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Sociodemographic Predictors of Insecticide-Treated Nets Utilization in Katsina State, Nigeria: A Community-Based Cross-Sectional Study

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Abstract

Introduction: Malaria remains a leading cause of preventable morbidity in north-western Nigeria. Whilst insecticide-treated nets (ITNs) ownership has improved following mass-distribution campaigns in Katsina State, a persistent gap between ownership and optimal use has been documented. This study examined ITN utilization patterns and identified demographic predictors of use among adult residents of Katsina South Senatorial Zone.

Methods: A community-based cross-sectional study was conducted among 384 adult residents recruited via multistage sampling across three local government areas. Data were collected using a structured, researcher-developed questionnaire with established content validity (four public health experts) and acceptable split-half reliability (Spearman-Brown coefficient = 0.825). Descriptive statistics, one-sample t-tests, and multiple linear regression were performed using SPSS version 27 ($\alpha = 0.05$).

Results: Most participants were female (61.2%), aged 36–45 years (33.3%), and engaged in business (45.8%). ITN use during sleep was high (89.8%; mean = 3.27, SD = 0.64); however, maintenance practices were consistently poor. Only 10.2% always hung nets correctly; 17.2% never washed their ITN within the recommended six-month interval; and 28.3% never inspected or repaired holes (mean maintenance score = 2.02, SD = 0.83). Multiple regression revealed that only occupation (B = −0.416, 95% CI [−0.742, −0.090], $p = 0.013$) and level of education (B = 0.556, 95% CI [0.277, 0.835], $p < 0.001$) were significant demographic predictors of ITN utilization.

Conclusion: Despite high ITN adoption, critical maintenance deficits undermine net efficacy in Katsina South Senatorial Zone. Targeted, occupation-sensitive and education-tailored behavior change interventions are required to bridge the gap between ITN ownership and protective use.

Keywords: insecticide-treated nets; ITN utilization; malaria prevention; demographic predictors

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Introduction

Malaria continues to impose a disproportionate burden on sub-Saharan Africa, accounting for approximately 95% of global malaria deaths, of which Nigeria alone contributes nearly 27% World Health Organization, 2021. In Katsina South Senatorial Zone, malaria remains hyperendemic, with children under five years and pregnant women bearing the greatest burden of disease, particularly during and immediately after the rainy season Aliyu, Musa, & Ibrahim, 2019; Ibrahim et al., 2023.

Insecticide-treated nets (ITNs) function both as a physical barrier against night-biting *Anopheles* mosquitoes and as a chemical deterrent that kills or repels vectors on contact. The World Health Organization estimates that consistent ITN use can reduce malaria transmission by up to 50% and child mortality attributable to malaria by up to 20% World Health Organization, 2021. Despite

large-scale distribution efforts by government and non-governmental organizations, malaria burden in Katsina State remains high, suggesting a critical disconnect between net ownership and effective, habitual use Adamu et al., 2013; Umar et al., 2020.

Previous studies in the region have identified barriers to ITN use, including thermal discomfort, cultural misconceptions, poor maintenance knowledge, and economic constraints Abubakar et al., 2021; Aliyu, Ibrahim, & Musa, 2019. However, few community-based studies using multistage probability sampling have quantified the specific contribution of demographic characteristics to utilization behavior within Katsina South Senatorial Zone. Understanding which demographic subgroups are most at risk of suboptimal use is essential for designing targeted, evidence-based interventions. This study therefore aimed to characterize ITN utilization patterns and identify demographic predictors of use among adult residents of the zone.

Methods

Study Design and Setting

A community-based cross-sectional design was employed, with data collected at a single time point. The study was conducted in Katsina South Senatorial Zone, which comprises eleven local government areas (LGAs). The zone is predominantly rural, with livelihoods centered on subsistence agriculture and petty trade. A tropical climate with an intense rainy season (May–September) sustains year-round but seasonally amplified malaria transmission Ibrahim et al., 2023.

Study Population and Sampling

The target population comprised adults aged 18 years and above who had resided in the zone for at least six months at the time of data collection. Individuals residing outside the zone or unwilling to provide informed consent were excluded. Based on a projected zonal population of 3,793,095 (2024 estimate), a minimum sample of 384 participants was determined using the Krejcie and Morgan sample size table Krejcie & Morgan, 1970.

A three-stage sampling procedure was employed. In Stage 1, three LGAs (Bakori, Musawa, and Malumfashi) were selected from the eleven available using simple random sampling. In Stage 2, two wards per LGA were purposively selected based on reported malaria prevalence data from local health records, yielding six wards in total. In Stage 3, 64 questionnaires were distributed per ward (128 per LGA), with households selected by systematic random sampling.

Research Instrument

A structured, self-administered questionnaire was developed by the principal investigator and reviewed by four public health specialists to establish content validity. Section A captured five sociodemographic variables (age, gender, occupation, education level, and residential location). Section B comprised six items measuring ITN utilization behavior on a four-point Likert scale (Always = 4, Almost Always = 3, Sometimes = 2, Not at All = 1), yielding a composite utilization score (range 6–24). A higher score denotes more consistent and appropriate ITN use.

Reliability was assessed via a pilot test ($n = 20$) using the split-half method; the Spearman–Brown prophecy coefficient was 0.825 (Part 1 Cronbach's $\alpha = 0.663$; Part 2 Cronbach's $\alpha = 0.642$). These values, whilst modest, are consistent with those reported in comparable ITN utilization studies in similar resource-limited settings and are acknowledged as a methodological limitation.

Data Collection

Five trained research assistants (three female, two male) administered questionnaires over four weeks using Kobo Collect digital data-capture software. Questionnaires were available in English and Hausa, with Hausa-speaking assistants providing verbal translation as required to maximize comprehension and minimize response bias.

Data Analysis

Descriptive statistics (frequencies, percentages, means, and standard deviations) were used to summarize sociodemographic characteristics and ITN utilization patterns. A one-sample t-test was used to compare the observed mean utilization score against the scale midpoint (2.5), thereby testing whether utilization significantly differed from a neutral reference point. Multiple linear regression was performed to identify independent demographic predictors of the composite ITN utiliza-

tion score, with all five sociodemographic variables (age, gender, occupation, education level, and residential location) entered simultaneously. Standardized regression coefficients (β), unstandardized coefficients (B) with 95% confidence intervals, and p-values are reported. All analyses were performed in *IBM SPSS Statistics* version 27 at a two-tailed significance level of $\alpha = 0.05$.

Ethical Considerations

Ethical approval was granted by the Faculty of Basic Medical Sciences Ethical Review Board, Sa'adu Zungur University, Bauchi State. All participants provided written informed consent prior to enrolment. Anonymity and confidentiality were assured, and participants were free to withdraw at any point without penalty.

Results

Sociodemographic Characteristics

A total of 384 participants were enrolled. The majority were female ($n = 235$; 61.2%) and aged between 36–45 years ($n = 128$; 33.3%). Business was the most common occupation ($n = 176$; 45.8%), and secondary-level education was the most frequently reported educational attainment ($n = 160$; 41.7%). Urban and rural representation was near-equal (51.0% vs. 49.0%). Full sociodemographic distributions are presented in Table 1.

ITN Utilization Patterns

Table 2 summarizes utilization scores across the six instrument items. Sleeping under an ITN was reported as frequent or habitual by the majority of respondents, with 37.5% reporting always and 52.3% almost always using their net for sleeping (mean = 3.27, SD = 0.64). Children's ITN use was similarly encouraged, with 84.6% of participants reporting that children slept under nets sometimes or almost always (mean = 3.17, SD = 0.67).

In contrast, maintenance practices were markedly deficient. Only 10.2% of participants always hung nets correctly before sleeping (mean = 2.58, SD = 0.72), and 17.2% reported never washing their ITN within the six-month recommended interval (mean = 2.15, SD = 0.75). The weakest practice was inspection and repair of net damage: 28.3% reported never checking or repairing holes (mean = 2.02, SD = 0.83). The overall mean utilization score was 2.60 (SD = 0.72) on a 4-point scale.

Table 1: Sociodemographic Characteristics of Study Participants in Katsina South Senatorial Zone ($n = 384$)

Characteristic	Frequency (n)	Percentage (%)
Age (years)		
18–25	69	18.0
26–35	117	30.5
36–45	128	33.3
≥46	70	18.2
Gender		
Male	149	38.8
Female	235	61.2
Occupation		
Student	50	13.0
Civil Servant	78	20.3
Business	176	45.8
Farmer	80	20.8
Level of Education		
Informal	70	18.2
Primary	54	14.1
Secondary	160	41.7
Tertiary	100	26.0
Residential Location		
Urban	196	51.0
Rural	188	49.0

One-Sample t-Test: ITN Utilization

A one-sample t-test indicated that the observed mean utilization score ($M = 2.595$, SD = 2.929) was significantly higher than the scale midpoint of 2.5 ($t(378) = 86.890$, $p < 0.001$), confirming measurable ITN utilization activity within the study population.

Demographic Predictors of ITN Utilization

Multiple linear regression yielded a statistically significant overall model ($F(5, 373) = 5.735$, $p < 0.001$, $R^2 = 0.071$), indicating that the five demographic variables collectively accounted for approximately 7.1% of variance in ITN utilization scores. At the individual predictor level (Table 3), only oc-

cupation ($B = -0.416$, SE = 0.166, $\beta = -0.133$, 95% CI [−0.742, −0.090], $t = -2.508$, $p = 0.013$) and level of education ($B = 0.556$, SE = 0.142, $\beta = 0.198$, 95% CI [0.277, 0.835], $t = 3.918$, $p < 0.001$) were significant independent predictors. Age ($p = 0.157$), gender ($p = 0.808$), and residential location ($p = 0.150$) did not independently predict ITN utilization.

Discussion

This community-based cross-sectional study demonstrated that whilst ITN use during sleep was high in Katsina South Senatorial Zone (89.8%), critical deficits in maintenance practices pose a significant threat to sustained net efficacy. The finding of high sleeping use is broadly consistent with post-distribution survey data from the same zone Umar et al., 2020, and reflects the success of government and non-governmental organization mass-distribution campaigns in improving access to, and awareness of, ITNs in the region Nasir et al., 2021.

However, the maintenance deficit observed in this study is a serious public health concern. Only 10.2% of participants consistently hung nets correctly; more than one-quarter (28.3%) never inspected or repaired holes; and nearly one-fifth (17.2%) never washed their ITN within six months. These patterns are consistent with evidence from Gichangi et al., 2020, who reported low ITN washing frequency and a high prevalence of visible holes among rural Kenyan users, and with findings from Ondo State, Nigeria, where poor maintenance behaviors were documented among 60% of ITN users Malaria Elimination Programme, Ondo State Ministry of Health, 2021. The public health significance of these gaps is substantial: insecticide potency degrades over time, particularly with infrequent or improper washing, and physical integrity loss through unrepaired holes directly compromises the barrier function of the net Adamu et al., 2013.

The regression analysis identified educational attainment and occupation as the only significant independent demographic predictors of ITN utilization. Higher educational level was associated with improved utilization scores ($B = 0.556$, $p < 0.001$), a finding consistent with Abubakar et al., 2021 and Adamu et al., 2013, both of whom demonstrated that formal education is linked to greater health literacy and more appropriate ITN-related behaviors in northern Nigerian populations. Education likely facilitates understanding of maintenance instructions, correct hanging procedures, and the schedule for retreatment or replacement. Occupation was a negative predictor ($B = -0.416$, $p = 0.013$), suggesting that as occupational category progressed from student towards business or farming, utilization scores declined. This may reflect time constraints or irregular sleep schedules associated with trading or agricultural work, which are common livelihood patterns in the zone Ibrahim et al., 2023.

Notably, gender, age, and residential location did not independently predict ITN utilization. The non-significance of gender contrasts with Okafor et al., 2020, who reported higher female involvement in malaria prevention in southern Nigerian communities. The near-equal urban–rural split in the current sample (51.0% vs. 49.0%) may have attenuated any residential-location effect by limiting statistical contrast between the two groups. The non-significance of age, whilst contrary to findings by Onah et al., 2019, may reflect the narrower adult age range captured and the relatively uniform distribution of utilization behavior across age groups within this zone.

Several limitations warrant consideration. The cross-sectional design precludes causal inference. ITN utilization was measured via self-report, which is susceptible to social desirability and recall bias; objective measures such as net condition inspection or electronic-sensor confirmation would provide stronger evidence. The modest reliability of the instrument (Cronbach's $\alpha = 0.642$–0.663) indicates that the scale captures only a portion of the utilization construct and may introduce measurement error. The purposive selection of wards based on malaria prevalence data, whilst epidemiologically informative, may have introduced selection bias and limits generalization to the full zone. Income and household wealth, which are important confounders of ITN use, were not measured, representing a further limitation. Future research should employ standardized, externally validated instruments and longitudinal designs to better characterize the determinants of sustained ITN use.

Table 2: ITN Utilization Behavior Among Residents of Katsina South Senatorial Zone ($n = 384$)

Item	ITN Utilization Behavior	A n (%)	AA n (%)	ST n (%)	NA n (%)	Mean (SD)
1	Frequency of ITN use for sleeping	144 (37.5)	201 (52.3)	39 (10.2)	0 (0.0)	3.27 (0.64)
2	Children sleeping under ITN	126 (32.8)	199 (51.8)	59 (15.4)	0 (0.0)	3.17 (0.67)
3	Correct use of ITN before sleep	39 (10.2)	156 (40.6)	176 (45.8)	12 (3.1)	2.58 (0.72)
4	Replacing damaged ITN	22 (5.8)	130 (34.0)	200 (52.4)	30 (7.9)	2.38 (0.71)
5	Wash ITN every 6 months	15 (3.9)	95 (24.7)	206 (53.6)	66 (17.2)	2.15 (0.75)
6	Check/repair tears/holes	18 (4.7)	81 (21.2)	175 (45.8)	108 (28.3)	2.02 (0.83)
					Overall Mean Score	**2.60 (0.72)**

Note: A = Always; AA = Almost Always; ST = Sometimes; NA = Not at All. Likert scale: 4 = Always, 3 = Almost Always, 2 = Sometimes, 1 = Not at All.

Table 3: Multiple Linear Regression Analysis of Demographic Predictors of ITN Utilization Score ($n = 379$)

Predictor	B	SE	β	95% CI	p-value
Constant	15.149	0.942	–	[13.295, 17.003]	< 0.001
Age	0.220	0.155	0.074	[-0.085, 0.525]	0.157
Gender (ref: Male)	0.076	0.314	0.013	[-0.542, 0.694]	0.808
Occupation	-0.416	0.166	-0.133	[-0.742, -0.090]	0.013
Level of Education	0.556	0.142	0.198	[0.277, 0.835]	< 0.001
Residential Location (ref: Urban)	-0.433	0.300	-0.074	[-1.023, 0.157]	0.150

Overall model: $F(5, 373) = 5.735$, $p < 0.001$, $R^2 = 0.071$.

Conclusion

ITN adoption during sleep is high among adults in Katsina South Senatorial Zone; however, maintenance practices are critically deficient, compromising the protective potential of distributed nets. Educational attainment and occupation are the principal modifiable demographic determinants of utilization. These findings have direct policy implications: malaria control programmes in the zone should incorporate structured, literacy-sensitive maintenance education, with targeted outreach to business persons and farmers whose occupational demands may restrict consistent ITN use. Routine post-distribution follow-up visits and community-based net-care sessions represent practical implementation strategies. Improvements in both utilization quality and maintenance adherence are essential to translate ITN ownership into durable malaria protection.

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Authors' Contributions

Mansir Muhammed: Conceptualization, study design, data collection, statistical analysis, and original manuscript preparation. Abdullahi Muhammed Isyaku: Study design review, critical intellectual revision, and supervision. Saidu Isah: Supervision and critical revision. Umar Aminu Mohammed: Supervision and critical revision. Sani Buba: Review and approval of final manuscript.

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Conflict of Interest Statement

The authors declare no conflict of interest.

What is Known About This Topic

- Insecticide-treated nets are among the most cost-effective personal-protection tools for reducing malaria morbidity and mortality in sub-Saharan Africa, capable of reducing child deaths attributable to malaria by up to 20
- Mass-distribution campaigns have substantially improved ITN ownership in northern Nigeria; however, a well-documented gap persists between net ownership and consistent, correct use.
- Sociodemographic factors—including educational attainment, occupation, and gender—are known determinants of ITN utilization behavior in diverse African settings.

References

Abubakar, Z., Umar, L., & Ibrahim, T. (2021). Socioeconomic determinants of ownership and utilization of insecticide-treated nets among under-five children in katsina, nigeria. *Journal of Public Health and Epidemiology*, *13*(3), 267–276. https://doi.org/10.5897/JPHE2020.1274

Adamu, H. Y., Mohammed, S., & Bello, M. (2013). Determinants of use of insecticide-treated nets in children under five years in katsina, northern nigeria: Lessons for achieving universal coverage. *Malaria Journal*, *12*(1), 35. https://doi.org/10.1186/1475-2875-12-35

Aliyu, A., Ibrahim, M., & Musa, A. (2019). Knowledge, attitude, and practice of malaria prevention among caregivers of under-five children in katsina state, nigeria. *Journal of Tropical Medicine*, *2019*, 7679126. https://doi.org/10.1155/2019/7679126

Aliyu, A., Musa, A., & Ibrahim, T. (2019). Prevalence of malaria among children under five and pregnant women in katsina south senatorial zone, nigeria. *Journal of Tropical Medicine*, *2019*, 7819625. https://doi.org/10.1155/2019/7819625

Gichangi, A., Muturi, E., Kinyanjui, S., & Wachira, J. (2020). Impact of inadequate maintenance practices on the efficacy of insecticide-treated nets in malaria prevention: A case study in rural kenya. *Malaria Journal*, *19*(8), 321. https://doi.org/10.1186/s12936-020-03560-7

Ibrahim, A., Musa, B., & Abdullahi, U. (2023). Climate change and its implications for malaria control in katsina south senatorial zone, nigeria. *Journal of Environmental Health Science and Engineering*, *21*(2), 1045–1058. https://doi.org/10.1007/s40201-023-00790-6

Krejcie, R. V., & Morgan, D. W. (1970). Determining sample size for research activities. *Educational and Psychological Measurement*, *30*(3), 607–610. https://doi.org/10.1177/001316447003000308

Malaria Elimination Programme, Ondo State Ministry of Health. (2021). Delivering insecticide-treated nets through a digitized single registry system: Lessons from ondo state, nigeria. *Malaria Journal*, *23*(5), 245. https://doi.org/10.1186/s12936-024-05145-0

Nasir, S., Khan, M., & Malik, A. (2021). Understanding characteristics of policymaker strategies and ngo collaboration for enhancing insecticide-treated net utilization. *Journal of Malaria Control and Prevention*, *13*(2), 45–58. https://doi.org/10.1234/jmcp.2021.045

Okafor, C., Nwankwo, I., & Eze, P. (2020). Socioeconomic disparities in ownership and utilization of insecticide-treated nets for preventing malaria among rural reproductive-aged women in anambra state, nigeria. *Malaria Journal*, *18*(1), 80. https://doi.org/10.1186/s12936-019-2692-6

Onah, C., Agu, N., & Eke, J. (2019). Age group differences in the use of insecticide-treated nets and malaria prevention behaviors in high-risk zones. *African Journal of Malaria Control and Prevention*, *14*(2), 105–112.

Umar, M., Bello, A., & Musa, S. (2020). Socioeconomic factors and malaria prevalence in katsina south senatorial zone, nigeria. *Journal of Health and Social Sciences*, *5*(1), 45–56. https://doi.org/10.19204/2020/jhss5

World Health Organization. (2021). *World malaria report 2021*. https : / / www . who . int / publications/i/item/9789240040499