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EFFICACY OF MASS DISTRIBUTION OF INSECTICIDE-TREATED NETS (ITNs) AND GENDER DIFFERENCES IN MALARIA PREVENTION AND PRACTICES AMONG HOUSEHOLD DWELLERS IN KANO METROPOLIS

SALISU HALADU[1]; ABDULLAHI SABO MUHAMMAD PhD[2]; KABIRU MUSTAPHA YAKASAI PhD[3]; MUHAMMAD, ABDULLAHI PhD[4]; BASHIR IDRIS PhD[5], HADIZA SAIDU BALA[6]; UMAR MOHAMMED YUSUF[7]; EDREES ABDULLAHI MUHAMMAD[8]; & USMAN MOHAMMED[9]

[1]School of Health Technology Kano. salisuhaladu3@gmail.com [2]Department of Public Health, Maryam Abacha American University of Nigeria, Kano state. likitasabo@gmail.com [3]Department of Public Health, Maryam Abacha American University of Nigeria, Kano state. kbmyakasai@gmail.com [4]Community Health Practitioners' Registration Board of Nigeria. abdullahim26@yahoo.com [5]Community Health Practitioners' Registration Board of Nigeria. idrisbashir942@gmail.com [6]Faulty of Medicine, Bayero University Kano, kano. hsaidu2006@yahoo.com [7]Community Health Practitioners' Registration Board of Nigeria. uyusufm@gmail.com [8]Community Health Practitioners' Registration Board of Nigeria. abdullahiidrism99@gmail.com [9]Department of Information Technology, Bayero University kano, kano State. likitausse@gmail.com

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Abstract

Malaria remains a major public health challenge in Nigeria, accounting for approximately 27% of global cases. Despite mass distribution of insecticide-treated nets (ITNs) and other interventions, gaps persist in household-level prevention practices. This study assessed the efficacy of mass ITN distribution strategy and gender differences in malaria prevention and practices among household dwellers in Kano Metropolis, Nigeria. A descriptive cross-sectional survey was conducted among 386 household dwellers selected from eight Local Government Areas using multistage sampling. Data were collected using a

Keywords: Malaria prevention, insecticide-treated nets, mass distribution, gender differences, household dwellers, Kano Metropolis, Nigeria

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Prof. A.S. Hossein [Saskatchewan]

structured questionnaire assessing ITN distribution efficacy, gender differences, and prevention practices. Descriptive statistics and inferential statistics (one-sample t-test, independent t-test) were employed at α=0.05. Mass ITN distribution efficacy was significantly below expected levels (grand mean=3.04, t=-5.112, p<.001), with inadequate nets per household (mean=2.59) and poorly organised distribution (mean=2.93) being key challenges. ITN ownership was 55.9%, while 44.1% of households lacked nets. Females demonstrated significantly higher prevention practices than males (M=21.44 vs 19.19, t=9.026, p<.001). Women showed better knowledge of antimalarial drug use (mean=3.13) and were more likely to take children to health facilities (mean=3.20), while men made most decisions about purchasing prevention supplies (mean=3.30). Mass ITN distribution programs face significant operational challenges including inadequate coverage and poor organisation. Gender disparities persist, with women demonstrating better prevention practices despite limited decision-making authority. Addressing coverage gaps, improving distribution logistics, and implementing gender-sensitive interventions are essential for optimising malaria control outcomes.

Introduction

Background of the Study

Malaria remains one of the world's most persistent and intricate infectious diseases, impacting millions annually despite decades of scientific advancements and financial commitments. Recent estimates suggest over 249 million cases and over 600,000 fatalities occurred in 2022, indicating a concerning plateau following the progress achieved between 2000 and 2015 (WHO, 2024). The worldwide stagnation in progress is increasingly associated with the proliferation of insecticide-resistant mosquito vectors, environmental alterations induced by climate change, and disturbances resulting from global crises (Michaud et al., 2024).

Sub-Saharan Africa constitutes the geographical epicentre of worldwide malaria transmission, accounting for approximately 94% of all malaria cases and fatalities. This considerable burden arises from a confluence of environmental, biological, structural, and socio-behavioural elements. The region's tropical climate facilitates continuous breeding of the *Anopheles* mosquito, especially *Anopheles gambiae*, which is internationally acknowledged as the most effective malaria vector (Villena et al., 2022). Poverty and inadequate health systems perpetuate the cycle of transmission throughout the region (Etiaba et al., 2025).

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Nigeria bears the largest malaria burden worldwide, accounting for roughly one-third of all global malaria fatalities each year. The country is responsible for 32% of malaria fatalities and 27% of all malaria cases globally (WHO, 2022). Despite significant governmental and donor investments, malaria continues to pose a considerable public health burden in Nigeria. Kano State, in northwestern Nigeria, exemplifies the tremendous difficulty in managing malaria in intricate metropolitan settings. Kano is home to over 15 million inhabitants, making it one of the most densely inhabited areas in West Africa (National Bureau of Statistics, 2022).

Insecticide-treated nets (ITNs) remain one of the most cost-effective interventions for malaria prevention, with the World Health Organization recommending universal coverage for all populations at risk (WHO, 2023). Mass distribution campaigns have been implemented across sub-Saharan Africa, including Nigeria, with the goal of achieving universal coverage. However, ownership does not always translate to consistent use, and various barriers—including inadequate numbers of nets per household, distribution logistics, and gender dynamics—continue to impede optimal utilisation (Mboma et al., 2021; Wetzler et al., 2022).

Problem Statement

Despite significant investments in mass ITN distribution programs in Kano Metropolis, malaria continues to pose a considerable public health burden. Studies reveal persistent gaps between net ownership and utilisation, with many households lacking adequate nets for all members (Etiaba et al., 2025). Operational challenges including inadequate distribution logistics, insufficient net quantities, and lack of follow-up monitoring undermine program effectiveness.

Gender dynamics further complicate malaria prevention efforts. Women, who bear primary responsibility for child health, often lack decision-making authority regarding household health expenditures (Saaka et al., 2024; Ratnadass & Sarter, 2025). Men, who control financial resources, may not prioritise malaria prevention supplies. This gendered power dynamic creates a structural barrier that limits the effectiveness of even well-intentioned prevention programs.

Limited studies have examined the efficacy of mass ITN distribution and gender differences in malaria prevention practices in Kano Metropolis. This gap in empirical evidence constrains the development of targeted, context-sensitive interventions. The present study addresses this gap by evaluating ITN distribution efficacy and gender differences in malaria prevention among household dwellers in Kano Metropolis.

Aim and Objectives

The aim of this study was to evaluate the efficacy of mass distribution of insecticide-treated nets (ITNs) strategy and gender differences in malaria prevention and practices among household dwellers in Kano Metropolis.

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The specific objectives were:

1. To evaluate the efficacy of mass distribution of insecticide-treated nets (ITNs) strategy as it relates to malaria prevention and practices among household dwellers in Kano Metropolis
2. To find the differences between male and female household dwellers level of malaria prevention and practices in Kano Metropolis.

Research Questions

This study specifically addressed the following research questions:

1. What is the efficacy level of mass distribution of insecticide-treated nets (ITNs) strategy as it relates to malaria prevention and practices among household dwellers in Kano Metropolis?
2. What are the differences between male and female household dwellers as it relates to malaria prevention and practices in Kano Metropolis?

Research Hypotheses

Based on the research questions, the following null hypotheses were formulated:

1. The efficacy level of mass distribution of insecticide-treated nets (ITNs) strategy as it relates to malaria prevention and practices among household dwellers in Kano will not be significantly high
2. There is no significant difference between male and female household dwellers as it relates to malaria prevention and practices in Kano Metropolis

Concept of Malaria

Malaria is a life-threatening disease caused by parasites of the genus Plasmodium, transmitted to humans through the bites of infected female Anopheles mosquitoes. The disease has plagued humanity for millennia, with historical records dating back to ancient Egyptian and Greek civilisations (Reiter, 2010). Four species of Plasmodium commonly infect humans: *P. falciparum*, *P. vivax*, *P. ovale*, and *P. malariae*, with *P. falciparum* being the most deadly and prevalent in sub-Saharan Africa (Arora et al., 2023). Malaria disproportionately affects children under five years and pregnant women, who have weaker immune systems and are particularly vulnerable to severe disease and death (Kumar et al., 2022).

The malaria parasite has a complex life cycle involving both human and mosquito hosts. The cycle begins when an infected mosquito injects sporozoites into the human bloodstream. These sporozoites travel to the liver, where they multiply asexually before releasing merozoites into the bloodstream. The merozoites then invade red blood cells, where they multiply further, causing the infected cells to rupture and release more

parasites. This erythrocytic cycle is responsible for the clinical manifestations of malaria, including fever, chills, anaemia, and in severe cases, organ failure and death (Roques et al., 2023; White, 2022).

Insecticide-Treated Nets (ITNs) for Malaria Prevention

Insecticide-treated nets (ITNs) are a form of personal protection against mosquito bites. They consist of a mesh net treated with insecticide that kills or repels mosquitoes. ITNs have been proven to reduce malaria transmission by providing both physical and chemical protection during the night when Anopheles mosquitoes are most active (WHO, 2023). Long-lasting insecticidal nets (LLINs) are a type of ITN with insecticide incorporated into the net fibres, maintaining efficacy for up to three years.

The WHO recommends universal coverage of ITNs for all populations at risk of malaria, with a target of one net for every two persons (WHO, 2023). Mass distribution campaigns, often conducted every 2-3 years, are the primary strategy for achieving this coverage. In addition to mass campaigns, ITNs are distributed through routine channels such as antenatal care and immunisation services (WHO, 2023).

Gender and Malaria Prevention

Gender plays a crucial role in malaria prevention practices. Women are often the primary caregivers for children and are responsible for ensuring family members sleep under ITNs (Saaka et al., 2024). However, in many patriarchal societies, men control household resources and make decisions about health expenditures (Ratnadass & Sarter, 2025). This gender dynamic creates a structural barrier: women may have the knowledge and motivation to prevent malaria but lack the authority to implement prevention measures.

Studies across sub-Saharan Africa demonstrate that gender-sensitive interventions that engage both men and women achieve better outcomes (Abiola et al., 2023). Health education programs that target women have shown success, but involving men as allies is essential for sustainable change (Adesina & Lawal, 2023). Gender-transformative approaches that challenge traditional gender norms and promote shared decision-making are increasingly advocated for malaria prevention (Achieng et al., 2024).

Theoretical Framework: Health Belief Model

The Health Belief Model (HBM) provides the theoretical foundation for this study. Developed in the 1950s, the HBM explains why individuals fail to engage in preventive health behaviours by examining their perceptions of susceptibility, severity, benefits, barriers, and cues to action (Rosenstock et al., 2020). The model posits that health behaviour is influenced by an individual's perceived susceptibility to a health threat,

perceived severity of the condition, perceived benefits of taking action, perceived barriers to action, cues to action (such as health education messages), and self-efficacy.

The HBM is particularly suitable for understanding ITN use because it explains why households with access to nets may not use them consistently. Perceived barriers, such as heat discomfort or inconvenience, can outweigh perceived benefits, leading to inconsistent use (Scarpassa et al., 2025). Gender dynamics also influence HBM constructs: women may perceive higher susceptibility for their children but face barriers in accessing resources. The HBM framework helps understand why gender differences in prevention practices persist despite equal awareness.

Mass Distribution of Insecticide-Treated Nets

Mass distribution of ITNs has been a cornerstone of malaria control programs across sub-Saharan Africa. The WHO recommends universal coverage through mass distribution campaigns supplemented by routine distribution channels (WHO, 2023). In Nigeria, mass distribution campaigns have significantly increased ITN ownership, with coverage reaching 55.9% in Kano Metropolis (this study). However, ownership does not always translate to consistent use.

Several studies have evaluated ITN distribution efficacy across sub-Saharan Africa. Wetzler et al. (2022) found that while 83% of Mozambican households owned ITNs, only 59% reported consistent use. Similar discrepancies were observed in Ghana, where ITN utilisation was influenced by cultural perceptions of heat discomfort and misconceptions about mosquito behaviour (Saaka et al., 2024). In northern Nigeria, Etiaba et al. (2025) reported that despite massive distribution campaigns, net use among household dwellers was below 60%.

Key challenges in ITN distribution include inadequate numbers of nets per household, poor distribution logistics, lack of user education, and insufficient post-distribution monitoring (Mboma et al., 2021). Households with more members than nets leave some individuals unprotected, undermining the effectiveness of the program. Distribution that is poorly organised or inaccessible may exclude vulnerable populations, particularly those in remote areas or urban slums (Park et al., 2022).

Gender Differences in Malaria Prevention

Gender differences in malaria prevention practices have been well documented. Women, particularly mothers, play a pivotal role in ITN use and the management of febrile illnesses in children (Saaka et al., 2024). Studies show that women are more likely to ensure children sleep under ITNs and to seek prompt treatment for malaria symptoms (Ratnadass & Sarter, 2025). Women also demonstrate better knowledge of correct antimalarial drug use than men (Adesina & Lawal, 2023).

However, women's knowledge and motivation do not always translate into action due to limited decision-making authority. In patriarchal households, men control household resources and health expenditures, meaning women may be unable to purchase ITNs or seek care without male approval (Haruna & Galadima, 2020). This structural barrier undermines the effectiveness of health education programs that target women without addressing gender power dynamics.

Abiola et al. (2023) found that gender-inclusive programs that engage both men and women lead to 68% higher participation in preventive measures. Achieng et al. (2024) observed that gender dynamics and household hierarchies significantly affected adherence to prescribed malaria medication in several East African communities. Gender-transformative approaches that challenge traditional norms and promote shared decision-making are increasingly advocated for malaria prevention (Adesina & Lawal, 2023).

Summary of Empirical Review

Empirical evidence demonstrates the importance of ITNs for malaria prevention and the influence of gender on prevention practices. Mass distribution campaigns have increased ITN ownership but gaps in consistent use persist (Wetzler et al., 2022; Etiaba et al., 2025). Key challenges include inadequate net quantities, poor distribution logistics, and lack of user education (Mboma et al., 2021). Gender differences in prevention practices are significant, with women showing better knowledge and practices but often lacking decision-making authority (Saaka et al., 2024; Ratnadass & Sarter, 2025). Gender-sensitive interventions that engage both men and women achieve better outcomes (Abiola et al., 2023; Achieng et al., 2024).

METHODOLOGY

Kano Metropolis, one of Nigeria's oldest and most populous urban settlements, spans 11.85°N to 12.17°N and 8.39°E to 8.67°E, including Dala, Fagge, Gwale, Kano Municipal, Nassarawa, Tarauni, and parts of Kumbotso and Ungogo LGAs. Kano Metropolis, on the High Plains of Hausaland in tropical climatic conditions with hot and dry (rani), warm and wet (damina), warm and dry (kaka), and cool and dry (bazara) seasons, is drained by the Challawa, Jakara, Kano, and Watari river systems, tributaries of the Hadejia river system (Ah A densely populated and socioeconomically varied metropolitan center, Kano Metropolis was anticipated to have 4,219,000 persons in 2022 and 4,645,000 by 2025 (National Population Commission, 2022). Most households had six to eight members. All household residents of Kano Metropolis' eight LGAs, including in-school and out-of-school adolescents, adult male and female permanent residents who actively engage in home health decisions, were studied. Households required to live in selected wards of the eight

LGAs for at least six months, have an adult respondent 18 years or older as the household head or primary caretaker present at the interview, and offer informed written (or thumbprint) agreement. Households with residents for less than six months, institutional residences (prisons, military barracks, boarding hostels, and hotels), households with no adult respondent after three visits at different times or days, and respondents who were too ill, cognitively impaired, or otherwise unable to respond are excluded. The sample size was determined using Cochran's (1977) formula: $n = Z^2 p(1-p) / d^2$, with Z = 1.962 (95% confidence), p = 0.05 (estimated target population proportion at 50%), and d = 0.07 (statistical significance Attrition was 10%, therefore 414 participants were recruited from a minimal sample size of 373. Of them, 386 completed and validated questionnaires were examined. A multistage sampling technique was employed to select participants, beginning with the purposive selection of the eight LGAs that make up Kano Metropolis (Dala, Fagge, Gwale, Kano Municipal, Nassarawa, Tarauni, Kumbotso, and Ungogo) due to their high population density and malaria risk, followed by the selection of wards from each LGA using simple random sampling, then systematic sampling of households within each selected ward whereby a sampling interval was calculated by dividing the total number of households in the ward by the number allocated for the study and every kth household was selected after a random start, and finally within each selected household, one eligible adult (18 years or older and resident for at least six months) was chosen as the respondent using the Kish grid method when more than one eligible adult was present, with the total sample size of 414 households proportionally allocated to the selected LGAs and wards based on population size to ensure representativeness. The researcher designed a two-section questionnaire after reading research constructs and variables literature: Section A included respondents' age, gender, marital status, and highest academic qualification, while Section B addressed research objectives and questions on the efficacy of mass insecticide-treated nets (ITNs) distribution and gender differences in malaria prevention and practices among household dwellers. To ensure content, construct, and face validity, the researcher's supervisors and two other health education and public health experts validated the research instrument. Cronbach's alpha coefficient was used to assess the questionnaire's reliability, yielding 0.96 for the overall instrument and 0.96 for the sub-instruments. After an official letter of introduction from Maryam Abacha American University of Niger management, the researcher personally administered the questionnaire with trained research assistants over four weeks, filing and returning copies promptly and offering question clarification. For research questions, SPSS version 25 was used to analyse data using descriptive statistics (frequency, percentage, mean, and standard deviation). We utilised inferential statistics (one-sample t-tests for ITN distribution efficacy and independent samples t-tests for gender differences) to test null hypotheses at a significance threshold of $\alpha = 0.05$

Socio-Demographic Characteristics of Respondents

The sociodemographic factors reveal that the sample is primarily male, with 304 respondents (77.6%) vs 88 females (22.4%). This considerable gender disparity indicates that the study's findings are predominantly influenced by the male viewpoint. When evaluating variables such as occupation or education, it is crucial to recognise that the outcomes may not entirely reflect the experiences or perspectives of women in the community.

The age distribution indicates that the research population is predominantly youthful. The predominant age group is 18-25 years, consisting of 267 individuals (68.1%). This is succeeded by a significant decrease, with individuals aged 26-35 comprising 77 respondents (19.6%). The older demographics are underrepresented, with the 36-45 and 46-55 age groups constituting merely 7.7% and 4.6%, respectively. This suggests that any findings reached will predominantly represent the traits, behaviours, and perspectives of young adults.

The sample predominantly consists of single persons, with 268 responders (68.4%). Married participants comprise a mere 66 persons (16.8%), whereas widowed respondents total 39 (9.9%) and divorced/separated individuals amount to 19 (4.8%). This profile indicates that the household and health-related decisions examined in this study are likely affected by single-person or single-adult homes.

The responders exhibit a varied range of educational attainment. The predominant group has attained secondary education, with 154 individuals (39.3%). The next substantial group consists of primary school leavers at 105 (26.8%), closely followed by individuals with tertiary education at 86 (21.9%). A minor percentage lacks formal schooling (29 respondents, 7.4%) or possesses a post-graduate degree (18 respondents, 4.6%). This indicates that although literacy and fundamental education are prevalent, the populace possesses a diverse array of educational backgrounds that may affect their comprehension of health communications.

Agriculture is the predominant occupation, engaging nearly half of the respondents, namely 174 individuals (44.4%). Students represent the second-largest demographic, including 84 respondents (21.4%), consistent with the youthful age profile. The economy comprises traders (57 respondents, 14.5%) and artisans (49 respondents, 12.5%), with civil servants constituting the smallest sector at merely 28 (7.1%). This occupational analysis reveals a society predominantly involved in agricultural and informal sector endeavours.

Household sizes are typically substantial and uniformly distributed across the assessed categories. The predominant household size is 7-9 individuals, as indicated by 116 respondents (29.6%), closely succeeded by 4-6 individuals, stated by 114 respondents (29.1%). Households comprising 1-3 individuals represent 95 responses (24.2%). The total percentages amount to 87.9%, indicating a potential omission of a category for households exceeding 9 individuals. The research indicates that extended family living arrangements are prevalent.

Mean Monthly Earnings The economic data reveals that the sample is primarily low-income. A significant majority of 228 responders (58.2%) earn below 30,000 monthly. The subsequent most prevalent range is 60,000-89,999, encompassing 69 responders (17.6%). persons earning 120,000 or more constitute a negligible portion of the sample, with merely 19 persons (4.8%). This low-income demographic aligns with prevalent agricultural and artisanal professions, significantly impacting the affordability of healthcare and preventive measures.

Position inside Kano Metropolis The geographic distribution is significantly biassed towards the Gwale local government area, with 164 respondents (41.8%). Additional regions with significant representation comprise Dala (76 respondents, 19.4%), Kano Municipal (67 respondents, 17.1%), and Fagge (58 respondents, 14.8%). Tarauni and Kumbotso are markedly under-represented, with 18 (4.6%) and 9 (2.3%) responders, respectively. Thus, the study's results will predominantly represent conditions in Gwale and be minimally relevant to regions such as Kumbotso.

Exposure to malaria-related health education is almost evenly distributed. A marginal majority of 209 respondents (53.3%) indicated they had gotten such schooling, but a substantial minority of 183 (46.7%) reported they had not. This nearly equal division underscores a considerable deficiency in health communication initiatives, indicating that a significant segment of the community may be deprived of critical information concerning malaria prevention and treatment.

Possession of Insecticide-Treated Nets (ITNs) A majority of households own an ITN (219 respondents, 55.9%), while a significant minority—173 respondents (44.1%)—lack one. The prevalence of non-ownership of ITNs, notwithstanding their efficacy as a principal tool for malaria prevention, signifies a substantial deficiency in protective coverage. A substantial segment of the population remains susceptible to infection, indicating the presence of access or utilisation hurdles that require attention.

Descriptive Statistics

Research Question One: What is the efficacy level of mass distribution of insecticide-treated nets (ITNs) strategy as it relates to malaria prevention and practices among household dwellers in Kano Metropolis?

Table 1: Responses of the respondents on the efficacy level of mass distribution of insecticide-treated nets (ITNs) strategy as it relates to malaria prevention and practices among household dwellers in Kano Metropolis

S/No	Efficacy of mass distribution of insecticide-treated nets (ITNs) strategy as it relates to malaria prevention and practices among household dwellers	Mean	SD	Decision
1	The ITNs distributed were adequate for all members of my household.	2.59	1.172	Disagreed
2	The distribution of ITNs was well organized and accessible to everyone in the community.	2.93	1.07	Disagreed

S/No	Efficacy of mass distribution of insecticide-treated nets (ITNs) strategy as it relates to malaria prevention and practices among household dwellers	Mean	SD	Decision
3	Health workers provided proper education on how to use and maintain ITNs during distribution.	3.13	1.013	Agreed
4	My household uses the distributed ITNs consistently every night.	3.17	1.038	Agreed
5	The use of ITNs has significantly reduced malaria cases in my household.	3.04	1.186	Agreed
6	The mass distribution strategy increased awareness of malaria prevention in my community.	3.11	0.991	Agreed
7	The ITNs distributed were of good quality and lasted long enough before replacement.	3.26	1.034	Agreed
8	The government or health agencies regularly monitor the use and condition of distributed ITNs.	3.12	1.037	Agreed
	Grand Mean	**3.04**	**1.08**	**Agreed**

Source: Field Work, 2025

Condensed data presented in Table 1 shows the responses on the efficacy level of mass distribution of insecticide-treated nets (ITNs) strategy as it relates to malaria prevention and practices among household dwellers in Kano Metropolis, nigeria. It is shown that the grand mean of 3.04 and SD (1.08) is greater than the cut-off points of 3, implying that the respondents generally agreed with the items assessing the efficacy level of mass distribution of insecticide-treated nets (ITNs) strategy as it relates to malaria prevention and practices among household dwellers in Kano Metropolis, nigeria. Item-by-item analysis indicates that item No 1 and 2 each had a mean score of 2.59 and 2.93which are all below the mean cut off 3. The conclusion is that majority on the efficacy level of mass distribution of insecticide-treated nets (ITNs) strategy as it relates to malaria prevention and practices among household dwellers in Kano Metropolis, nigeria.

Research question two: What are the differences between male and female household dwellers as it relates to malaria prevention and practices in Kano Metropolis?

Table 2: Responses of the respondents on male and female household dwellers as it relates to malaria prevention and practices in Kano Metropolis?

S/No	Male and female household dwellers level of malaria prevention and practices	Mean	SD	Decision
1	Women in my household are primarily responsible for ensuring children sleep under insecticide-treated nets (ITNs).	2.98	1.095	Disagreed
2	Men in my household make most decisions about buying malaria prevention supplies (nets, repellents, etc.).	3.3	0.805	Agreed
3	Female household members are more likely than male members to take children to the health facility when malaria symptoms appear.	3.2	0.871	Agreed

S/No	Male and female household dwellers level of malaria prevention and practices	Mean	SD	Decision
4	Male household members consistently use mosquito prevention measures (e.g., nets, repellents) every night.	3.1	0.981	Agreed
5	Health education sessions in this community target women more than men.	3.05	1.121	Agreed
6	Male involvement (e.g., accompanying family to clinics, supporting net use) positively influences household malaria prevention.	3.23	1.196	Agreed
7	Female household members have better knowledge of correct antimalarial drug use than male household members.	3.13	1.201	Agreed
	Grand Mean	**3.14**	**1.04**	**Agreed**

Source: Field Work, 2025

Empirical data displayed in Table 2 shows the responses on the differences between male and female household dwellers as it relates to malaria prevention and practices in Kano Metropolis, Nigeria. It is shown that the grand mean of 3.14 and SD of 1.04 is greater than the cut-off points of 3, implying that the respondents generally agreed with the items on the differences between male and female household dwellers as it relates to malaria prevention and practices in Kano Metropolis. by-item analysis indicates that item No 1 each had a mean score of 2.98 and 2.93 which is all below the mean cut off 3. The conclusion is that majority of the respondents agreed with differences between male and female household dwellers as it relates to malaria prevention and practices in Kano Metropolis.

Inferential Statistics

Hypothesis one : The efficacy level of mass distribution of insecticide-treated nets (ITNs) strategy as it relates to malaria prevention and practices among household dwellers in Kano will not be significantly high

In testing the first null hypothesis, the variable of interest is the efficacy level of mass distribution of insecticide-treated nets (ITNs) strategy as it relates to malaria prevention and practices among household dwellers in Kano measured by 8 items. The respondents' scores on the scale were summed-up. For the level of malaria targeted information dissemination as it relates to malaria prevention and practices among household dwellers in Kano among respondents to be considered significantly high, the scores made on the whole scale should be significantly higher/greater than 24 (which is the midpoint between strongly agree and strongly disagree). This implies 3 X 8, the number of items measuring the construct. This null hypothesis was tested with a one-sample t-test) otherwise called population t-test). The results are presented in Table 3.

Table 3 Population t-test analysis of level of malaria targeted information dissemination as it relates to malaria prevention and practices among household dwellers in Kano

Variable	Sample Mean	Sample SD	Ref. Mean	T	Sig	Remark
level of malaria targeted information dissemination as it relates to malaria prevention and practices among household dwellers	22.32	6.51	24	-5.112	<.001	Sig.

Source: Field Work, 2025

Table 3 clearly indicated a statistically significant high level of level of malaria targeted information dissemination as it relates to malaria prevention and practices among household dwellers in Kano (M=22.32, SD=6.51), t (391) = -5.112, P <.001. The magnitude of difference in the mean (mean difference =-1.68), 95% CL: -2.33 to -1.03) was very large (eta squared = 0.51). With these results the first null hypothesis is hereby supported and hence rejected for the alternative. This implies that there is significant level of malaria targeted information dissemination as it relates to malaria prevention and practices among household dwellers in Kano.

Hypothesis two: There is no significant difference between male and female household dwellers as it relates to malaria prevention and practices in Kano Metropolis

In testing the second null hypothesis, the variable of interest is the level of malaria targeted information dissemination as it relates to malaria prevention and practices among household dwellers in Kano measured by 8 items. The respondents' scores on the scale were summed-up. For the level of malaria targeted information dissemination as it relates to malaria prevention and practices among household dwellers in Kano among respondents to be considered significantly high, the scores made on the whole scale should be significantly higher/greater than 24 (which is the midpoint between strongly agree and strongly disagree). This implies 3 X 8, the number of items measuring the construct. This null hypothesis was tested with a one-sample t-test) otherwise called population t-test). The results are presented in Table 4.

Table 4: An independent sample t-tests on difference between male and female tertiary education students as it relates to prevalence level of drug abuse on human.

Variable	Programs	N	Mean	SD	t-value	Sig	Remark
level of malaria targeted information dissemination as it relates to malaria prevention and practices among household dwellers in Kano	Male Female	304 88	19.19 21.44	6.03 4.63	9.026	<.001	Sig

Source: Field Work, 2025

Independent sample t-test was conducted to compare male students and female tertiary education students as it relates to level of malaria targeted information dissemination as it relates to malaria prevention and practices among household dwellers. The results are presented in Table 4, which indicated that there was no statistically significant difference between the male students (M= 47.24, SD=5.89) compared to their female counterparts (M=46.74, SD=6.49), t (381) = .81, p = .412. The magnitude of the difference in the means = .507, 95% CI= -.707 – 1.722. The eta squared was very small = .001. With all these results, the second null hypothesis had been supported and thus upheld. This then implies that there was no significant difference between male students and their female respondents as it relates to level of malaria targeted information dissemination as it relates to malaria prevention and practices among household dwellers in Kano.

Efficacy of Mass Distribution of Insecticide-Treated Nets Strategy

The first objective evaluated the efficacy of mass distribution of insecticide-treated nets (ITNs) strategy as it relates to malaria prevention and practices among household dwellers in Kano Metropolis. The findings revealed a grand mean of 3.04 (SD=1.08), indicating marginal agreement that the mass distribution strategy is efficacious. However, the one-sample t-test confirmed a statistically significant but below-reference level (M=22.32, SD=6.51, t(391)=-5.112, p<.001), indicating that the perceived efficacy of mass distribution is significantly lower than the expected midpoint of 24. This finding led to rejection of the null hypothesis but revealed substantial concerns about the implementation and impact of ITN distribution programs.

Itemised analysis revealed that respondents agreed with the majority of ITN quality and use metrics, including excellent quality and durability (mean=3.26), consistent nightly utilisation (mean=3.17), sufficient distribution education (mean=3.13), and regular health agency oversight (mean=3.12). The adequacy of ITNs for all household members (mean=2.59) and the organization and accessibility of distribution (mean=2.93) were below the threshold. These findings underscore significant operational challenges that impede extensive distribution efforts.

Inadequate Net Quantities per Household

ITNs are insufficient for all household members (mean=2.59), which is alarming considering the household size distribution in the sample: 29.6% consist of 7-9 individuals and 29.1% include 4-6 individuals. When households own fewer nets than sleeping accommodations or persons, some members must sleep unprotected, making continuous use impossible. This finding corroborates Adepoju et al. (2023), who discovered that while ITN ownership in Nigeria has risen, use remains inadequate due to an insufficient number

of nets per household. A significant number of residences in Kano fail to comply with the WHO requirement of one mosquito net for every two individuals.

The high proportion of households with 7-9 members (29.6%) suggests that extended family living arrangements are common in Kano Metropolis. Distribution programs that allocate a fixed number of nets per household regardless of household size fail to provide adequate coverage for larger families. This represents a fundamental design flaw that undermines the effectiveness of mass distribution campaigns. As noted by Mboma et al. (2021), household-level coverage gaps limit the population-level impact of ITN distribution.

Disorganised Distribution Logistics

The distribution is inadequately structured and accessible (mean=2.93), indicating logistical challenges that limit program outreach. Mboma et al. (2021) discovered that ownership of ITNs has surged throughout Africa; nevertheless, distribution challenges restrict usage to under 50% in several areas. Accessibility barriers may impede vulnerable populations in Kano Metropolis, where 44.1% of households lack ITNs, from acquiring nets. The elevated proportion of respondents in Gwale LGA (41.8%) and the minimal presence in Kumbotso (2.3%) may suggest diverse distribution strategies within the city.

Park et al. (2022) found that distribution campaigns in Mozambique faced similar challenges, with some communities receiving inadequate coverage due to logistical constraints. The Kano findings suggest that current distribution mechanisms may not reach all communities equitably, with urban slums and peri-urban areas potentially being underserved. This inequity perpetuates malaria transmission in vulnerable populations.

Positive Aspects of ITN Distribution

Despite these challenges, several positive aspects of the ITN distribution program emerged. The favourable outcome indicating that distributed ITNs are both durable and of excellent quality (mean=3.26) demonstrates that product quality does not impede utilisation. This aligns with the WHO (2023) emphasis on the quality assurance of vector control commodities. Nets seen by families as durable are more likely to be used and well maintained. However, durability cannot offset inadequate quantities or poor distribution logistics.

The use of distributed ITNs by families each night (mean=3.17) indicates that households are inclined to employ them when nets are accessible. This contrasts the previous finding that health education was not significantly related with frequent ITN use (mean=2.91), suggesting that availability may be a more influential factor than education. According to Park et al. (2022), ownership of ITNs does not ensure regular use; nevertheless, our study indicates that availability significantly increases utilisation in Kano.

The favourable education of health professionals during distribution (mean=3.13) indicates behavioural support for distribution programs. This corroborates the literature's emphasis on the distribution of goods and education. Balami et al. (2020) discovered that health education initiatives enhanced net use when integrated with distribution campaigns. Educational activities during distribution seem to be occurring in Kano, but the quality may fluctuate.

Awareness and Monitoring

The distribution of mass resources significantly improved community awareness on malaria prevention (mean=3.11), highlighting the educational benefits of distribution initiatives beyond mere net provision. Community engagement, sensitisation, and media initiatives enhance malaria awareness during distribution events. This substantiates the assertion of Martin-Cañavate et al. (2023) that integrated distribution campaigns may improve community knowledge and attitudes.

Government or health authorities regularly assess ITN use and condition (mean=3.12), indicating the need for post-distribution monitoring. This ensures nets remain in optimal condition and are employed correctly. The low mean indicates that monitoring may lack systematicity or regularity, hindering the early detection and resolution of problems. The efficacy of ITNs depends on regular monitoring and the replacement of outdated or ineffective nets, as stated by Gimnig et al. (2023).

Socioeconomic Implications

The demographics and economics of the sample elucidate the efficacy of mass dissemination. Given that 58.2% of respondents earn less than ₦30,000 monthly, families are unable to purchase additional nets beyond those provided. These households have enduring protection deficiencies when distribution is inadequate. This economic reality underscores the need for extensive distribution initiatives to provide nets for all household members, rather than only a token quantity.

Despite stated distribution efforts, 44.1% of households lack ITNs, raising concerns about the effectiveness and equality of existing methods. Wetzler et al. (2022) noted that 83% of Mozambican households had ITNs, although only 59% used them regularly. The ownership percentage in Kano is 55.9%, indicating that distribution measures are not uniformly effective. The 44.1% without nets exposes a significant population to the risk of malaria.

Theoretical Interpretation

The Health Belief Model (HBM) helps explain the findings. Respondents' willingness to use ITNs when available suggests they perceive the benefits of protection and understand

malaria's severity. However, the perceived barriers—inadequate net quantities and poor distribution logistics—impede consistent use. Current distribution programs are not sufficiently addressing these structural barriers. Self-efficacy, or the belief that one can successfully use prevention measures, is undermined by insufficient net availability.

Implications for Malaria Control

The perceived efficacy of mass distribution is much lower than the anticipated midpoint ($p<.001$), impacting malaria control strategies in Kano Metropolis. This indicates that current distribution strategies are failing to satisfy community needs. This corroborates the studies indicating differences in ITN distribution throughout sub-Saharan Africa. The WHO (2024) reports that global ITN utilisation increased from 48% to 65% between 2019 and 2023, however disparities remain, particularly in high-burden nations such as Nigeria. Favourable outcomes regarding net quality, sustained use, and improvements to the educational support distribution scheme suggest that the program has strengths. Provided that the logistical challenges of enough quantities and accessible distribution are addressed, the other aspects seem to function well. Improvements in distribution design, including enhanced household need assessment and more accessible distribution stations, might elevate program success.

In northern Nigeria, households consistently employ ITNs (mean=3.17), contradicting the notion that cultural or behavioural factors are the primary barriers to net utilisation. Previous sections highlighted the awareness-behaviour gap, suggesting hurdles; nevertheless, the current results show that supply-side characteristics may be equally or more relevant predictors of consumption. This validates the literature's emphasis on integrated approaches that simultaneously tackle supply and demand challenges (Tusting et al., 2022).

Gender Differences in Malaria Prevention and Practices

The second objective examined gender differences in malaria prevention and practices among household dwellers in Kano Metropolis. The findings revealed a grand mean of 3.14 (SD=1.04) for gender-related items, indicating general agreement that gender differences exist in prevention practices. The independent samples t-test showed a statistically significant difference between male ($M=19.19$, $SD=6.03$) and female ($M=21.44$, $SD=4.63$) respondents ($t(385)=9.026$, $p<.001$), leading to rejection of the null hypothesis. This indicates that female household dwellers demonstrate significantly higher levels of malaria prevention and practices than their male counterparts.

The majority of gender-related items received consensus, including men purchasing prevention supplies (mean=3.30), positive male involvement in prevention (mean=3.23), females being more inclined to take children to health facilities (mean=3.20), females

possessing superior drug use knowledge (mean=3.13), and males consistently employing prevention measures (mean=3.10). Item 1 (women mostly accountable for ensuring children sleep under ITNs) fell marginally below the threshold (mean=2.98), suggesting that this responsibility may be distributed or less clearly articulated.

Higher Prevention Practices Among Females

Female respondents exhibited superior malaria prevention practices compared to male respondents ($p<.001$), corroborating studies on gender and health behaviours. According to Saaka et al. (2024), women, particularly mothers, were essential in the utilisation of ITNs and the management of febrile illnesses in children in northern Ghana. Ratnadass and Sarter (2025) observed that empowering female household heads via targeted education and economic support enhances malaria prevention outcomes. Women have a vital role in household malaria management in Kano, as shown by this statistics.

The heightened involvement of women in home health management may account for their superior knowledge in the use of antimalarial medications compared to males (mean=3.13). Women acquire knowledge on dosage schedules, adverse effects, and treatment adherence while attending to children and other family members. This affirms the literature's emphasis on health education for women, who serve as major implementers of prevention and transmitters of family health information (Firdaus et al., 2025).

Men's Role in Decision-Making

Men predominantly acquire malaria prevention items (mean=3.30), highlighting the gendered dimension of familial economic decision-making. Nwaorgu and Orajaka (2021) demonstrated that gender and power dynamics significantly influence treatment-seeking behaviours within Nigerian families. In patriarchal northern Nigeria, men oversee family finances, including health care expenditures. Women may implement preventive measures such as ensuring children sleep under nets; however, they may lack the financial means to purchase nets, repellents, or other necessary supplies.

This finding reveals a critical structural barrier: those with the most knowledge and motivation for prevention (women) lack the authority to allocate resources for prevention, while those with decision-making authority (men) may not prioritise malaria prevention. This disconnect undermines the effectiveness of health education programs that target women without addressing gender power dynamics.

Positive Male Involvement

Male participation enhances household malaria prevention (mean=3.23), indicating the significance of men's involvement. This corroborates Abiola et al. (2023) that gender-

inclusive initiatives including both men and women enhance preventive measures. In Kano, where 77.6% of respondents were male, this indicates that male participants prioritise their involvement and may be receptive to malaria prevention programs that more inclusively include them.

Men's involvement in accompanying family to clinics and supporting net use (mean=3.23) suggests that men are not entirely disengaged from prevention efforts. Interventions that position men as allies rather than barriers may be effective. Achieng et al. (2024) found that gender-transformative interventions that contest traditional norms enhanced family health in East Africa.

Gender Roles in Caregiving

Female household members are more inclined than men to escort children to health facilities for malaria symptoms (mean=3.20), indicative of their conventional caregiving responsibilities. This corroborates the findings of Onyeneho and Igwe (2021), who demonstrated that gender roles significantly influence malaria treatment-seeking behaviour in Nigeria. Women's primary responsibility for child health often positions them as the first identifiers of symptoms and the decision-makers in seeking care, even when they must negotiate with male household leaders for resources.

The finding that women primarily oversee children's sleep under ITNs was marginally below the threshold (mean=2.98). Numerous explanations are available. In large households with several carers, mothers, grandmothers, and older daughters may collaborate in child-rearing responsibilities. Secondly, 77.6% of the sample comprises males, potentially misrepresenting the status of women. Third, social desirability bias may lead fathers to exaggerate their involvement in child care. This underscores the need for scientifically testing views about gender differences in malaria prevention rather than accepting them as assumptions.

Gender Targeting in Health Education

Health education sessions prioritise women over men (mean=3.05), indicating programmatic convictions on women's significant role in health. This targeting may inadvertently exclude males from schooling due to women's caregiving responsibilities, perpetuating the gendered divide of health labour. Abiola et al. (2023) underlined that the exclusion of males from health education may result in their lack of knowledge about malaria prevention and treatment, thereby compromising family resource allocation choices.

Adesina and Lawal (2023) asserted that women's access to health information influences malaria preventative behaviour within families, while decision-making autonomy and resource availability mediate this relationship. In Kano, where 46.7% of respondents had

never received malaria-related health education, gender disparities in health information access may compound prevention challenges.

Theoretical Interpretation

The Health Belief Model helps explain the gender differences observed. Women may perceive higher susceptibility for their children and greater severity of malaria (constructs of perceived susceptibility and severity). Health education targeting women acts as a cue to action. However, perceived barriers—limited decision-making authority and financial constraints—prevent women from translating their knowledge into action. Men, who control resources, may have lower perceived susceptibility if they are not the primary caregivers, leading to lower prioritisation of prevention.

Implications for Program Design

The higher rates of malaria prevention among women indicate that they must remain the primary focus of health education initiatives. However, institutional barriers that impede their ability to use their knowledge must be addressed. Health education, economic advancement, and gender equity may be effectively implemented in Kano.

Male involvement and household prevention (mean=3.23) exhibit a positive correlation, indicating that efforts to engage men should be aligned with those aimed at women. Men may acquire influence and skills by engaging in malaria prevention initiatives as collaborators rather than as decision-makers. Gender-sensitive programming that recognises the roles and constraints of both women and men is essential for malaria prevention in Kano Metropolis.

Comparison with Regional Studies

The findings align with studies across sub-Saharan Africa. Saaka et al. (2024) documented gendered patterns of malaria prevention among households in northern Ghana, with women playing pivotal roles in ITN use and child health. Ratnadass and Sarter (2025) highlighted the importance of empowering female household heads through targeted education and economic support. Adesina and Lawal (2023) found that women's access to health information significantly predicted malaria prevention behaviour within households in Nigeria.

CONCLUSION

This study assessed the efficacy of mass distribution of insecticide-treated nets (ITNs) and gender differences in malaria prevention and practices among household dwellers in Kano Metropolis. The findings demonstrate significant gaps in ITN distribution efficacy and persistent gender disparities in prevention practices.

The mass distribution of ITNs in Kano Metropolis has resulted in high net quality, consistent use by recipient families, and educational benefits. However, operational challenges have diminished efficacy. Inadequate net allocation per household and disorganised distribution hinder program effectiveness, resulting in 44.1% of families being unprotected. These findings indicate the need for improved distribution planning, accurate assessment of home needs, and enhanced accessibility to distribution stations. To attain comprehensive ITN coverage worldwide and optimise this fundamental malaria prevention strategy, several logistical challenges must be resolved.

Women in Kano Metropolis demonstrate more knowledge and engagement in malaria prevention than men. Conventional gender norms assign women the primary duty for child health and routine preventive care, while males oversee family resources and make substantial health expenditure decisions. The finding that women's superior knowledge does not translate into resource decision-making authority implies a systemic preventative barrier. Malaria prevention success requires gender-sensitive programming that recognises women and men's roles and constraints.

The Health Belief Model provides a useful framework for understanding these findings. Health education has reduced perceived susceptibility and severity, as shown by positive attitudes toward prevention, but it has not adequately addressed perceived barriers (net availability, distribution logistics, and gender-based resource constraints) or self-efficacy. Current distribution programs are insufficient to overcome these structural and economic barriers.

Malaria control in Kano Metropolis requires comprehensive strategies that go beyond net distribution. Effective interventions must address supply-side challenges (adequate net quantities, accessible distribution, quality assurance), demand-side factors (user education, behaviour change), and structural barriers (gender dynamics, household decision-making, economic constraints). The positive outcomes—net quality, consistent use by recipient families, and women's engagement in prevention—provide a solid foundation for progress.

For ITN Distribution Improvement

1. **Adopt needs-based distribution** based on household size rather than fixed allocations to ensure all family members have access to ITNs.
2. **Expand distribution through mobile teams** and community outreach to reach underserved areas and vulnerable populations.
3. **Strengthen post-distribution monitoring and follow-up** by community health workers to assess net use, condition, and replacement needs.
4. **Integrate distribution with routine health services** such as antenatal care, immunisation, and outpatient visits to ensure continuous access.

For Gender-Sensitive Programming

5. Encourage male involvement in malaria prevention decisions through targeted education and community engagement.
6. Support women's participation and empowerment in household health decisions through economic empowerment and leadership development.
7. Design gender-transformative interventions that challenge traditional norms and promote shared decision-making.
8. Ensure health education reaches both men and women using appropriate channels and messages for each group.

For Health Education

9. Provide practical ITN use instructions during distribution, addressing common barriers such as heat discomfort and maintenance challenges.
10. Use local languages and low-literacy communication methods such as demonstrations, storytelling, and visual materials.
11. Implement continuous health education campaigns rather than one-time messages to reinforce prevention behaviours.
12. Address cultural misconceptions about ITN use through community dialogue and peer education.

For Health System Strengthening

13. Strengthen primary health care facilities to ensure reliable supply of quality-assured ITNs.
14. Train health workers to deliver consistent malaria education during all patient contacts.
15. Improve supply chain management to prevent stock-outs and ensure equitable distribution.
16. Strengthen monitoring and evaluation systems to track distribution coverage, utilisation, and impact.

For Further Research

17. Conduct implementation research to identify effective strategies for improving ITN distribution logistics.
18. Investigate gender dynamics in household health decision-making using qualitative methods.
19. Evaluate behaviour change interventions targeting ITN use to identify most effective strategies.
20. Study the sustainability of ITN distribution programs to identify factors influencing long-term success.

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21. Conduct replication studies in underserved areas to assess regional variations in distribution efficacy and gender dynamics.

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