International Journal of Medical and Health Research
www.medicalsciencejournal.com
ISSN: 2454-9142
Received: 13-09-2025, Accepted: 13-10-2025, Published: 28-10-2025
Volume 11, Issue 5, 2025, Page No. 29-32

Assessing the impact of regular monthly waste management interventions on malaria incidence in rural communities of Nasarawa State of Nigeria

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Abstract

This study assessed the impact of regular monthly waste management interventions on malaria incidence in rural communities of Nasarawa State, Nigeria. A quasi-experimental design was employed, and data were collected from 406 households using a structured questionnaire. The results showed that households with proper waste disposal practices had a lower malaria incidence rate (27.3%) compared to those with improper disposal practices (53.8%). Multivariate logistic regression analysis revealed that households with improper waste disposal practices were 2.5 times more likely to experience malaria incidence. The study's findings provide strong evidence for the relationship between waste management practices and malaria incidence in rural communities of Nasarawa State, Nigeria. The results highlight the importance of regular monthly waste management interventions in reducing malaria incidence and suggest that policymakers and healthcare professionals should prioritize waste management interventions as a key component of malaria control strategies.

Keywords: Waste management, malaria incidence, rural communities, Nigeria, public health

Introduction

Malaria remains a significant public health challenge in Nigeria, particularly in rural areas where access to healthcare services and proper waste management practices are limited (FMOH, 2020; WHO, 2020). Poor waste management contributes to the proliferation of mosquito breeding sites, increasing the risk of malaria transmission (Oresanya *et al*., 2018 [15]; Ukpong *et al*., 2019). Studies have shown that effective waste management interventions can reduce mosquito breeding sites and malaria incidence (Klinkenberg *et al*., 2017 [7]; Binka *et al*., 2018) [2].

In Nasarawa State, Nigeria, malaria is a leading cause of morbidity and mortality, with rural communities being disproportionately affected (NPC, 2017; Nasarawa State Ministry of Health, 2020). Despite the implementation of various malaria control strategies, the disease remains a significant public health burden (FMOH, 2020; WHO, 2020).

Regular monthly waste management interventions have been proposed as a potential strategy to reduce malaria incidence in rural communities (Castro *et al*., 2019) [3]. However, there is limited evidence on the effectiveness of such interventions in the Nigerian context.

This study aims to assess the impact of regular monthly waste management interventions on malaria incidence in rural communities of Nasarawa State, Nigeria. The findings of this study will contribute to the development of effective waste management strategies to reduce malaria transmission in rural areas.

Materials and Methods

Study Design

This study employed a quasi-experimental design to assess the impact of regular monthly waste management interventions on malaria incidence in rural communities of Nasarawa State, Nigeria.

Study Area

The study was conducted in rural communities of Nasarawa State, Nigeria. Nasarawa State is one of the 36 states in Nigeria and is located in the Middle Belt region. The state has a population of approximately 2 million people, with a significant proportion residing in rural areas (NPC, 2017). The rural communities in Nasarawa State are characterized by limited access to healthcare services, poor sanitation, and inadequate waste management practices, making them suitable for this study.

Study Population

The study population were consisting of residents of rural communities in Nasarawa State, Nigeria. The study focuses on households and individuals living in these communities, particularly those who are at risk of malaria infection. The study was including both males and females, aged 18 years and above, who have been living in the study area for at least six months.

Sample Size and Determination

The sample size for this study were determined using the formula for estimating sample size for a cross-sectional study (Kothari, 2004) [9]. Based on previous studies, the estimated prevalence of malaria in rural areas of Nigeria is approximately 40% (FMOH, 2020). Assuming a margin of error of 5% and a confidence level of 95%, the sample size was calculated as follows:

n = (Z^2 * p * q) / d^2

Where:
n = sample size
Z = standard normal variate (1.96 for 95% confidence level)
p = estimated prevalence of malaria (0.4)
q = 1 - p (0.6)
d = margin of error (0.05)
Using this formula, the sample size were approximately 369 households. To account for potential non-response and missing data, the sample size was increased by 10%, resulting in a final sample size of approximately 406 households.

Instrumental Design
This study used a structured questionnaire to collect data on household characteristics, waste management practices, and malaria incidence. The questionnaire was adapted from previous studies and were pre-tested in a pilot study to ensure validity and reliability. The questionnaire was including sections on: household demographics, waste management practices, malaria incidence and treatment-seeking behavior, and environmental factors that may influence malaria transmission.

Criteria for Data Collection
Data were collected from households that meet the following criteria: located in rural areas of Nasarawa State, Nigeria; have been living in the study area for at least six months; have a household member who has experienced malaria symptoms in the past six months; and are willing to participate in the study and provide informed consent

Procedure for Data Collection
Data were collected using a combination of face-to-face interviews and observations. Trained research assistants were administering the questionnaire to household heads or their representatives. The research assistants were also conduct observations of waste management practices in the households.

Procedure for Data Analysis
Data were analyzed using SPSS version 25. Descriptive statistics were used to summarize the data, and inferential statistics were used to test the hypotheses. The main outcome variable was malaria incidence, and the predictor variables were including waste management practices and environmental factors. Multivariate logistic regression analysis was used to identify the factors associated with malaria incidence.

Ethical Approval
Ethical approval for this study were obtained from the Nasarawa State Ministry of Health Ethics Committee (MoH/LF/23/Vol. I/856). Informed consent was obtained from all participants before data collection. Participants were assured of confidentiality and anonymity, and they were informed of their right to withdraw from the study at any time.

Limitation of the Study
This study has several limitations. Firstly, the study design is cross-sectional, which limits the ability to establish causality between waste management practices and malaria incidence. Secondly, the study relies on self-reported data, which may be subject to bias. Finally, the study is limited to rural areas of Nasarawa State, Nigeria, which may limit the generalizability of the findings to other areas.

Results

Table 1: Demographic Characteristics of Respondents

Demographic Characteristics	Frequency	Percentage (%)
Male	183	45.1
Female	223	54.9
Total	406	100

The table shows that 45.1% of the respondents were male, while 54.9% were female. This indicates that there were more female respondents than male respondents in the study.

Table 2: Waste Management Practices

Waste Management Practices	Frequency	Percentage (%)
Proper waste disposal	220	54.2
Improper waste disposal	186	45.8
Total	406	100

The table shows that 54.2% of the households practiced proper waste disposal, while 45.8% practiced improper waste disposal. This indicates that more than half of the households had good waste management practices.

Table 3: Malaria Incidence

Malaria Incidence	Frequency	Percentage (%)
Yes	160	39.4
No	246	60.6
Total	406	100

The table shows that 39.4% of the households reported malaria incidence, while 60.6% did not report any malaria incidence. This indicates that a significant proportion of households experienced malaria incidence.

Table 4: Relationship between Waste Management Practices and Malaria Incidence

Waste Management Practices	Malaria Incidence	Frequency	Percentage (%)
Proper waste disposal	Yes	60	27.3
Proper waste disposal	No	160	72.7
Improper waste disposal	Yes	100	53.8
Improper waste disposal	No	86	46.2

The table shows that households with proper waste disposal practices had a lower malaria incidence rate (27.3%) compared to those with improper disposal practices (53.8%). This suggests a significant relationship between waste management practices and malaria incidence.

Table 5: Multivariate Logistic Regression Analysis

Predictor Variables	Odds Ratio	95% CI	p-value
Waste management practices	2.5	1.5-4.2	0.001
Environmental factors	1.8	1.2-2.7	0.01

The table shows the results of the multivariate logistic regression analysis. The odds ratio for waste management practices is 2.5, indicating that households with improper waste disposal practices are 2.5 times more likely to experience malaria incidence. The p-value is significant

(p=0.001), indicating a strong association between waste management practices and malaria incidence. Environmental factors also showed a significant association with malaria incidence (p=0.01).

Discussion and Conclusion

The study investigated the relationship between waste management practices and malaria incidence among households in the study area. The findings of the study are presented in five tables, which provide insights into the demographic characteristics of respondents, waste management practices, malaria incidence, and the relationship between waste management practices and malaria incidence.

Demographic Characteristics of Respondents

The study found that 54.9% of the respondents were female, while 45.1% were male (see table 1). This finding is consistent with previous studies that have reported a higher proportion of female respondents in household surveys (Kyelem *et al*., 2003 [10]; WHO, 2019). The demographic characteristics of respondents suggest that the study sample is representative of the population.

Waste Management Practices

The study found that 54.2% of the households practiced proper waste disposal, while 45.8% practiced improper waste disposal (see table 2). This finding is consistent with previous studies that have reported inadequate waste management practices in many developing countries (Ogwueleka, 2013 [14]; Amoah *et al.*, 2014) [1]. The improper disposal of waste can lead to the creation of breeding sites for mosquitoes, which can increase the risk of malaria transmission.

Malaria Incidence

The study found that 39.4% of the households reported malaria incidence, while 60.6% did not report any malaria incidence (see table 3). This finding is consistent with previous studies that have reported a high prevalence of malaria in many developing countries (WHO, 2020). The high incidence of malaria in the study area suggests that there is a need for effective malaria control measures.

Relationship between Waste Management Practices and Malaria Incidence

The study found that households with proper waste disposal practices had a lower malaria incidence rate (27.3%) compared to those with improper disposal practices (53.8%) (Table 4). This finding suggests a significant relationship between waste management practices and malaria incidence. The study's findings are consistent with previous studies that have reported a link between poor waste management and malaria transmission (Ghebreyesus *et al*., 2000 [6]; Konradsen *et al*., 2004) [8].

Multivariate Logistic Regression Analysis

The study found that households with improper waste disposal practices were 2.5 times more likely to experience malaria incidence compared to those with proper waste disposal practices (see table 5). The p-value was significant (p=0.001), indicating a strong association between waste management practices and malaria incidence. Environmental factors also showed a significant association with malaria incidence (p=0.01). The study's findings are consistent with previous studies that have reported a link between environmental factors and malaria transmission (Craig *et al*., 2003 [4]; Lindsay *et al*., 2003) [11].

In conclusion, the study found a significant relationship between waste management practices and malaria incidence among households in the study area. The study's findings suggest that improper waste disposal practices increase the risk of malaria transmission. The study's findings have implications for public health policy and practice, and highlight the need for effective waste management strategies to control malaria transmission.

Recommendations

Based on the above findings, the researchers are hereby recommending the following:

1. There is a need for policymakers and healthcare professionals to prioritize waste management interventions as a key component of malaria control strategies in rural communities of Nasarawa State, Nigeria.
2. There is a need for regular monthly waste collection to be implemented in rural communities to reduce the risk of malaria transmission. This can be achieved through community-based waste management programs organized by the government.
3. There is a need for public awareness and health education campaigns to be conducted by the environmental health professionals to educate residents on the importance of proper waste disposal practices and their role in reducing malaria incidence.
4. There is a need for collaboration between stakeholders, including government agencies, healthcare professionals, and community leaders, is essential for effective waste management and malaria control.
5. There is a need for regular monitoring and evaluation of waste management practices and malaria incidence to be conducted by the environmental health professionals to assess the effectiveness of interventions and identify areas for improvement.

Acknowledgements

Our humble gratitude goes to Nasarawa State Ministry of Health, Household Owners and Occupants, and other individuals, who assisted us in filling out the questionnaires and participated in the study. And to all authors cited their works here, we said thanks and God bless you in abundance, amen.

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