



## Assessment of insecticide-treated nets (ITNs) devaluation: knowledge, attitude and practices regarding misuse of ITN in Taraba State of Nigeria

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### ABSTRACT

*Insecticide-Treated Nets (ITNs) are essential for malaria prevention, but their misuse for non-malaria-related activities, such as fishing, bathing, and fencing, has been increasingly reported in Nigeria. This study aimed to assess the knowledge, attitudes, and practices regarding ITN misuse among residents and identify the factors contributing to the devaluation of ITNs. A cross-sectional survey was conducted among 396 adults from Taraba State, using structured online questionnaires. Using a convenient sampling, a sample size of 396 respondents was collected from the study population. Data were analyzed using SPSS software, and descriptive was used to explore KAP regarding ITN misuse. The findings showed that 77% of respondents were aware of ITNs being used for fishing, 83% observed that ITNs is used as bathing sponges, and 94% had observed ITNs used for fencing gardens. The primary factor contributing to ITN misuse was lack of awareness (55%). While 88% of respondents found ITN misuse unacceptable, 41% rated government efforts to promote proper ITN use as ineffective. A significant portion (76%) believed that ITN misuse negatively affects malaria prevention efforts. This study highlights the widespread misuse of ITNs in Taraba State, driven by socioeconomic factors and a lack of awareness. Targeted interventions, including community education and stronger policy enforcement, are urgently needed to prevent ITN devaluation and ensure effective malaria control in the region.*

**Keywords:** ITN misuse, malaria prevention, public health, Taraba State, knowledge, attitudes, practices

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### INTRODUCTION

Malaria continues to be a significant global health challenge, particularly affecting tropical and subtropical regions, with Sub-Saharan Africa bearing the highest burden. In Nigeria, malaria is endemic, contributing to a substantial number of deaths and illnesses annually, despite concerted efforts to control and prevent the disease. Effective malaria prevention strategies, such as the use of Insecticide-Treated Nets (ITNs), Indoor Residual Spraying (IRS), and prompt treatment with

effective antimalarial medications, are crucial for reducing transmission and mitigating its impact on public health (WHO, 2023). Malaria, caused by Plasmodium parasites transmitted through the bites of infected Anopheles mosquitoes, remains a leading cause of morbidity and mortality globally. In Nigeria, malaria contributes significantly to the country's disease burden, particularly affecting vulnerable populations such as children and adults. Despite ongoing efforts to control the disease through vector control measures, access to effective

treatment, and public health education, challenges persist in achieving sustainable malaria control and elimination goals (Odewale, 2019).

Effective prevention strategies are crucial for reducing the burden of this mosquito-borne disease. Central to these strategies is the level of knowledge individuals have regarding malaria transmission and prevention measures. Malaria is primarily transmitted through the bites of infected female *Anopheles* mosquitoes. Understanding this mode of transmission is fundamental for communities to adopt appropriate preventive behaviors. However, studies have revealed varying levels of awareness regarding how malaria is spread. Misconceptions, such as attributing malaria to environmental factors or dietary habits, can undermine efforts to promote effective prevention methods (Bell, 2018).

In many endemic areas, ITNs have proven effective in reducing malaria transmission by providing a physical barrier against mosquito bites and through insecticidal properties that kill mosquitoes on contact. However, the consistent use of ITNs remains a challenge due to logistical barriers in distribution, maintenance, and community adherence. Key preventive measures recommended by health authorities include the use of Insecticide-Treated Nets (ITNs), Indoor Residual Spraying (IRS) with insecticides, mosquito repellents, and the prompt use of antimalarial medications. While these measures are widely promoted, their adoption rates are influenced by socioeconomic factors, access to healthcare services, and educational levels within communities (Jerry, 2023).

Effective malaria prevention strategies encompass a range of interventions, including the distribution and use of ITNs, IRS, Intermittent Preventive Treatment for pregnant women (IPTp), and prompt diagnosis and treatment with Artemisinin-based Combination Therapies (ACTs). However, the success of these interventions depends significantly on the knowledge individuals possess about malaria transmission, preventive measures, and treatment options. Similarly, IRS, which involves spraying insecticides on indoor surfaces to kill mosquitoes, requires community cooperation and regular application to maintain effectiveness. Awareness of these interventions exists among populations, but their implementation often faces barriers such as inadequate infrastructure, funding constraints, and community perceptions of the effectiveness and safety of insecticides (Kodi, 2022). Furthermore, Salawu (2022), stated that cultural beliefs and practices play a significant role in shaping community attitudes towards malaria prevention. Local customs and traditions may influence perceptions of disease causation and preferred treatment methods, sometimes conflicting with scientifically endorsed preventive measures. Addressing these cultural factors is essential for ensuring that prevention strategies are culturally sensitive and effectively integrated into local health practices.

In Nigeria, the misuse of ITNs includes various practices that deviate from their intended use, such as using nets for

fishing, gardening, or other household purposes. In many communities, the durable and versatile material of ITNs makes them attractive for alternative uses. For instance, ITNs are sometimes repurposed as fishing nets due to their fine mesh, which can efficiently capture fish. However, this practice poses significant environmental risks as the chemicals embedded in the nets, such as pyrethroids, can leach into water bodies, harming aquatic life and potentially entering the food chain (Bami, 2019).

In addition to fishing, ITNs are often used in gardening to protect crops from pests or as makeshift fencing. These alternative uses not only reduce the number of ITNs available for their primary purpose which is protecting against malaria-carrying mosquitoes but also expose the nets to conditions that degrade their insecticidal properties more rapidly. For example, frequent exposure to sunlight, water, and soil can break down the chemical treatment in the nets, reducing their effectiveness as a mosquito repellent when they are eventually used for sleeping. The diversion of ITNs for non-protective purposes also diminishes the overall coverage of ITNs within the community. When ITNs are not used as intended, the community loses a critical layer of protection against malaria. This reduction in coverage can lead to higher mosquito populations and increased malaria transmission, undermining public health efforts and the benefits of mass ITN distribution campaigns (Suleiman, 2023).

Improper handling and maintenance of ITNs further compromise their efficacy. When ITNs are not regularly washed and dried according to recommended guidelines, they can become less effective at repelling and killing mosquitoes. Washing ITNs with harsh detergents or scrubbing them vigorously can strip away the insecticidal coating, while drying them in direct sunlight can accelerate the degradation of the chemicals. Moreover, if ITNs are not stored properly, they can become torn or damaged, providing insufficient coverage and allowing mosquitoes to enter (Bello, 2018).

Studies have shown that gaps in knowledge and inconsistent adherence to preventive practices can undermine malaria control efforts (Hill, 2018). The combination of these misuse practices highlights a critical gap in the proper utilization of ITNs. It shows the need for comprehensive education and behavior change communication strategies to ensure that communities understand the importance of using ITNs solely for malaria prevention. Addressing these issues requires a multifaceted approach that includes reinforcing the value of ITNs through community engagement, improving distribution and accessibility to reduce the temptation of alternative uses, and providing clear guidelines and support for the proper care and maintenance of ITNs.

Understanding the attitude and practices of the residents of Taraba State regarding ITNs is crucial for identifying the factors contributing to their misuse. This knowledge will inform the development of targeted interventions to improve ITN utilization and maintenance, thereby enhancing their effectiveness in malaria control.

Therefore, this study aims to assess the devaluation of ITNs in Taraba State by examining the community's attitude and practices towards these nets. By identifying the gaps and challenges in the proper use of ITNs, the research seeks to provide evidence-based recommendations for policy makers, public health officials, and community leaders to strengthen malaria prevention strategies in the region. Through this assessment, it is hoped that the full potential of ITNs in reducing malaria transmission can be realized, ultimately contributing to better health outcomes for the residents of Taraba State and beyond.

**METHODOLOGY**

The study focused on adults over 18 years of age in Taraba State, Nigeria, who were mentally stable and willing to participate. This population included households and individuals directly affected by malaria and who are potential users of Insecticide-Treated Nets (ITNs). Using a convenient sampling, a sample size of 396 respondents was collected from the study population. The sample size was considered significant to provide reliable insights into the knowledge, attitudes, and practices (KAP) of the state residents regarding ITN misuse.

Convenient sample technique was use for the data collection. A structured online questionnaire, designed to assess respondents' awareness of ITN usage, their attitudes towards the effectiveness of ITNs, and any observed practices of misuse, such as using ITNs for fishing. The online format facilitated access to a geographically dispersed population. To ensure comprehensive coverage, the questionnaire was divided into sections addressing demographic information, knowledge of ITNs, attitudes toward malaria prevention, and practices of ITN usage or misuse.

Ethical standards were rigorously adhered to, including obtaining informed consent from all participants and ensuring their confidentiality and anonymity throughout the process. Collected data were analyzed using SPSS software, where descriptive statistics provided a general summary of respondents' KAP. The results were presented in figures which is suitable for representation of such findings.

**RESULTS AND DISCUSSION**

The findings reveal widespread misuse of Insecticide-Treated Nets (ITNs) in Taraba State, Nigeria, which is consistent with previous research conducted by other researchers within Nigeria. According to (Figure 1), 77% of participants are aware of ITNs being used for fishing purposes, which aligns with earlier study by Doda et al. (2018) highlighting similar misuse linked to economic pressures and limited access to alternatives. This misuse threatens malaria prevention efforts and could adversely affect aquatic ecosystems due to the insecticide

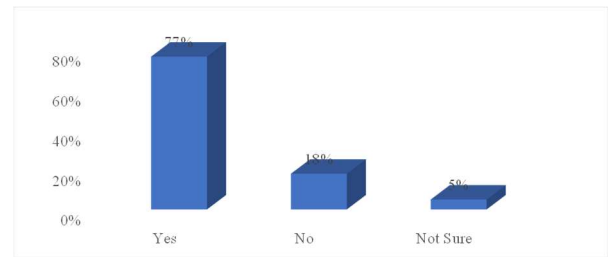


Figure 1: Show participants' response of being aware of instances where some individuals have used ITN for fishing purposes within Taraba State communities.

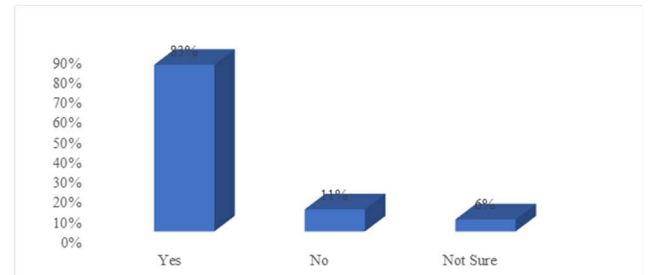


Figure 2: Show participants' response of being aware of instances where some individuals in the state have used ITNs as bathing sponges.

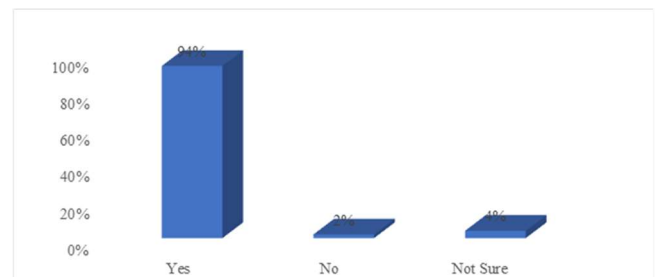


Figure 3: Show participants' response on if they have observed or heard of cases where insecticidal treated nets are used for fencing gardens.

contamination on the nets. Similarly, (Figure 2) shows that 83% of respondents are aware of ITNs being used as bathing sponges, a practice observed in other study (Gutierrez-Jara et al., 2022) and reflecting a lack of understanding regarding their intended purpose in malaria prevention. These findings support the notion that misconceptions about ITNs' role contribute to their devaluation.

The high percentage of respondents (94%) reporting ITNs being used for garden fencing (Figure 3) further reconfirms the findings from other study (Taremwa et al., 2017), which have documented similar widespread misuse due to socioeconomic challenges. The misuse in agricultural settings not only reduces the availability of ITNs for malaria prevention but also introduces environmental contaminants, worsening malaria prevention efforts. These findings highlight the urgent need for alternative solutions to economic pressures that lead to such behaviors.

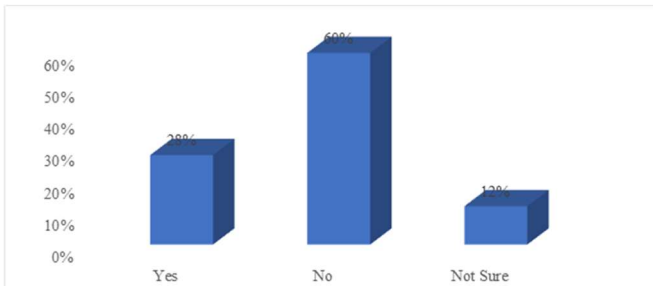


Figure 4: Show participants' response on if they think people their community are aware of the risks associated with using ITNs for purposes other than malaria prevention.

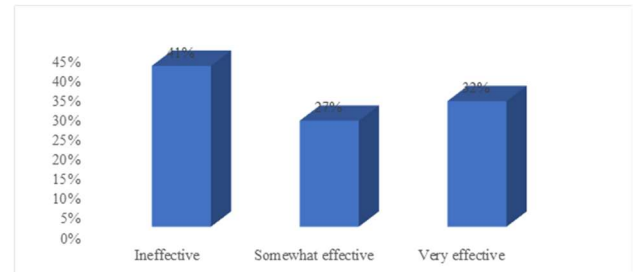


Figure 8: Show participants' rating on the involvement of the government in promoting the proper use of ITNs for malaria prevention in your community.

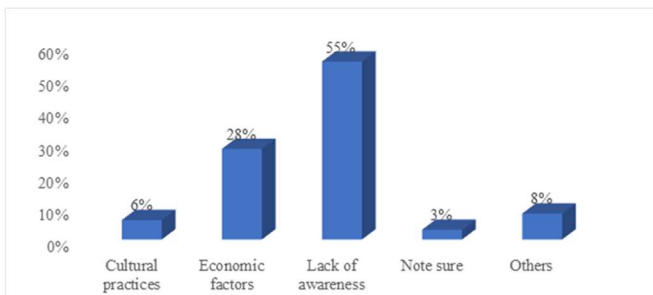


Figure 5: Show participants' response on factors they believe is most common in contributing to the devaluation of ITNs, leading to their use for activities other than preventing malaria.

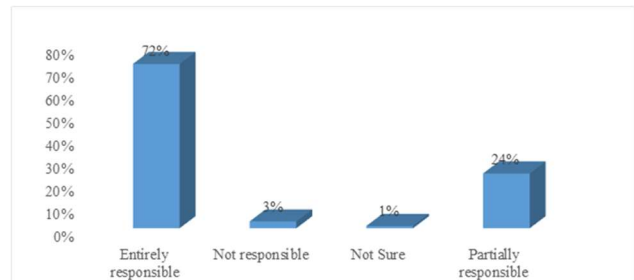


Figure 9: Show participants' response on the need for communities to be responsible for ensuring the proper use of ITNs for malaria prevention.

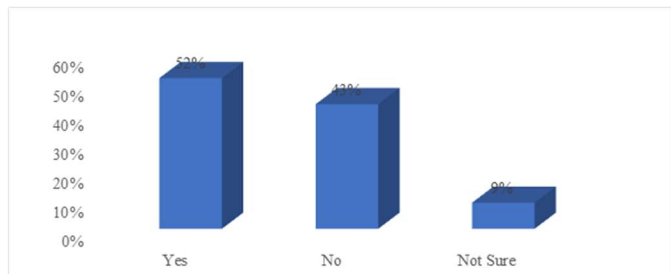


Figure 6: Show participants' response on being aware of any community awareness programs specifically addressing the proper use of ITNs for malaria prevention.

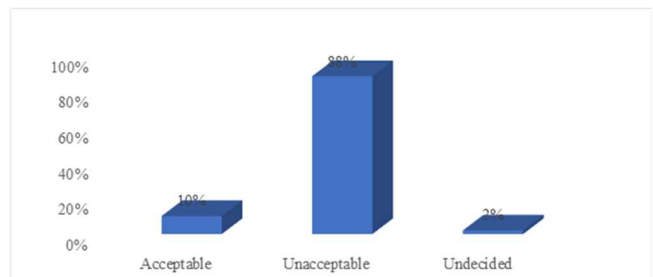


Figure 7: Show participants' response how they personally feel about the use of ITNs for activities like fishing, bathing (sponge), or fencing gardens.

misuse, Figure 4 reveals that only 28% believe people in their community are aware of these risks. This knowledge gap aligns with previous study that emphasize the role of inadequate public education in fostering misuse (Onyinyechi *et al.*, 2023). The significant proportion of respondents (55%) identifying lack of awareness as the primary factor contributing to ITN misuse (Figure 5) further supports findings from Doda *et al.* (2018), reinforcing that educational interventions coupled with community-level awareness campaigns are essential for addressing this issue.

Despite some awareness of community-based programs promoting ITN use (Figure 6), the study found that 43% of participants remain unaware of such initiatives. This agrees with findings by Gutierrez-Jara *et al.* (2022), who highlighted the gap between awareness of intervention programs and actual behavior change. To close this gap, more widespread, targeted, and well-communicated efforts are necessary.

In comparison to other research, Figure 7 shows that 88% of respondents disapprove of ITN misuse for activities like fishing, bathing, or fencing, which is consistent with previous studies documenting strong public disapproval of these practices (Taremwaa *et al.*, 2017). However, the persistence of such behaviors suggests that economic factors are still driving these activities despite public disapproval. Governmental efforts in promoting ITN use, as reflected in (Figure 8), received mixed reviews, with 41% rating them as ineffective. These results align with other research highlighting the challenge of inconsistent or insufficient governmental campaigns (Onyinyechi *et al.*, 2023). Figure 9 shows that 72% of respondents believe the

In terms of knowledge about the risks associated with ITN

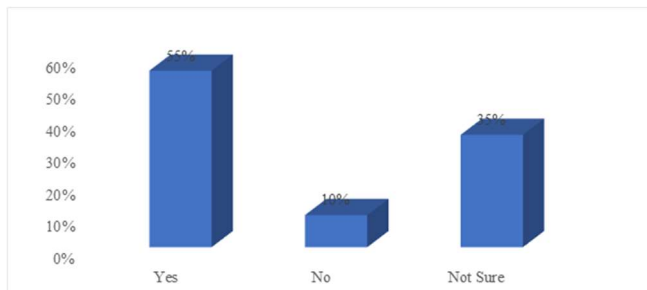


Figure10: Show participants' response on if there are effective measures in their community to enforce the proper use of ITNs for malaria prevention.

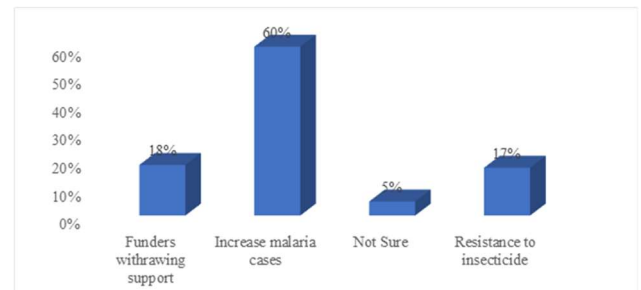


Figure13: Show participants' response on what they think could be the most potential consequence of widespread misuse of ITNs for activities other than malaria prevention in your community.

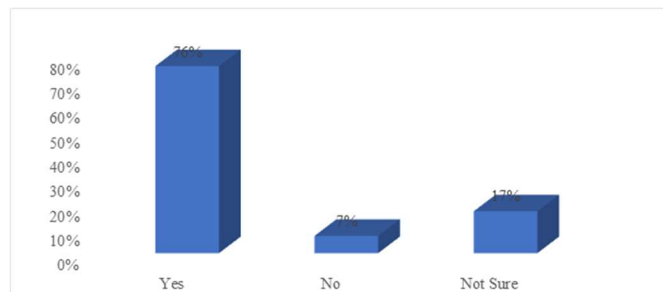


Figure11: Show participants' opinion on if the use of ITNs for activities other than malaria prevention affect the overall effectiveness of malaria prevention efforts in their community.

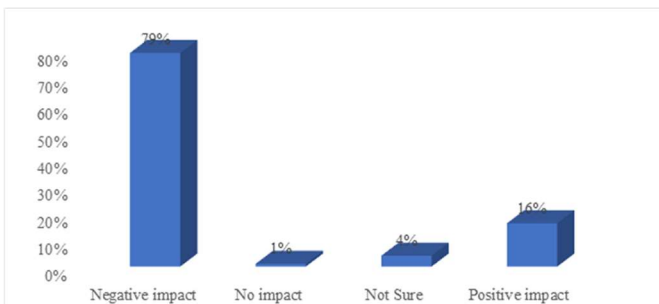


Figure12. Show participants' response on how they think the misuse of ITNs for non-malaria purposes may impact the overall health of individuals in their community.

community should take responsibility for ensuring ITN use for malaria prevention. This supports findings from Onyinyechi *et al.* (2023), who emphasize the potential for community-led initiatives in tackling ITN misuse, suggesting a need for grassroots efforts involving local leaders and healthcare workers to foster behavioral change. The mixed responses regarding the effectiveness of measures to enforce ITN use (Figure 10) are consistent with previous research by Gutierrez-Jara *et al.* (2022), which indicates that while some enforcement exists, it is often poorly communicated or enforced, leading to continued misuse. Finally, (Figure 11) reveals that 76% believe ITN misuse negatively affects malaria prevention efforts, reinforcing findings from Taremwa *et al.* (2017), who highlighted the counterproductive nature of such practices. The majority of participants (79%) also believe

that ITN misuse contributes to increased malaria cases (Figure 12), aligning with prior research showing the public's awareness of the health consequences of ITN misuse.

### Conclusion

This study reveals a significant level of ITN misuse in Taraba State, with many residents repurposing nets for fishing, bathing, and garden fencing. Such practices undermine malaria prevention efforts, contribute to environmental contamination, and pose health risks to individuals through exposure to harmful insecticides. Moreover, a large portion of the population remains unaware of the risks associated with ITN misuse, highlighting a critical gap in public health education. There is a clear need for comprehensive and targeted interventions, including educational campaigns, policy enforcement, and the provision of economic alternatives, to address both the devaluation of ITNs and the broader challenges facing malaria control in the region.

### Implications for public health

Moving forward, a multi-approach is essential, combining governmental action, community involvement, and ongoing research to ensure that ITNs are used as intended. By addressing the socioeconomic factors driving misuse and strengthening awareness programs, Taraba State can better protect its population from malaria and safeguard the effectiveness of ITNs in the long term.

### Limitations and Recommendations

The study has some limitations, starting with its reliance on self-reported data, which can introduce response bias. Participants may have underreported or over reported their ITN misuse due to social desirability or memory recall issues, potentially affecting the accuracy of the findings. Additionally, the use of online questionnaires and small sample size could have excluded individuals without internet access, particularly those in rural areas, resulting in a sample that may not fully represent the entire

population of Taraba State. Lastly, the study's cross-sectional design limits its ability to assess changes over time or establish causal relationships between factors contributing to ITN misuse and its consequences.

To address these limitations, future research should consider adopting longitudinal studies that track changes in ITN usage and community awareness over time. This would provide a better understanding of how interventions impact behavior in the long term. Moreover, a mixed-methods approach incorporating qualitative data through interviews or focus groups would allow for deeper insights into the underlying reasons for ITN misuse, providing richer context beyond survey responses. There is also a need for studies that assess the effectiveness of community-based interventions aimed at raising awareness and reducing ITN misuse, as well as research into economic alternatives that could alleviate the pressures leading to this repurposing of ITNs. More so, future study should compare the KAP with demography information of the respondents

### Conflict of interest

There is no conflict of interest

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