention. Findings from this research can potentially be extrapolated to other similar populations, such as healthcare professionals or university students in malaria-endemic areas. This broader applicability enhances the impact and relevance of the research beyond the specific study population.**Aims:** To assess the perception and practice of sleeping under LLINs among undergraduates of the College of Health Sciences, Benue State University Makurdi, with the aim of informing interventions and strategies to improve LLIN usage.**Study design:** Cross sectional descriptive study design was used for the study.**Place and Duration of Study:** College of health sciences, Benue State University Makurdi, Benue State and research was conducted between April 2022 – January 2023.**Methodology:** A cross-sectional study was conducted among undergraduates of College of Health Sciences, Benue State University Makurdi. A semi structured questionnaire was administered to collect data on demographics, knowledge, attitudes, and practices related to LLIN usage. Descriptive statistics weas used to analyze the data, including frequencies and percentages.**Results:** The study included 198 students, with a majority (48.5%) between 20 - 23 years of age. Regarding LLIN knowledge, majority of respondents demonstrated good to very good knowledge (66%). Ninety six percent 96.0% of respondents were aware of LLINs, with television (17.2%) and social media (18.0%) being common sources of information. Despite high awareness and positive attitude score (100%), suboptimal practices were observed, with only 23.2% of respondents reporting consistent LLIN usage every night. Various barriers to LLIN utilization were identified, including cost-related issues (6.0%), lack of information (10.6%), and discomfort (1.5%).**Conclusion:** The study highlights the importance of addressing knowledge gaps and barriers to LLIN utilization among medical students at Benue State University, Makurdi. Educational interventions, accessibility improvements, and behavior change interventions tailored to the unique needs of this population are recommended to enhance LLIN uptake and contribute to malaria prevention efforts in Nigeria. |

*Keywords: Perception, practice, LLIN.*

1. INTRODUCTION

Malaria remains a major cause of morbidity worldwide. Globally, it is estimated that there were 247 million malaria cases in 2021 in 84 endemic countries; an increase from 245 million in 2020, with the bulk of the increase coming from countries in the WHO African region.1 With an estimated risk of infection of 1.38 billion people today, malaria remains one of the most important global tropical health challenges.2,3 It is an infectious vector borne disease transmitted by female Anopheles mosquitoes4, which carry the infectious sporozoite stage of the Plasmodium parasite in their salivary glands.5

There are more than 400 different species of anopheles mosquitoes and about 40, known as vector species6, may transmit the disease. The likelihood of infection varies by location depending on a number of variables, including the species of local mosquitoes. Seasonal variations are also possible, with the risk in tropical countries being highest during the rainy season.7

Although it is better and less expensive to prevent malaria than to treat it, previous research has shown that when the risk is viewed as low, malaria prevention is typically low and difficult to implement.8 However, a variety of methods have recently been used for malaria prevention, with a more recent focus on vector control. In addition, the usage of LLIN has grown over time in Sub-Saharan Africa, lowering the percentage of the population at risk for the disease.9,10

Mosquito net is a proven effective method for malaria prevention. Statistic shows that about 55% of households in Nigeria possess at least one mosquito net.11Despite these, the practice of sleeping under Insecticide treated nets has been shown to be poor.3,12,13 Using mosquito nets as a protection against insects was practiced in historical times especially during World War II (1939-1945), Russian, German and United States armies treated bed nets to protect soldiers against vector-borne disease.14

Ownership and utilization of mosquito nets for malaria prevention is still sub-optimal with only 62 percent ownership of at least one mosquito net and only 37 percent of children using the nets.15 The World Health Organization's Global Malaria Program recommends the distribution of ITNs as one of the effective methods of malaria control.16

LLIN serves as a physical barrier against mosquitoes, contains chemicals (pyrethroids)17, that repels the mosquitoes or kill them when they come in contact with it, and reduces the overall mosquito population in the community when majority of the residents sleep under LLIN.18

Over time, the benefits of using LLIN have fallen short of the significant investments made in the purchase and distribution of the commodity. According to recent surveys in Nigeria, household ownership and use of insecticidal nets remains below the target, and Benue state is no exception.14,19 A study on malaria prevention and management knowledge and practice among non-medical students at the University of Nigeria, Nsukka, revealed a strong relationship between the students' faculty and their knowledge of malaria.10In the course of their training, undergraduate students of the College of Health Sciences receive much information about malaria and care for patients affected by the disease. As a result, it is frequently assumed that the intensive training they receive will contribute to their perception and practice of malaria prevention. However, there is inadequate practice for malaria prevention among medical students in Nigeria.8

Despite the fact that the use of LLINs is critical to the reduction of malaria and other vector-borne diseases, ownership and utilization of LLINs has been found from previous studies to be poor.19

In addition, while LLIN distribution campaigns have been implemented in many malaria-endemic regions13,20,21, including Benue State, there may be gaps in knowledge and understanding of the benefits and correct usage of LLINs among the target population.19 Feedback from a recent mosquito net campaign in Benue State, between 28 October, 2023 to 11 January, 2024, as reported by the State Malaria Elimination Program, indicated that trainings were conducted, personnel were deployed to the field, and approximately four million nets were distributed. Conducting research among undergraduate medical students can help identify existing misconceptions, barriers, and challenges associated with LLIN use.13 This information can inform educational initiatives that address specific concerns and improve the overall uptake and consistent use of LLINs.22

The WHO recommends universal access to LLINs for all at-risk populations36, and through various initiatives and partnerships, millions of LLINs have been distributed to high-burden regions.11,37 Studies have demonstrated the success of LLINs in reducing malaria transmission and mortality, contributing significantly to the decline in global malaria cases.18,24,26 Additionally, LLINs have shown promise in preventing other mosquito-borne diseases, such as dengue fever and Zika virus, by acting as a physical barrier against mosquito bites, effectively reducing the risk of infection.30

Beyond their impact on malaria, LLINs have also demonstrated effectiveness in preventing other mosquito-borne diseases such as leishmaniasis, Japanese encephalitis, dengue and lymphatic filariasis.38 This section of the literature review provides an overview of LLIN usage on different scales, from a global perspective down to the national level, while also highlighting their role in preventing other mosquito-borne diseases.

The use of ITNs, particularly LLINs, IRS, and improved malaria case management are primarily responsible for the global drop in malaria cases since 2000.18,33,39Malaria-endemic nations have made significant strides in expanding LLIN coverage, particularly in areas with a high malaria burden.40

The health benefits of using LLINs have not been proportional to the significant financial investments made in their purchase and distribution.19,30 A systematic review of studies across the world found that knowledge about malaria and LLINs was generally high but the practices of sleeping under LLIN was low.2,24,29,30There were some misconceptions about the effectiveness of LLINs.33 The review also found that attitudes towards LLINs were generally positive, but there were some negative attitudes, such as believing that LLINs were uncomfortable to sleep under.13,41,42

In Africa, which bears the highest malaria burden1,39, LLIN distribution campaigns have been instrumental in malaria control efforts.19 The Roll Back Malaria Partnership has played a significant role in advocating for and supporting LLIN distribution across the continent37, resulting in notable progress in malaria prevention.13,18 Moreover, LLINs have proven effective in preventing other mosquito-borne diseases endemic to Africa, such as dengue fever and chikungunya.43 The impact of LLINs extends beyond malaria control, with these nets serving as essential tools in protecting populations from multiple vector-borne diseases, contributing to improved public health outcomes in the region.22,38

A study in Ethiopia found that there is significant increase in the distribution and usage of LLINs44, but there were some misconceptions about the effectiveness of LLINs44–46. There was also a major gap between ownership and usage of the nets.34

A study among university students in Namibia found that most students had a good knowledge of LLINs as a means of malaria prevention, but there were some misconceptions about the usage of LLINs. For example, some students (33%) believed that LLINs were only necessary to prevent malaria among women and children.13

Nigeria's National Malaria Elimination Program launched the first round of public campaigns to distribute LLINs to all homes in Kano State.50 The gains on LLIN utilization throughout time have not been in line with the significant investments made in the procurement and distribution of the commodity.19 In 2013, only 48% and 49.5% of Nigerian homes owned at least one LLIN and ITN, respectively. The proportion of households that slept under an ITN or LLIN the previous night was lower than the proportion of households that owned nets; only 12.9% and 12.6% of the population slept under an ITN or LLIN the previous night, respectively, and only 23.7% of those who owned at least one ITN slept under the net the previous night.19,51 A study carried out on Malaria Prevention Amongst Medical Students of Obafemi Awolowo University, Ile-Ife, Osun State in 2022 suggested that 35.97% of participants slept under ITNs. However, 67.59% of the participants combined the use of insecticides with the ITNs. Roughly 34.78% of students have never slept under an ITN, while approximately 2% use ITNs often.8

Benue state, like the rest of the federation, gets its LLINs mostly from the Global Fund, World Bank37, the US President's Malaria Initiative51, and UKAID/Department of International Development.52,53 The State Ministry of Health and a number of business groups complement these supplies.12,19 In 2019, a study conducted in Benue State revealed that the distribution of LLINs was highly successful, with 95.3% of households receiving nets. However, the study also found that net retention, hanging, and proper usage fell below the national target of 80%, indicating some challenges in ensuring that LLINs were being effectively utilized by the households.19

2. methodology

**2.1 Study Design**

A cross-sectional descriptive design was used for the research.

**2.2 Study Area**

College of Health Sciences, Benue State University Makurdi, Benue State, was the study area.

**2.3 Study population**

The students of college of health sciences, Benue State University Makurdi participated in this study.

**2.3.1 Inclusion Criteria**

All consenting students of College of Health Sciences, Benue State University, Makurdi from various levels participated in this study.

**2.3.2 Exclusion Criteria**

1. Postgraduate students
2. Those with physical or mental health conditions that could hinder their ability to respond accurately to the study's questions were excluded to ensure data reliability.

**2.4 Sample Size**

The minimum sample size was determined using the formula:56

$N=\frac{Z^{2}Pq}{d^{2}}$

Where;

N=the Minimum sample size.

Z=the standard normal deviate, set at 1.96 which corresponds to 95% confidence interval.

P= the proportion of the target population estimated to have used insecticide treated mosquito net in a previous study=0.85.57

q= 1-P

d= Degree of accuracy desired = 0.05

$$N=\frac{1.96^{2}x 0.85 x 0.15}{0.05^{2}}$$

n= 196

To correct for non- response at 10%

$$n^{1}=\frac{n}{1-f}$$

Where;

n1=sample size after non-response rate at 10% has been corrected

n= minimum sample size

f= Assumed non-response rate

$$n^{1}=\frac{196}{1-0.1}$$

$$n^{1}=\frac{196}{0.9}$$

n1 = 217.7778

 n1 ~218

Approximately 218 undergraduate students were used for this study

**2.5 Sampling Technique**

Stratified Random Sampling Technique was employed in carrying out the study:

**Step 1:** The population was divided into strata based on faculties.

Faculty Strata: BMS; BCS; and Clinical Sciences.

**Step 2:** Departmental strata: the departments within the faculties were selected (Nursing, Anatomy, Physiology, Biochemistry, Radiography, Pathology, Pharmacology, Medicine, Surgery, Epidemiology and Community Health).

**Step 3:** Class Strata within BMS and BCS: 100, 200, 300, and 400 level were selected; Class Strata within Clinicals: 500 and 600 Level were selected.

**Step 4:** Selection of respondents; we randomly selected participants from each stratum. A proportionate number of participants were selected from each faculty. The sample frame was 1486.

$$Number of students per faculty =Sample size X \frac{No. of students in the faculty}{ Sample frame}$$

**Table 1: Proportionate number of respondents**

|  |  |  |
| --- | --- | --- |
| **Faculty** | **Number of students** | **Proportionate number of respondents** |
| **Basic Medical Sciences** | 821 | 120 |
| **Basic Clinical Sciences** | 504 | 74 |
| **Clinical Sciences** | 161 | 24 |

**2.6 Study Instrument**

Self-administered questionnaire was used; we adapted and modified a previous similar study to obtain information such as social demographic characteristics, perception and practice of the use of LLIN

**2.6.1. Pretesting of the Questionnaire**

For pre-test, questionnaires were administered to approximately 10% of the sample size at random in another faculty at Benue State University The pre-test results were meticulously analyzed, and necessary corrections were subsequently made, to ensure questionnaire was refined and optimized before the commencement of our actual study.

**2.7. Data Collection Method**

Data was collected using self-administered electronic questionnaires. Participants received an explanation of the study's purpose along with an informed consent form before accessing the questionnaires online. The informed consent form was presented electronically, and participants were required to provide their consent through electronic signature indicating their agreement to participate. The questionnaires were accessible electronically throughout the day for participants to complete at their convenience. Research personnel were available via email, phone, or WhatsApp to address any questions or concerns participants had during the questionnaire completion process. Once completed, participants submitted their questionnaires electronically. Incomplete questionnaires prompted an automatic notification to participants to fill in any missing information before final submission

**2.8. Data Management and Analysis**

The collected data was checked for completeness, and analysis was conducted using the SPSS version 23. A 95% confidence interval was applied, with a p-value of less than 0.05 considered statistically significant. Categorical variables were summarized using frequency and proportion, while the statistical significance of associations between categorical variables was tested using the chi-square test. Quantitative variables were analyzed using the mean and standard deviation for normally distributed data and the median and range for skewed distributions. Results were interpreted and presented in tables and charts.

3. results and discussion

3.1 rESULTS

This section pertains to the presentation and analysis of the data. The study retrieved a total of 198 responses from 218 respondents, yielding a response rate of 90.8%.

**Table 2: Socio-demographic characteristics**

|  |  |  |
| --- | --- | --- |
| **Variable** | **Frequency (N=198)** | **Percentage (%)** |
| **Age group** |  |  |
| 16 - 19 years | 30 | 15.2 |
| 20 - 23 years | 96 | 48.5 |
| 24 - 27 years | 54 | 27.3 |
| 28 - 31 years | 14 | 7.1 |
| >= 32 years | 4 | 2.0 |
| **Gender** |  |  |
| Female | 90 | 45.5 |
| Male | 107 | 54.0 |
| Non binary | 1 | 0.5 |
| **Marital\_Status** |  |  |
| Married | 8 | 4.0 |
| Single | 190 | 96.0 |
| **Religion** |  |  |
| Christianity | 196 | 99.0 |
| Islam | 1 | 0.5 |
| Pagan | 1 | 0.5 |
| **Accommodation** |  |  |
| Off campus | 92 | 46.5 |
| On campus | 103 | 52.0 |
| Others | 3 | 1.5 |

**Table 3: Socio-Economic Characteristics**

|  |  |  |
| --- | --- | --- |
| **Variable** | **Frequency (N=198)** | **Percentage (%)** |
| **Ethnicity** |  |  |
| Tiv | 108 | 54.5 |
| Idoma | 57 | 28.8 |
| Igede | 21 | 10.6 |
| Others\* | 9 | 4.5 |
| **Faculty** |  |  |
| Basic Medical Sciences | 149 | 75.3 |
| Clinicals | 31 | 15.7 |
| Basic Clinical Sciences | 18 | 9.1 |
| **Department** |  |  |
| Anatomy | 10 | 5.1 |
| Biochemistry  | 14 | 7.1 |
| MBBS | 94 | 47.5 |
| MLS | 5 | 2.5 |
| Nursing | 40 | 20.2 |
| Physiology  | 11 | 5.6 |
| Radiography | 24 | 12.1 |
| **Class (Level)** |  |  |
| 100 | 55 | 27.8 |
| 200 | 24 | 12.1 |
| 300 | 61 | 30.8 |
| 400 | 27 | 13.6 |
| 500 | 19 | 9.6 |
| 600 | 12 | 6.1 |
| **Monthly Stipend** |  |  |
| Nil | 27 | 13.6 |
| NGN1 - NGN5,000 | 57 | 28.8 |
| > NGN5,000 - NGN15,000 | 47 | 23.7 |
| > NGN15,000 - NGN25,000 | 41 | 20.7 |
| > NGN25,000 - NGN35,000 | 16 | 8.1 |
| > NGN35,000 | 10 | 5.1 |

\*Other ethnicities included: Anang, Bacham, Ebira, Hausa, Eggom, Igala, Igbo, Ijaw, Urhobo, and Yoruba

**Table 4: Knowledge of sleeping under a LLIN I**

|  |  |  |
| --- | --- | --- |
| **Variable** | **Frequency (n=198)** | **Percentage (%)** |
| **LLIN Awareness** |  |  |
| No | 8 | 4.0 |
| Yes | 190 | 96.0 |
| **Information Source (N =361) \*** |  |  |
| Television | 62 | 17.2 |
| Social media | 65 | 18.0 |
| School | 89 | 24.7 |
| Others | 66 | 18.3 |
| Radio | 53 | 14.7 |
| Newspaper | 26 | 7.2 |
| **Know Primary use of LLIN** |  |  |
| No | 13 | 6.6 |
| Yes | 185 | 93.4 |
| **Primary use of LLIN (N=188)1** |  |  |
| Disease prevention | 180 | 95.7 |
| Others | 8 | 4.3 |
| **Disease preventable by LLINs (N=226) \*** |  |  |
| Malaria | 194 | 85.9 |
| Dengue fever | 19 | 8.4 |
| Zika virus | 9 | 4.0 |
| Chikungunya | 3 | 1.3 |
| None of these | 1 | 0.4 |
| **Know proper way to hang and use LLINs** |  |  |
| No | 32 | 16.2 |
| Yes | 166 | 83.8 |
| **Sleep inside the net properly hung and fixed in the bed** |  |  |
| No | 75 | 37.9 |
| Yes | 123 | 62.1 |

\*Multiple responses.

1 N=226 due to missing responses

**Table 5: Knowledge of sleeping under a LLIN II**

|  |  |  |
| --- | --- | --- |
| **Variable** | **Frequency (n=198)** | **Percentage (%)** |
| **Awareness of Frequency of LLIN replacement or treatment** |  |  |
| No | 133 | 67.2 |
| Yes | 65 | 32.8 |
| **Frequency of LLIN replacement (N=84) \*** |  |  |
| 1-2 years | 51 | 60.7 |
| 3-5 years | 27 | 32.1 |
| 6-10 years | 4 | 4.8 |
| More than 10 years | 2 | 2.4 |
| **Care for LLINs** |  |  |
| Do not wash | 47 | 23.7 |
| Others | 25 | 12.6 |
| Wash with ash | 3 | 1.5 |
| Wash with detergent | 120 | 60.6 |
| Wash with jik | 3 | 1.5 |
| **LLIN should be sewn when torn** |  |  |
| No | 74 | 37.4 |
| Yes | 124 | 62.6 |
| **Aware of programs promoting LLIN usage** |  |  |
| No | 105 | 53.0 |
| Yes | 93 | 47.0 |

\*Missing responses.

**Figure 1: Pie-chart showing the knowledge score of respondents**

**Table 6: Attitude towards sleeping under a LLIN I**

|  |  |  |
| --- | --- | --- |
| **Variable** | **Frequency (N=198)** | **Percentage (%)** |
| **Effective measure to prevent mosquito borne diseases** |  |  |
| Strongly agree | 0 | 0 |
| Agree | 62 | 31.3 |
| Neutral | 0 | 0 |
| Disagree | 1 | .5 |
| Strongly agree | 135 | 68.2 |
| **A daily priority** |  |  |
| Strongly Agree | 93 | 47.0 |
| Agree | 74 | 37.4 |
| Neutral | 24 | 12.1 |
| Disagree | 4 | 2.0 |
| Strongly Disagree | 3 | 1.5 |
| **Important to educate others about LLIN use** |  |  |
| Strongly agree | 125 | 63.1 |
| Agree | 73 | 36.9 |
| Neutral | 0 | 0 |
| Disagree | 0 | 0 |
| Strongly Disagree | 0 | 0 |
| **Comfort of sleeping inside an LLIN** |  |  |
| Very comfortable | 59 | 29.8 |
| Comfortable | 45 | 22.7 |
| Neutral | 50 | 25.3 |
| Uncomfortable | 38 | 19.2 |
| Very uncomfortable | 6 | 3.0 |
| **Concern about side effects of using an LLIN** |  |  |
| No | 46 | 23.2 |
| Yes | 152 | 76.8 |
| **Actual concern about side effects of using an LLIN (N=283)\*** |  |  |
| Hotness of skin | 107 | 37.8 |
| Skin rash | 79 | 27.9 |
| Teary eyes | 50 | 17.7 |
| Tingling sensation | 39 | 13.8 |
| Headache | 7 | 2.4 |
| Chemicals might be carcinogenic | 1 | 0.4 |

\*Multiple Responses

**Table 7: Attitude towards sleeping under a LLIN II**

|  |  |  |
| --- | --- | --- |
| **Variable** | **Frequency (N=198)** | **Percentage (%)** |
| **Confidence in the ability of LLIN to prevent mosquito bites** |  |  |
| Very confident | 83 | 41.9 |
| Confident | 88 | 44.4 |
| Neutral | 20 | 10.1 |
| Not very confident | 7 | 3.5 |
| Not confident at all | 0 | 0 |
| **LLIN should be promoted in societies** |  |  |
| Strongly agree | 120 | 60.6 |
| Agree | 70 | 35.4 |
| Neutral | 6 | 3.0 |
| Disagree | 2 | 1.0 |
| Strongly Disagree | 0 | 0 |
| **Extent to which training influenced understanding of LLIN in disease prevention** |  |  |
| Highly | 91 | 46.0 |
| Moderately | 93 | 47.0 |
| Poorly | 9 | 4.5 |
| No effect | 5 | 2.5 |

**Figure 2: Bar chart showing the attitude score of respondents**

**Table 8: Practice of sleeping Under a LLIN**

|  |  |  |
| --- | --- | --- |
| **Variable** | **Frequency (N=198)** | **Percentage (%)** |
| **Current ownership of LLIN** |  |  |
| No | 77 | 38.9 |
| Yes | 121 | 61.1 |
| **Frequency of sleeping inside an LLIN** |  |  |
| Every night | 46 | 23.2 |
| Most nights | 36 | 18.2 |
| Never | 21 | 10.6 |
| Occasionally | 42 | 21.2 |
| Rarely | 53 | 26.8 |
| **Recommended the use of LLINs to others** |  |  |
| No | 38 | 19.2 |
| Yes | 160 | 80.8 |
| **Medical training adequately emphasized the importance of LLINs for disease prevention** |  |  |
| No | 62 | 31.3 |
| Yes | 136 | 68.7 |

**Table 9: Barriers to Obtaining LLIN**

|  |  |  |
| --- | --- | --- |
| **Variable** | **Frequency (N=77)** | **Percentage (%)** |
| **Barriers to obtaining LLINs** |  |  |
| Lack of information about where to obtain one | 21 | 27.3 |
| Limited access to a long-lasting insecticidal net | 17 | 22.1 |
| Cost of purchasing a long-lasting insecticidal net | 13 | 16.9 |
| Dislike it | 7 | 9.1 |
| It's uncomfortable | 3 | 3.9 |
| Allergy | 2 | 2.6 |
| No hook to hang the net | 2 | 2.6 |
| No interest | 2 | 2.6 |
| Heat | 1 | 1.3 |
| I use insecticides and repellent | 1 | 1.3 |
| Inconvenience of using a net | 1 | 1.3 |
| No excuse | 1 | 1.3 |
| Personal reasons | 1 | 1.3 |
| Prefer not to say | 1 | 1.3 |
| Red eyes and headache | 1 | 1.3 |
| Setting up difficulty | 1 | 1.3 |
| The practice is not promoted | 1 | 1.3 |
| Tired of arranging it every night | 1 | 1.3 |

**Table 10: Barriers to sleeping under a LLIN**

|  |  |  |
| --- | --- | --- |
| **Variable** | **Frequency (N=218)\*** | **Percentage (%)** |
| **Barriers to sleeping under LLINs** |  |  |
| I don't like the feeling of sleeping under a net | 70 | 32.1 |
| I don't have access to an LLIN | 54 | 24.8 |
| I don't find it necessary | 43 | 19.7 |
| I forget to use it | 34 | 15.6 |
| Allergies | 6 | 2.7 |
| Difficulty hanging it in my room | 4 | 1.8 |
| Irregular sleeping time | 4 | 1.8 |
| I use insecticide spray or repellants | 2 | 1.0 |
| They are not promoted in BSU CHS Hostel | 1 | 0.5 |

\*Multiple responses

**Figure 3: Pie-chart showing the practice score of respondents**

**3.2 DISCUSSION**

The current study explored the perceptions and practices concerning sleeping under LLINs among undergraduate students of the College of Health Sciences, Benue State University, Makurdi. This discussion critically examines the findings in relation to existing literature, highlighting key similarities and differences, and propose recommendations for future interventions.

The age distribution of respondents in our study reflects a predominant presence of young adults, with (48.5%) falling within the age range of 20 to 23 years. This is similar to a study done among medical students of Obafemi Awolowo University Ile-Ife, Osun State, Nigeria (58.9% in this age bracket)8 , and Namibia (mean age of 21.4years).13 This demographic composition is characteristic of a university setting, where medical students pursuing tertiary education typically belong to this age group.58 Additionally, our study observed a predominance of male respondents (54.0%), consistent with the gender distribution typically observed in medical education institutions in Nigeria.8 The marital status of respondents indicates a high proportion of single individuals (96.0%), reflecting the social norm of prioritizing education before marriage among young adults in our study population. Similarly, the religious composition predominantly comprises Christians (99.0%), reflecting the religious demographics of the study area. The distribution of respondents across accommodation types, ethnic groups, faculties, and class levels provides a comprehensive overview of the diverse representation within the study population, underscoring the need to consider these demographic factors in interpreting the study findings.40,45

Our study revealed a high level of knowledge regarding LLINs among medical students at Benue State University, with the majority of respondents demonstrating good to very good knowledge (66%). This finding aligns with those from studies in Nigeria, Africa and global trends indicating widespread awareness of LLINs as a malaria prevention intervention.50,59,60 The sources of information about LLINs varied, with educational institutions (24.7%), social media (18.0%), and television (17.2%) emerging as primary sources. While the majority of respondents were aware of the primary use of LLINs (93.4%) and identified malaria (85.9%) as the main disease preventable by LLINs, gaps in knowledge were observed regarding the frequency of LLIN replacement and treatment (32.8% indicated awareness). Additionally, practices related to LLIN care and maintenance varied among respondents, highlighting the importance of targeted educational interventions to address knowledge gaps and promote proper LLIN utilization. The perception of LLINs' mechanism of action varied, with the physical barrier (60.0%) and insecticidal effect (53.2%) being commonly cited.

Our study indicates a positive attitude towards LLINs among medical students with all respondents having good (61.1%) to very good (38.9%) attitude, and the majority expressing strong agreement regarding the effectiveness and importance of LLIN use in preventing mosquito-borne diseases (68.2% strongly agreed). This is similar to a study in Osun state, Nigeria where 96.8% had good attitude.8 the comfort level of sleeping inside LLINs was generally favorable, with a significant proportion expressing confidence in LLINs' ability to prevent mosquito bites (41.9% felt very confident). Additionally, respondents endorsed the promotion of LLINs in societies and acknowledged the impact of training on their understanding of LLINs in disease prevention. These findings underscore the importance of fostering positive attitudes towards LLINs through targeted educational campaigns and behavioral interventions.

Despite high levels of knowledge and positive attitudes towards LLINs, our study revealed suboptimal practices of sleeping under LLINs among medical students. While a majority of respondents reported current ownership of LLINs (61.1%), inconsistent usage patterns were observed, with a significant proportion rarely (26.8%) or never (10.6%) sleeping inside LLINs. Cost-related barriers, limited access to LLINs, and comfort-related challenges were identified as key factors influencing LLIN usage. These findings are similar to those from studies from other centers in Nigeria61,62, Africa45,63,64 and globally24,30,36. Additionally, knowledge and attitudinal barriers contributed to suboptimal LLIN utilization among a subset of respondents. These findings highlight the importance of addressing multifaceted barriers to LLIN usage and implementing targeted interventions to promote consistent and correct LLIN utilization among medical students and the broader community. Moreover, efforts to improve LLIN uptake should consider the unique needs and preferences of different demographic groups within the study population.

4. Conclusion

In conclusion, our study provides valuable insights into the perception and practice of sleeping under LLINs among undergraduate students at College of Health Sciences, Benue State University, Makurdi. The findings highlight the importance of LLINs as a key malaria prevention intervention and underscore the need for targeted interventions to address knowledge gaps, promote positive attitudes, and improve LLIN utilization among this population. Despite high levels of awareness and positive attitudes towards LLINs, suboptimal practices were observed, indicating the presence of multifaceted barriers to LLIN usage. These findings emphasize the importance of comprehensive strategies to address barriers to LLIN utilization, including educational campaigns, accessibility improvements, and behavior change interventions tailored to the unique needs of medical students and the broader community.

**4.1 RECOMMENDATIONS**

Based on the findings of our study, the following recommendations are proposed:

1. College Management should develop and implement targeted educational campaigns to improve knowledge and awareness of LLINs among undergraduate students of the College of Health Sciences. These interventions should focus on highlighting the importance of LLINs in malaria prevention, correct usage, and maintenance practices.
2. The university management should enhance access to LLINs by ensuring their availability in university hostels, and collaborate with relevant stakeholders to facilitate the distribution of LLINs and promote their uptake among students.
3. The State Ministry of Health through the State Malaria Elimination Program (SMEP) should design and implement behavior change interventions aimed at promoting consistent and correct LLIN utilization among undergraduate students. These interventions should address barriers such as cost, comfort, and knowledge gaps, while also fostering a positive attitude towards LLINs.
4. Researchers should conduct further research to explore the underlying factors contributing to suboptimal LLIN usage among undergraduate students, including socio-economic factors, cultural beliefs, and access to healthcare services. Monitor LLIN utilization trends over time to assess the effectiveness of interventions and identify areas for improvement.
5. The Student Union should forge partnerships with local health authorities, non-governmental organizations, and community leaders to coordinate efforts in promoting LLIN utilization and malaria prevention initiatives. Pool resources and expertise to develop comprehensive and sustainable interventions that address the diverse needs of the students.

By implementing these recommendations, we can work towards improving LLIN utilization among undergraduate students of the College of Health Sciences, Benue State University and contribute to the broader goal of reducing the burden of malaria in Nigeria. Together, we can create a healthier and more resilient community equipped to combat malaria and other vector-borne diseases effectively.

**DISCLAIMER (ARTIFICIAL INTELLIGENCE)**

Author(s) hereby declare that the project titled “Perception and Practice of Sleeping Under Long-Lasting Insecticidal Net Among Undergraduates of College of Health Sciences, Benue State University Makurdi, Benue State,” was carried out by us; and during the generation of our manuscript, NO generative AI technologies such as Large Language Models (ChatGPT, etc) and text-to-image generators have been used.

Ethical CONSIDERATIONS

Ethical Clearance was sought for and obtained from the Research and Ethics Committee, College of Health Sciences, Benue State University, Makurdi, and assigned a code number: CREC/UGP/069. A letter of introduction was gotten from the department of Epidemiology and Community Health of the College of Health Sciences, Benue State University.

The respondents were informed about the objective and purpose of the study and written informed consent was obtained from each respondent, before questionnaire administration. Confidentiality was ensured and information gotten was recorded anonymously.

Definitions, Acronyms, Abbreviations

**Definition of terms;**

1. **LLIN**: “*ITN designed to remain effective for multiple years without retreatment*.”25
2. **Perception**: Refers to the way undergraduate medical students at Benue State University Makurdi interpret or understand the concept of sleeping under LLINs for malaria prevention. It includes their beliefs, attitudes, and subjective opinions about LLINs.8
3. **Practice**: Refers to the actual behavior or action of sleeping under LLINs among undergraduate medical students at Benue State University Makurdi. It focuses on the extent to which students consistently and correctly use LLINs as a preventive measure against malaria.10
4. **Malaria Prevention**: Encompasses strategies and actions aimed at reducing the risk of malaria transmission and infection. In this study, it specifically refers to the utilization of LLINs as a key preventive measure against malaria among undergraduate medical students.18

**Acronyms/ Abbreviations;**

IRS: Indoor Residual Spraying

BMS: Basic Medical Sciences

BCS: Basic Clinical Sciences

WHO: World Health Organization

LLIN: Long-Lasting Insecticide Net

ITN: Insecticide Treated Net

CHS: College of Health Sciences

BSU: Benue State University

SPSS: Statistical Package for the Social Sciences

SMEP: State Malaria Elimination Program

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APPENDIX

SECTION 1: DEMOGRAPHIC INFORMATION

1. GENDER: MALE [ ] FEMALE [ ] PREFER NOT TO SAY [ ] OTHERS [ ]
2. AGE: \_\_\_\_\_\_\_ YEARS
3. ETHNICITY: TIV [ ], IDOMA [ ], IGEDE [ ] OTHERS [ ]
4. MARITAL STATUS: MARRIED [ ], SINGLE [ ], WIDOWED [ ] SEPARATED [ ] DIVORCED [ ] OTHERS [ ]
5. RELIGION: CHRISTIANITY [ ] , ISLAM[ ] OTHERS [ ]
6. FACULTY: BAMS [ ] CLINICALS [ ]
7. DEPARTMENT: MBBS [ ] NURSING [ ] ANATOMY [ ] PHYSIOLOGY [ ] BIOCHEMISTRY [ ] RADIOLOGY [ ] MEDICAL LABORATORY SCIENCES [ ]
8. CLASS LEVEL: 100 [ ] 200 [ ] 300 [ ] 400 [ ] 500 [ ] 600 [ ]
9. MONTHLY STIPENDS \_\_\_\_\_\_\_\_\_\_\_
10. ACCOMMODATION: ON CAMPUS [ ] OFF CAMPUS [ ] OTHERS [ ]

SECTION 2: KNOWLEDGE OF SLEEPING INSIDE A LONG-LASTING INSECTICIDAL NETS (LLINS)

PLEASE INDICATE YOUR LEVEL OF KNOWLEDGE BY SELECTING ONE OPTION FOR EACH QUESTION.

1. HAVE YOU HEARD OF LONG-LASTING INSECTICIDAL NET BEFORE? YES [ ] NO[ ]
2. IF YES TO 11 ABOVE, WHAT WAS THE SOURCE OF THE INFORMATION? RADIO [ ] TELEVISION [ ] NEWSPAPER [ ] SOCIAL MEDIA [ ] SCHOOL [ ] OTHERS [ ]
3. DO YOU KNOW THE PRIMARY PURPOSE OF A LONG LASTING INSECTICIDAL NET? YES [ ] NO [ ]
4. IF YES TO NUMBER 13 ABOVE, WHAT IS THE PURPOSE? DISEASE PREVENTION [ ] CROP FARMING [ ] ROOM DECORATION [ ] CASSAVA PROCESSING [ ] OTHERS [ ]
5. WHAT DISEASE ARE PREVENTABLE BY LLINS DENGUE FEVER [ ] ZIKA VIRUS [ ] CHIKUNGUNYA [ ] MALARIA [ ] NONE OF THE ABOVE [ ]
6. ARE YOU FAMILIAR WITH THE PROPER WAY TO HANG AND USE LLINS? YES [ ] NO [ ]
7. DO YOU SLEEP INSIDE THE NET PROPERLY HUNG AND FIXED IN THE BED? YES [ ] NO [ ]
8. DO YOU KNOW HOW OFTEN A LONG LASTING INSECTICIDAL NET SHOULD BE REPLACED OR TREATED? YES [ ] NO [ ]
9. IF YES TO NUMBER 18 ABOVE, HOW OFTEN SHOULD IT BE REPLACED? 1-2 YEARS [ ] 3-5 YEARS 6-10 YEARS [ ] MORE THAN 10 YEARS [ ]
10. HOW SHOULD AN LLIN BE CARED FOR? WASH WITH DETERGENT [ ] WASH WITH JIK [ ] WASH WITH ASH [ ] OTHERS [ ]
11. SHOULD IT BE SEWN WHEN TORN? YES [ ] NO [ ]
12. WHAT IS THE MECHANISM OF ACTION OF LLINS? PHYSICAL BARRIER [ ] INSECTICIDAL COATING [ ] REPELLANT EFFECT [ ]
13. ARE YOU AWARE OF ANY LOCAL PROGRAMS PROMOTING LLIN USAGE? YES [ ] NO [ ]

SECTION 3: PERCEPTION ABOUT SLEEPING INSIDE A LONG-LASTING INSECTICIDAL NET (LLIN)

PLEASE INDICATE YOUR AGREEMENT LEVEL WITH THE FOLLOWING STATEMENTS:

1. SLEEPING INSIDE A LONG-LASTING INSECTICIDAL NET IS AN EFFECTIVE MEASURE TO PREVENT MOSQUITO-BORNE DISEASES.

STRONGLY AGREE [ ] AGREE [ ] NEUTRAL [ ] DISAGREE [ ] STRONGLY DISAGREE [ ]

1. SLEEPING INSIDE A LONG-LASTING INSECTICIDAL NET IS A DAILY PRIORITY.

STRONGLY AGREE [ ] AGREE [ ] NEUTRAL [ ] DISAGREE [ ] STRONGLY DISAGREE [ ]

1. IT IS IMPORTANT IN EDUCATE OTHERS ABOUT THE IMPORTANCE OF USING LONG LASTING INSECTICIDAL NET.

STRONGLY AGREE [ ] AGREE [ ] NEUTRAL [ ] DISAGREE [ ] STRONGLY DISAGREE [ ]

1. HOW COMFORTABLE DO YOU FIND SLEEPING INSIDE AN LLIN

VERY COMFORTABLE NEUTRAL UNCOMFORTABLE VERY UNCOMFORTABLE

1. ARE YOU CONCERNED ABOUT ANY POTENTIAL SIDE EFFECTS OF USING A LONG-LASTING INSECTICIDAL NET? YES [ ] NO [ ] NOT SURE [ ]
2. IF YES, TICK AS APPROPRIATE:

SKIN RASH [ ] TEARY EYES [ ] HOTNESS OF SKIN [ ] TINGLING SENSATION [ ] HEADACHE [ ] OTHERS [ ]

1. HOW CONFIDENT ARE YOU IN THE ABILITY OF LLIN TO PREVENT MOSQUITO BITE?

VERY CONFIDENT [ ] NEUTRAL [ ] NOT VERY CONFIDENT [ ] NOT CONFIDENT ALL [ ]

1. LLIN USAGE SHOULD BE PROMOTED IN COMMUNITIES.

STRONGLY AGREE [ ] AGREE [ ] NEUTRAL [ ] DISAGREE [ ] STRONGLY DISAGREE [ ]

1. TO WHAT EXTENT HAS YOUR TRAINING INFLUENCED YOUR UNDERSTANDING OF THE USE OF LLIN IN DISEASE PREVENTION?

HIGHLY [ ] MODERATELY [ ] POORLY [ ] NO EFFECT [ ]

SECTION 4: PRACTICE SLEEPING INSIDE A LONG-LASTING INSECTICIDAL NET (LLIN)

PLEASE INDICATE YOUR PERSONAL PRACTICE REGARDING SLEEPING INSIDE A LONG-LASTING INSECTICIDAL NET.

1. DO YOU CURRENTLY OWN A LONG-LASTING INSECTICIDAL NET? YES [ ] NO [ ]
2. HOW FREQUENTLY DO YOU SLEEP INSIDE A LONG-LASTING INSECTICIDAL NET?

EVERY NIGHT [ ] MOST NIGHTS [ ] OCCASIONALLY [ ] RARELY [ ] EVER [ ]

1. IF YOU DON'T CURRENTLY OWN A LONG-LASTING INSECTICIDAL NET, WHAT ARE THE BARRIERS TO OBTAINING ONE?

COST OF PURCHASING A LONG LASTING INSECTICIDAL NET [ ] LIMITED ACCESS TO A LONG LASTING INSECTICIDAL NET [ ] LACK OF INFORMATION ABOUT WHERE TO OBTAIN ONE [ ]

OTHERS (SPECIFY):\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

1. IF YOU DO NOT SLEEP UNDER A LONG-LASTING INSECTICIDAL NET REGULARLY, WHAT ARE THE REASONS? (SELECT ALL THAT APPLY)

I DON'T FIND IT NECESSARY [ ] I DON'T HAVE ACCESS TO AN LLIN [ ] I DON'T LIKE THE FEELING OF SLEEPING UNDER A NET [ ] I FORGET TO USE IT [ ] OTHER (PLEASE SPECIFY): \_\_\_\_\_\_\_

1. HAVE YOU EVER RECOMMENDED THE USE OF LONG-LASTING INSECTICIDAL NET TO OTHERS?

YES [ ] NO [ ]

1. DO YOU FEEL THAT YOUR MEDICAL TRAINING HAS ADEQUATELY EMPHASIZED THE IMPORTANCE OF LONG-LASTING INSECTICIDAL NET FOR DISEASE PREVENTION?

YES [ ] NO [ ] NOT SURE [ ]

THANK YOU FOR TAKING THE TIME TO COMPLETE THIS QUESTIONNAIRE! YOUR RESPONSES ARE VALUABLE FOR OUR RESEARCH. IF YOU HAVE ANY FURTHER QUESTIONS, PLEASE CONTACT: