

**RADIO MESSAGES AND APPLICATION OF
INSECTICIDES TREATED NET FOR
MALARIA PREVENTION AMONG
PREGNANT WOMEN IN ABAKALIKI
METROPOLIS**

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ABSTRACT

Malaria has been posing serious health challenge in Nigeria, and has often affected pregnant women

who are highly susceptible due to pregnancy-related immunosuppression. This study investigated the influence of radio messages on the knowledge and consistent use of insecticide-treated nets (ITNs) among 400 pregnant women in Abakaliki metropolis, Ebonyi State, Nigeria, using a quasi-experimental design with pre- and post-intervention phases. Data were collected through structured questionnaires and analyzed with descriptive statistics and chi-square tests. Results revealed that radio messages significantly enhanced ITN knowledge, with most respondents reporting improved understanding of malaria prevention, proper ITN use, and pregnancy-related risks. However, only a minority consistently used ITNs due to radio messages, with high neutral responses indicating limited behavioral impact. Major barriers included difficulties accessing ITNs and lack of awareness about distribution points, though cost was less prohibitive. The study recommended that radio's efficacy in urban settings, emphasizing the need for targeted messaging to address access and practical barriers. Recommendations included integrating radio campaigns with antenatal care and providing clear information on ITN distribution to improve uptake and reduce malaria prevalence among pregnant women.

Keywords: Insecticide, Malaria, Insecticides
Treated Net (ITNS), Radio Messages

Background to the Study

Malaria continues to pose a significant public health challenge in Nigeria, particularly affecting pregnant women who are highly susceptible due to pregnancy-related immunosuppression. Nigeria accounts for approximately 27% of global malaria cases, with *Plasmodium falciparum* being the predominant species responsible for severe outcomes, including maternal anemia, low birth weight, and preterm delivery (World Health Organization, 2020). The World Health Organization (WHO) advocates for the use of insecticide-treated nets (ITNs), intermittent preventive treatment with sulfadoxine-pyrimethamine (IPTp-SP), and prompt case management to mitigate malaria in pregnancy (MiP). However, the uptake of these interventions, particularly ITNs, remains suboptimal in Nigeria due to knowledge gaps, socio-cultural barriers, and limited access to health resources. In urban settings like Abakaliki metropolis, where access to mass media such as radio is relatively high, there is potential for radio messages to address these barriers and enhance ITN utilization among pregnant women. Despite this potential, the specific impact of radio-based health communication on ITN use in this population remains underexplored. Research conducted across Nigeria highlights persistent challenges in malaria prevention among pregnant women. For instance, Idris, Umar, Auta and Abdulmalik, (2023) reported a 42.9% malaria

prevalence among 140 pregnant women attending Muhammad Abdullahi Wase Teaching Hospital in Kano, with primigravidae (23.6%) and those in the first trimester (25%) showing the highest infection rates. Despite ITN distribution during antenatal care, consistent use was low; indicating that awareness alone is insufficient without effective health communication strategies. Similarly, Valentine, Ndidi,, Ndubuisi and Ugbo (2020) documented a 70.8% malaria prevalence among 284 pregnant women in Aboh Mbaise, Imo State, identifying non-use of ITNs ($p < 0.05$) and lack of IPTp as significant risk factors, alongside environmental factors like mosquito breeding sites and low educational status. These studies underscore the need for targeted interventions to bridge the gap between awareness and practice in urban Nigerian contexts. In Ebonyi State, where Abakaliki metropolis is located, similar challenges are evident. Okedo-Alex, Akamike. Nwafor, Agu, Abateneh, and Uneke. (2022) found that while 63.5% of 817 respondents in three Ebonyi communities were aware of ITNs, only 37.5% knew about IPTp, with radio messages serving as a primary information source and 77.2% supporting community-directed interventions. This suggests radio's potential to enhance ITN uptake in urban settings like Abakaliki.

Again, Akpa., Azuogu, Akpa, Umeokonkwo, Denwigwe, Azuogu and Uzochukwu (2022) reported that although 65% of 340 women in Ebonyi

owned ITNs, only 35% used them consistently, citing inadequate education on proper use as a barrier. Radio messages were noted as a key awareness tool but required reinforcement to improve usage. Given the widespread access to radio in urban areas and the persistent gap between ITN awareness and consistent use, this study seeks to investigate the influence of radio messages on the knowledge and consistent use of ITNs among pregnant women in Abakaliki metropolis. By addressing this gap, the study aims to contribute to the development of effective mass media strategies to reduce MiP and improve maternal and fetal health outcomes in urban Nigeria.

Statement of the Problem

Malaria poses a significant health challenge in Nigeria, particularly for pregnant women, who face increased risks due to immunosuppression, leading to maternal anemia, low birth weight, and preterm delivery. Despite WHO recommendations for insecticide-treated nets (ITNs) and intermittent preventive treatment (IPTp-SP), ITN uptake remains low due to knowledge gaps and socio-cultural barriers. Idris et al. (2023) reported 42.9% malaria prevalence among 140 pregnant women in Kano, with low ITN use despite distribution, indicating ineffective health communication. Similarly, Valentine et al. (2020) found a 70.8% prevalence in Aboh Mbaise, Imo State, linking non-use of ITNs ($p < 0.05$) to environmental and educational factors. Both studies highlight a gap

between ITN awareness and consistent use. However, the specific impact of radio messages, a widely accessible medium in urban areas like Abakaliki metropolis, on ITN utilization among pregnant women remains underexplored. This study aims to address this gap by investigating how radio messages influence ITN knowledge and use among pregnant women in Abakaliki, seeking to enhance malaria prevention strategies and improve maternal and fetal health outcomes.

Research Objectives

The general objective of this study is to investigate the effectiveness of radio messages and application of insecticides treated net for malaria prevention among pregnant women in Abakaliki metropolis. The specific objectives are to:

1. Assess the level of awareness among pregnant women in Abakaliki metropolis regarding the use of insecticide-treated nets (ITNs) for malaria prevention, as influenced by radio messages.
2. Evaluate the effectiveness of radio messages in promoting the consistent and correct use of ITNs among pregnant women in Abakaliki metropolis.
3. Explore the barriers and challenges faced by pregnant women in Abakaliki metropolis in accessing and utilizing ITNs, despite awareness campaigns through radio messages.

Research questions

1. What is the level of awareness among pregnant women in Abakaliki metropolis regarding the use of insecticide-treated nets (ITNs) for malaria prevention, as influenced by radio messages?
2. How effective are radio messages in promoting the consistent and correct use of ITNs among pregnant women in Abakaliki metropolis?
3. What are the barriers and challenges faced by pregnant women in Abakaliki metropolis in accessing and utilizing ITNs, despite awareness campaigns through radio messages?

Hypothesis

H₀: Exposure to radio messages does not significantly increase the consistent and correct use of insecticide-treated nets (ITNs) for malaria prevention among pregnant women in Abakaliki metropolis.

Scope of Study

This study examined the influence of radio messages on the knowledge and consistent use of insecticide-treated nets (ITNs) among pregnant women in Abakaliki metropolis, Ebonyi State, Nigeria, from 2015 to 2024, the period when ITNs were first introduced in Ebonyi State. It targeted pregnant women attending antenatal clinics in selected urban health facilities. The research

assessed the effectiveness of radio-based health communication in enhancing ITN awareness and adherence for malaria prevention, exploring socio-demographic factors such as age, education, and gravidity. The study was limited to Abakaliki metropolis, excluding rural areas, and focused solely on radio messages, not other malaria prevention methods or media platforms.

Significance of the Study

Theoretically, the study will contribute to literature for further studies. Practically, the findings of this study will help NGO's and government of Ebonyi state to formulate policies that will make or encourage pregnant women in Ebonyi State to use mosquito treated net.

Review of Related Literature

Conceptual Review

Malaria

Malaria in pregnancy (MiP) remains a significant public health challenge in Nigeria, where the country accounts for 27% of global malaria cases and 31% of malaria-related deaths, with pregnant women and children under five being the most vulnerable groups (World Health Organization [WHO], 2020). MiP is caused primarily by *Plasmodium falciparum* in sub-Saharan Africa, leading to adverse maternal and fetal outcomes. This section reviews the epidemiology, health risks, and preventive measures for MiP, focusing on Nigeria and similar contexts, to provide a

foundation for understanding the role of health communication in promoting natal malaria vaccination uptake. Malaria is hyperendemic in Nigeria, with year-round transmission facilitated by a tropical climate (WHO, 2020). Studies report a high prevalence of MiP, particularly in rural areas. For instance, Agomo and Oyibo (2013) found a 59.9% prevalence of asymptomatic malaria parasitemia among pregnant women in rural Ebonyi State, with the highest rates in the first trimester (84.1%). Similarly, a cross-sectional study in northwestern Nigeria reported a 41.6% prevalence of malaria infection among pregnant women attending antenatal care (ANC), with younger women and primigravidae at greater risk (Daboer et al., 2010). These findings underscore the widespread burden of MiP in Nigeria, exacerbated by limited healthcare access in rural settings like Ebonyi Central Senatorial District.

MiP poses significant risks to both mother and fetus. Maternal complications include severe anemia, which contributes to 11% of maternal deaths in Nigeria (WHO, 2020). A study by Ugwu et al. (2014) in southeastern Nigeria found that 62.4% of pregnant women with malaria had anemia, linked to placental parasitemia. Fetal outcomes include low birth weight (LBW), preterm delivery, and increased neonatal mortality. Okafor and Mbah (2019) reported that MiP was associated with a 2.27 times higher odds of LBW (95% CI: 0.98–5.28) and a 1.93 times higher odds of preterm birth (95% CI:

1.08–3.44) in Ibadan. These adverse outcomes highlight the urgent need for effective interventions to mitigate MiP's impact.

The WHO recommends three key strategies for MiP prevention: insecticide-treated nets (ITNs), intermittent preventive treatment with sulfadoxine-pyrimethamine (IPTp-SP), and prompt case management (WHO, 2012). Despite these recommendations, uptake remains low in Nigeria. A 2018 Nigeria Demographic and Health Survey (NDHS) revealed that only 17% of pregnant women received three or more doses of IPTp-SP, far below the 80% target set by the Roll Back Malaria initiative (National Population Commission [NPC] & ICF, 2019). ITN usage is similarly low, with only 20.1% of pregnant women in Ibadan reporting consistent use (Okafor & Mbah, 2019). The National Malaria Elimination Programme (NMEP) in Nigeria promotes free distribution of ITNs and IPTp-SP through ANC, yet implementation challenges persist (Federal Ministry of Health [FMoH], 2014).

Several barriers hinder the effective prevention of MiP. Oladimeji et al. (2018) identified knowledge gaps, with only 43.5% of Nigerian women demonstrating good knowledge of malaria prevention, influenced by low education levels and rural residence. Socio-cultural factors, such as misconceptions about malaria causation (e.g., attributing it to sunlight or dirty environments), further reduce uptake of preventive measures (Singh

et al., 2019). Health system barriers include stock outs of IPTp-SP, inadequate training of health workers, and poor ANC attendance, particularly in rural areas (Hill et al., 2013). In Ebonyi State, Agomo and Oyibo (2013) noted that poverty and limited access to health facilities exacerbate these challenges, contributing to high MiP prevalence.

Mosquito Treated Net: Knowledge and Use of Insecticide Treated Nets

The World Health Organization (WHO) recommends insecticide-treated nets (ITNs), particularly long-lasting insecticide-treated nets (LLINs), as a cornerstone of malaria prevention, especially in high-transmission areas like sub-Saharan Africa (WHO, 2020). ITNs are highly effective, reducing malaria incidence by up to 50% and all-cause child mortality by 17% when used consistently (Lengeler, 2004). WHO advocates for universal ITN coverage, targeting at least 80% usage in endemic regions, with free distribution and health education to ensure proper use. Globally, ITN distribution has increased, with 68% of households in sub-Saharan Africa owning at least one ITN by 2020 (WHO, 2020). However, consistent use lags behind ownership due to behavioural, environmental, and socio-economic barriers, necessitating targeted interventions to bridge this gap.

In Nigeria, which accounts for 27% of global malaria cases, ITN use remains suboptimal despite widespread distribution campaigns (WHO, 2020). Valentine et al. (2020) reported a 70.8% malaria prevalence among 284 pregnant women in Aboh Mbaise, Imo State, identifying non-use of ITNs as a significant risk factor ($p < 0.05$). The study highlighted environmental factors, such as mosquito breeding sites, and low educational status as barriers to ITN adoption. Similarly, Idris et al. (2023) found 42.9% malaria prevalence among 140 pregnant women in Kano, noting low consistent ITN use despite antenatal care distribution. These findings underscore a critical gap between ITN availability and consistent use, driven by inadequate health education and socio-cultural misconceptions, such as discomfort from net use or perceived low malaria risk.

In Ebonyi State, local studies reveal similar challenges. Akpa et al. (2022) surveyed 340 women, reporting that 65% owned ITNs, but only 35% used them consistently, citing inadequate education on proper use as a key barrier. Okedo-Alex et al. (2022) also found that among 817 respondents in three Ebonyi communities, 63.5% were aware of ITNs, but consistent use was low, with only 37.5% knowledgeable about IPTp. Both studies emphasize that while ITN ownership is relatively high, effective utilization is hindered by limited understanding of correct application and maintenance, particularly among pregnant women.

These findings highlight the need for tailored health communication strategies, such as radio messages, to enhance ITN use in urban settings like Abakaliki metropolis.

Role of Radio Messages in Health Communication

Radio messages are audio-based health communication tools broadcast through radio stations, designed to educate and influence behaviour. Their effectiveness stems from radio's wide reach, affordability, and ability to deliver messages in local languages, making them accessible in urban settings like Abakaliki (Okedo-Alex et al., 2022). Radio messages can increase knowledge by providing clear instructions on ITN use (e.g., nightly application, maintenance) and dispel myths, such as discomfort from nets. They also leverage repetition and storytelling to reinforce behaviour change, aligning with HBM's emphasis on sustained cues.

Radio messages influence ITN use by enhancing awareness, shaping attitudes, and prompting action. First, they increase awareness by disseminating information about malaria risks and ITN benefits, addressing knowledge gaps noted in Ebonyi State, where only 35% of women used ITNs consistently despite 65% ownership (Akpa et al., 2022). Second, they shape attitudes by framing ITNs as essential for maternal and fetal health, countering socio-cultural

barriers like low perceived risk. Third, they prompt action through calls to action, such as encouraging pregnant women to obtain ITNs from antenatal clinics. Unlike other media, radio's accessibility ensures repeated exposure, critical for behaviour reinforcement in urban populations with high media access.

While radio is effective for awareness, its impact on sustained ITN use may be limited without complementary strategies. Studies like Idris et al. (2023) and Valentine et al. (2020) highlight low ITN use despite awareness, suggesting that radio messages alone may not address practical barriers (e.g., net availability, discomfort). Additionally, the urban focus of this study may limit generalizability to rural areas with lower radio access.

Empirical Review

The study by Idris, Umar, Auta, and Abdulmalik, (2023), titled "Prevalence of Malaria among Pregnant Women Attending Muhammad Abdullahi Wase Teaching Hospital, Kano State, Nigeria," aimed to determine malaria prevalence, identify risk factors, and assess insecticide-treated net (ITN) use among pregnant women. Employing a cross-sectional design, Idris, Umar, Auta, and Abdulmalik collected data from one hundred forty pregnant women using microscopy for malaria diagnosis and questionnaires on socio-demographic factors and ITN use, analyzed with descriptive statistics and

chi-square tests. They found a forty-two point nine percent malaria prevalence, with primigravidae and first-trimester women most affected. Only thirty percent used ITNs consistently, due to inadequate health education and misconceptions. Idris, Umar, Auta, and Abdulmalik recommended intensified community-based education and integrating ITN promotion into antenatal care. However, their study did not explore radio messages as a health communication tool to improve ITN use, limiting insights into media-driven behaviour change. This research addresses this gap by investigating radio messages' influence on ITN knowledge and consistent use among pregnant women in Abakaliki metropolis, leveraging radio's urban accessibility to enhance malaria prevention strategies.

The study by Valentine, Ndidi, Ndubuisi, and Ugbo, (2020), titled "Prevalence and Risk Factors of Pregnancy-Associated Malaria in Pregnant Women Attending a General Hospital" in Aboh Mbaise, Imo State, sought to assess malaria prevalence, risk factors, and preventive measures like ITN use. Using a descriptive cross-sectional design, Valentine, Ndidi, Ndubuisi, and Ugbo studied two hundred and eighty-four pregnant women, diagnosing malaria via blood smear microscopy and collecting data with questionnaires, analyzed using chi-square tests. They reported seventy point eight percent malaria prevalence, with non-use of ITNs as a significant risk factor; only twenty-five percent used ITNs consistently, hindered by low education

and environmental factors. Valentine, Ndidi, Ndubuisi, and Ugbo recommended targeted education for primigravidae and environmental management. Their study overlooked the potential of radio messages to promote ITN use, missing an opportunity to explore mass media's role in behavior change. This research fills this gap by examining how radio campaigns enhance ITN knowledge and adherence among pregnant women in Abakaliki, capitalizing on urban radio access to improve malaria prevention outcomes.

The study by Ankomah, Adebayo, Arogundade, Anyanti, Nwokolo, Inyang, and Meremikwu (2014), titled "The Effect of Mass Media Campaign on the Use of Insecticide-Treated Bed Nets among Pregnant Women in Nigeria," aimed to evaluate the impact of mass media campaigns, including radio, on ITN use among pregnant women. Using a cross-sectional design, Ankomah, Adebayo, Arogundade, Anyanti, Nwokolo, Inyang, and Meremikwu surveyed 2,348 pregnant women across six Nigerian states, employing questionnaires to assess media exposure and ITN use, analyzed with logistic regression. They found that 54% of women exposed to media campaigns used ITNs, compared to 39% without exposure, with radio being the most effective medium. They recommended sustained media campaigns and community-based distribution to enhance ITN uptake. However, the study did not focus on urban-specific contexts or barriers like access. The current research addresses

this by examining radio messages' influence on ITN knowledge and use in Abakaliki metropolis, emphasizing urban accessibility and specific barriers like distribution awareness to improve malaria prevention strategies.

The study by Amoran, Fatugase, and Fatugase (2017), titled "Determinants of Insecticide-Treated Nets Use among Pregnant Women in Nigeria: Evidence from the Nigeria Malaria Indicator Survey," sought to identify factors influencing ITN use among pregnant women. Amoran, Fatugase, and Fatugase analyzed data from 1,872 pregnant women in the 2015 Nigeria Malaria Indicator Survey using a cross-sectional design, with multivariate logistic regression to assess socio-demographic and knowledge-related determinants. They found that 41% of women used ITNs consistently, with higher education and media exposure, including radio, significantly increasing usage (OR=1.67, $p<0.05$). They recommended integrating media campaigns with antenatal care to boost ITN adherence. The study did not isolate radio's specific impact or urban barriers like access. The current study fills this gap by focusing on radio messages' role in enhancing ITN knowledge and use among pregnant women in Abakaliki metropolis, highlighting urban-specific barriers and leveraging radio's accessibility for targeted health communication.

The study by Ozodiegwu, Mhlanga, Bamgboye, Fagbamigbe, Adem, Okoronkwo, Akinyemi, Ogunwale, Ajayi, and Galatas (2025), titled "Co-creation and Application of a Framework for the De-prioritization of Urban Communities during Insecticide-Treated Bed Net Mass Campaigns in Kwara State, Nigeria," aimed to develop a framework for targeted ITN distribution in urban areas. Using participatory action research, Ozodiegwu, Mhlanga, Bamgboye, Fagbamigbe, Adem, Okoronkwo, Akinyemi, Ogunwale, Ajayi, and Galatas collected data in Ilorin, analyzing malaria risk scores and stakeholder inputs. They found that prioritizing high-risk areas improved ITN allocation efficiency, with radio aiding awareness. They recommended stakeholder-driven frameworks for resource-constrained settings. The study did not focus on pregnant women or radio's direct impact on behavior. The current research addresses this by examining radio messages' influence on ITN knowledge and use among pregnant women in Abakaliki, emphasizing urban-specific barriers and radio's role in behavior change.

Theoretical Framework: Health Belief Model (HBM)

This study is anchored on the Health Belief Model (HBM), a framework for explaining health behaviour change (Rosenstock, 1974). This model was first developed in the 1950s by social psychologists Hochbaum, Rosenstock and

Kegel who were working in the United States Public Health Services (Ogbuoshi, 2020, p. 197). The HBM suggests that individuals adopt preventive behaviors, such as consistent use of insecticide-treated nets (ITNs), when they perceive a health threat and believe the recommended action is effective and feasible. It includes six constructs: perceived susceptibility (belief in the risk of contracting malaria), perceived severity (belief in the seriousness of malaria in pregnancy, e.g., maternal anemia, low birth weight), perceived benefits (belief in ITNs' ability to prevent malaria), perceived barriers (challenges to ITN use, e.g., discomfort, lack of knowledge), cues to action (triggers for behavior, e.g., radio messages), and self-efficacy (confidence in using ITNs correctly).

In this study, radio messages act as cues to action, informing pregnant women in Abakaliki metropolis about malaria risks and ITN benefits. They address perceived susceptibility and severity by highlighting malaria's dangers during pregnancy, emphasize perceived benefits by promoting ITNs' protective role, and reduce perceived barriers by clarifying proper use and dispelling misconceptions. Radio messages also enhance self-efficacy by offering practical guidance on ITN application, fostering consistent use. The HBM provides a robust lens to examine how radio messages influence knowledge and behaviour regarding ITN use.

Summary of the Literature Review

The literature review highlights the significant burden of malaria in pregnancy (MiP) in Nigeria, which accounts for 27% of global malaria cases, with *Plasmodium falciparum* causing severe outcomes like maternal anemia and low birth weight (World Health Organization, 2020). Despite WHO recommendations for insecticide-treated nets (ITNs), studies reveal a gap between ITN ownership and consistent use. Valentine et al. (2020) reported a 70.8% malaria prevalence in Aboh Mbaise, identifying non-use of ITNs ($p < 0.05$) as a risk factor, while Idris et al. (2023) noted a 42.9% prevalence in Kano, with only 30% consistent ITN use due to inadequate education. In Ebonyi State, Akpa et al. (2022) and Okedo-Alex et al. (2022) found 65% ITN ownership but only 35% consistent use, citing knowledge gaps. Radio messages, a primary information source in Ebonyi (Okedo-Alex et al., 2022), show potential for health communication, yet their specific impact on ITN use among urban pregnant women remains underexplored. Grounded in the Health Belief Model, this study addresses this gap by investigating how radio messages influence ITN knowledge and consistent use in Abakaliki metropolis, aiming to inform effective malaria prevention strategies.

Research Methodology

Research Design

This study employs a quasi-experimental design with pre- and post-intervention phases to assess the impact of radio messages on the knowledge and consistent use of insecticide-treated nets (ITNs) among pregnant women in Abakaliki metropolis, Ebonyi State. An intervention group received targeted radio messages, while a control group did not, enabling comparison of ITN knowledge and usage outcomes. A quantitative survey method was used, with structured questionnaires administered to 400 pregnant women attending antenatal clinics in four purposively selected health facilities. The questionnaires captured socio-demographic details, ITN knowledge, usage frequency, and exposure to radio messages. Data was analyzed using descriptive statistics and chi-square tests to evaluate associations. The quasi-experimental design is suitable for assessing the intervention's effectiveness in an urban setting without full randomization, controlling for external factors via the control group. This approach aligns with the study's objectives, leveraging radio's accessibility in Abakaliki to drive behavior change, and builds on prior health communication research.

Area of the Study

The study is conducted in Abakaliki metropolis, the capital of Ebonyi State, Southeast Nigeria. This

urban center, spanning Abakaliki and Ebonyi local government areas, hosts a population engaged in trading, civil service, and farming. With a tropical climate favoring year-round *Plasmodium falciparum* malaria transmission, Abakaliki has multiple health facilities, including the Alex Ekwueme Federal University Teaching Hospital, providing antenatal care. Its widespread radio access makes it ideal for studying radio messages' influence on health behaviors. The study targets pregnant women in four selected antenatal clinics, assessing their knowledge and consistent use of insecticide-treated nets (ITNs) for malaria prevention, leveraging the urban media infrastructure.

Population of the Study

The study targets pregnant women in Abakaliki metropolis, Ebonyi State's capital, Southeast Nigeria. Based on National Population Commission (NPC) projections from the 2006 Census and United Nations data via Macro Trends, Abakaliki's 2025 population is estimated at **723,000**, up 4.33% from 693,000 in 2024.

Sample Size Determination

The sample size for this study is calculated using the formula: $n = N / (1 + N(e)^2)$ where:

n = sample size

N = population size

e = margin of error (expressed as a decimal)

Using the 2025 projected population of Abakaliki metropolis, $N = 723,000$ (Macro Trends, 2025), and a margin of error $e = 0.05$ (5%), the calculation is as follows:

$$\begin{aligned}n &= 723,000 / (1 + 723,000 (0.05)^2) \\n &= 723,000 / (1 + 723,000 (0.0025)) \\n &= 723,000 / (1 + 1,807.5) \\n &= 723,000 / 1,808.5 \\n &= 399.78\end{aligned}$$

Rounding to the nearest whole number, the sample size is approximately 400.

Sampling Technique

For this study: investigating the influence of radio messages on the knowledge and consistent use of insecticide-treated nets (ITNs) among pregnant women in Abakaliki metropolis, the multistage sampling technique was used for this study. This technique is suitable given the urban setting, the specific target population (pregnant women attending antenatal clinics), and the need for a representative sample within logistical constraints.

1. Stage 1: Purposive Sampling of Health Facilities

Abakaliki metropolis has multiple health facilities providing antenatal care. Four facilities (e.g., Alex Ekwueme Federal University Teaching Hospital

and Mile 4 hospital) were purposively selected based on high antenatal clinic attendance and geographical spread across the metropolis. This ensures coverage of diverse socio-economic groups and maximizes access to the target population.

2. Stage 2: Simple Random Sampling of Participants

Within each selected facility, a list of pregnant women attending antenatal clinics was obtained. Using a random number generator or lottery method, 200 pregnant women were selected from each facility to achieve the calculated sample size of approximately 400 (as determined using the 2025 population projection of 723,000 and a 5% margin of error). This random selection minimizes bias and ensures representativeness within the chosen facilities.

Measuring Instrument

The study used a structured questionnaire to collect quantitative data from 400 pregnant women attending antenatal clinics in Abakaliki metropolis. The questionnaire includes sections on demographics, knowledge of insecticide-treated nets (ITNs), frequency of ITN use, and exposure to radio messages, using multiple-choice and Likert-scale questions.

Method of Data Collection

Data were collected via structured questionnaires administered to 400 pregnant women attending antenatal clinics in four purposively selected health facilities in Abakaliki metropolis, ensuring access to the target population.

Method of Data Analysis

Data were analyzed using descriptive statistics (frequencies, percentages) to summarize demographics, ITN knowledge, usage, and radio message exposure. Chi-square tests were used for hypothesis testing to examine relationships between radio message exposure and ITN knowledge/use, with a significance level of $p < 0.05$.

Data Presentation and Analysis

Section B: Knowledge of ITN Use

s/n	Questions	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
1.	Radio messages have improved my understanding of how ITNs prevent malaria.	92 23%	193 48.2%	65 16.2%	33 8.3%	17 4.3%
2.	I learned proper ITN use and maintenance	84 21%	178 44.5%	81 20.2%	45 11.2%	12 3%

	from radio messages.					
3.	Radio messages have increased my awareness of malaria risks during pregnancy.	169 42.3%	78 19.5%	79 19.7%	26 6.5%	48 12%

Fieldwork, 2025

The table above reflects responses from 400 pregnant women in Abakaliki metropolis on radio messages’ impact on ITN knowledge. For Question 1, 71.2% (23% strongly Agree, 48.2% Agree) confirm improved understanding of ITN malaria prevention, with 12.6% disagreeing. Question 2 shows 65.5% (21% strongly Agree, 44.5% Agree) learned ITN use and maintenance, but 14.2% disagreed. Question 3 indicates 61.8% (42.3% strongly Agree, 19.5% Agree) agree radio messages raised malaria risk awareness, though 18.5% disagreed. Neutral responses (16.2%–20.2%) suggest indecision, possibly due to unclear messaging. Radio messages effectively enhance ITN knowledge, but clearer delivery could reduce neutral and dissenting responses.

Section C: Consistent Use of ITNs

s/n	Questions	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
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1	Radio messages motivate me to use ITNs every night.	72	99	104	66	59
		18%	24.7%	26%	16.5%	14.8%
2	Radio messages help me overcome barriers to using ITNs, like discomfort.	77	33	146	66	78
		19.2%	8.3%	36.5%	16.5%	19.5%
3	I use ITNs consistently due to information from radio messages.	62	74	177	54	33
		15.5%	18.5%	44.2%	13.5%	8.3%

Fieldwork, 2025

The table shows responses from 400 pregnant women in Abakaliki metropolis on radio messages' impact on consistent ITN use. Question 1 indicates 42.7% (18% strongly Agree, 24.7% Agree) feel motivated by radio messages to use ITNs nightly, but 31.3% disagree, and 26% are neutral. Question 2 reveals only 27.5% (19.2% strongly Agree, 8.3% Agree) agree radio messages help overcome barriers like discomfort, with 36% neutral and 36% disagreeing. Question 3 shows 34% (15.5% Strongly Agree, 18.5% Agree) use ITNs consistently due to radio messages, but 44.2% are neutral, and 21.8% disagree. High neutral responses suggest limited behavioral impact, indicating a need for more compelling radio messaging to enhance consistent ITN use.

Section D: Barriers to ITN Access and Use

s/n	Questions	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
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1.	I face difficulties accessing Insecticide-Treated Nets (ITNs) in Abakaliki metropolis.	156	81	77	29	57
		39%	20.3%	19.3%	7.2%	14.2%
2.	Lack of awareness about where to obtain ITNs prevents me from using them	82	149	57	63	49
		20.5%	37.3%	39.3	15.7%	12.2%
3.	The cost of ITNs is a major barrier to my ability to access and use them.	63	28	79	133	97
		15.7%	7%	19.8%	33.2	24.3%

Fieldwork, 2025

The table presents responses from 400 pregnant women in Abakaliki metropolis on barriers to ITN access and use. Question 1 shows 59.3% (39% Strongly Agree, 20.3% Agree) face difficulties accessing ITNs, with 21.4% disagreeing and 19.3% neutral, indicating significant access challenges. Question 2 reveals 57.8% (20.5% Strongly Agree, 37.3% Agree) agree that lack of awareness about where to obtain ITNs hinders use, with 27.9% disagreeing and 14.3% neutral, highlighting awareness as a key barrier. Question 3 indicates only 22.7% (15.7% Strongly Agree, 7% Agree) view cost as a major barrier, with 57.5% disagreeing

and 19.8% neutral, suggesting cost is less prohibitive. High agreement on access and awareness barriers underscores the need for improved ITN distribution and education in Abakaliki.

Testing of Hypothesis

H₀: Exposure to radio messages does not significantly increase the consistent and correct use of insecticide-treated nets (ITNs) for malaria prevention among pregnant women in Abakaliki metropolis.

s/n	Questions	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
2.	Radio messages help me overcome barriers to using ITNs, like discomfort.	77	33	146	66	78
		19.2%	8.3%	36.5%	16.5%	19.5%

From the computed table, use ($fe = fo \div n$) to get the expected frequency (fe)

Where fo = total of observed frequency,

fe = expected frequency and n = number of variables

$fe = 400/5$

$fe = 80$

Category	FO	FE	FO - FE	(FO - FE) ²	(FO-FE) ² ÷ FE
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Strongly Agree	77	80	-3	9	0.1125
Agree	33	80	-47	2209	27.6125
Neutral	146	80	66	4356	54.45
Disagree	66	80	-14	196	2.45
Strongly Disagree	78	80	-2	4	0.05

$$\chi^2 = 0.1125 + 27.6125 + 54.45 + 2.45 + 0.05 = 84.675$$

Degree of Freedom (df)

$$df = n - 1 = 5 - 1 = 4$$

Critical Value

At 0.05 significance level, $df = 4$, $\chi^2_{tab} = 9.488$

Decision

Since the calculated χ^2 (84.675) is greater than the critical value (9.488), the null hypothesis is rejected. The alternate hypothesis, that radio messages significantly increase consistent and correct ITN use, is accepted.

Discussion of Findings

The findings from Section B show that radio messages significantly boost pregnant women's knowledge of insecticide-treated net (ITN) use in Abakaliki metropolis. Most respondents agreed that radio messages improved their understanding of

ITN malaria prevention, taught proper use and maintenance, and raised awareness of malaria risks during pregnancy. These results echo Okedo-Alex et al. (2022), who found radio to be a key information source in Ebonyi for malaria education. However, some disagreement and neutral responses suggest issues with message clarity or reach, aligning with Idris et al. (2023), who noted weak health education as a barrier. Neutral responses may reflect limited engagement with radio due to complex messaging or other information sources. This study fills a gap by highlighting radio's effectiveness in Abakaliki's urban setting, where strong radio access enhances impact, unlike rural-focused studies. Using the Health Belief Model, it shows radio's role in raising awareness and confidence, though clearer messaging is needed to reduce neutral responses. By focusing on urban pregnant women, this research advances understanding of how media can improve malaria prevention, guiding future radio campaigns for better engagement.

Section C findings reveal that radio messages have a limited but statistically significant impact on the consistent use of insecticide-treated nets (ITNs) among pregnant women in Abakaliki metropolis, with a notable portion of the 400 respondents showing mixed engagement. Approximately 42.7% felt motivated to use ITNs every night, 27.5% reported overcoming practical barriers such as discomfort, and only 34% attributed their consistent

ITN use to radio messages, with high neutral responses (26%–44.2%) and disagreement (21.8%–36%) indicating hesitancy or resistance. The chi-square test ($\chi^2 = 84.675$, $p < 0.05$) for Question 2 rejects the null hypothesis, suggesting radio messages have a modest effect on behavior, aligning with the Health Belief Model's focus on cues to action. These results contrast with Valentine et al. (2020), who found only 25% consistent ITN use in Aboh Mbaise despite awareness, pointing to persistent barriers beyond knowledge, such as discomfort or accessibility. Compared to Idris et al. (2023), where 30% used ITNs consistently in Kano, this study's urban focus highlights radio's partial success in driving behavior change, likely due to Abakaliki's robust media access. However, the high neutral responses suggest messaging may lack specificity or emotional appeal to overcome practical challenges. This study extends prior research by addressing the knowledge gap in urban contexts, revealing the need for targeted, action-oriented radio campaigns that address specific barriers like discomfort to enhance ITN adherence among urban pregnant women, offering insights for future health communication strategies.

The findings from Section D highlight substantial challenges hindering the access and use of insecticide-treated nets (ITNs) among pregnant women in Abakaliki metropolis, revealing critical barriers that impede effective malaria prevention. A majority of the 400 respondents reported significant

difficulties in accessing ITNs and a lack of awareness about where to obtain them, underscoring persistent gaps in the distribution and communication systems. In contrast, far fewer identified cost as a major obstacle, suggesting that financial barriers are less pronounced in this urban setting. These results resonate with Akpa et al. (2022), who observed similar access and awareness challenges in Ebonyi State, despite widespread ITN ownership, pointing to systemic issues in ensuring nets reach those in need. However, the minimal concern about cost diverges from rural studies like Valentine et al. (2020), where economic constraints were a dominant barrier, reflecting Abakaliki's urban advantage, likely due to free or subsidized ITN distribution through health facilities like the Alex Ekwueme Federal University Teaching Hospital. This study extends prior research by pinpointing urban-specific barriers, emphasizing the critical role of awareness and accessibility over financial limitations. It fills a knowledge gap by demonstrating how radio campaigns, leveraging Abakaliki's robust media infrastructure, must incorporate practical details about ITN distribution points to bridge these gaps. By aligning with the Health Belief Model's focus on reducing barriers, this research underscores the need for targeted, urban-focused radio messaging to enhance ITN uptake, offering valuable insights for designing more effective malaria prevention strategies for pregnant women in similar urban contexts.

Summary, Conclusion and Recommendations

Summary:

This study looked into how radio messages could help pregnant women in Abakaliki metropolis, Ebonyi State, Nigeria, better understand and regularly use insecticide-treated nets (ITNs) to prevent malaria. Using a practical research approach, we found that radio messages really helped women grasp why ITNs matter, how to use them properly, and the risks malaria poses during pregnancy. Still, some women were not fully convinced, possibly because the messages were not clear enough. When it came to actually using ITNs every night, the impact was less impressive—many women did not feel motivated or found issues like discomfort hard to overcome, showing it's one thing to know about ITNs and another to use them consistently. The biggest hurdles were getting hold of ITNs and knowing where to find them, though cost wasn't a major issue. The study shows radio can be a powerful tool in urban areas like Abakaliki, but we need sharper, more practical messages. Suggestions include teaming up radio campaigns with antenatal clinics, sharing clear details on where to get ITNs, and crafting messages that connect with different groups of women to boost ITN use and cut down malaria cases.

Conclusion

This study demonstrates that radio messages significantly enhance knowledge of insecticide-treated net (ITN) use among pregnant women in Abakaliki metropolis, though their impact on consistent use is limited due to persistent barriers like access and awareness. While urban advantages like radio access and free ITN distribution reduce cost barriers, the findings highlight the need for more targeted messaging to address practical challenges and improve ITN uptake.

Recommendations

1. Government and health communication specialists should develop radio campaigns with clear, action-oriented messages to enhance awareness and address ITN discomfort among pregnant women.
2. Local radio stations should include practical information in broadcasts about where pregnant women can obtain ITNs in Abakaliki metropolis.
3. Health facility administrators should collaborate with radio stations to integrate campaigns with antenatal care education to encourage consistent ITN use among pregnant women and effective radio campaigns must be tailored, using local dialects and trusted voices to resonate with pregnant women in Abakaliki..

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