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ENVIRONMENTAL MANAGEMENT PRACTICES AND THEIR INFLUENCE ON MALARIA TRANSMISSION IN RURAL COMMUNITIES OF OGUN STATE, NIGERIA

Dike Ebenezer Chukwunweike
Department of Environmental Management, School of Management
Charisma University, Billings, Montana, USA

Ass. Ogbuyeme Jennifer Ngozika
Department of Public Health Sciences, School of Health Sciences
Charisma University, Billings, Montana, USA
Jenny1way@gmail.com

Ochechi Joseph Ugbede
Department of Public Health Sciences, Faculty of Allied Health
State University of Medical and Applied Sciences, Igbo-Eno
Joseph.ochechi@sumas.edu.ng

Corresponding Author
Ochechi Joseph Ugbede
Department of Public Health Sciences, Faculty of Allied Health
State University of Medical and Applied Sciences, Igbo-Eno
Joseph.ochechi@sumas.edu.ng
+2348063919163

Abstract

Malaria remains one of the most persistent public health challenges in Nigeria, particularly in rural communities where environmental conditions often support mosquito breeding and transmission. This study assessed environmental management practices and their influence on malaria transmission among residents of selected rural communities in Ogun State, Nigeria. A descriptive cross-sectional research design was employed among 300 residents selected from rural communities across the study area. Data were collected using a structured questionnaire and environmental observation checklist focusing on sanitation practices, drainage conditions, water storage behaviours, vegetation management, and malaria occurrence. Findings showed that stagnant water accumulation, inadequate drainage maintenance, poor waste disposal practices, and improper environmental sanitation were common within the communities. A high proportion of respondents reported previous malaria episodes, with increased occurrence observed among households located near stagnant water sources and poorly maintained surroundings. Statistical

analysis revealed a significant association between environmental management practices and reported malaria occurrence among residents ($p < 0.05$). The study concludes that environmental conditions contribute substantially to malaria transmission risk in rural communities of Ogun State. Strengthening community-based environmental sanitation, improving drainage management, and promoting sustainable vector control practices are recommended to reduce malaria burden.

Keywords: Environmental management, Malaria transmission, Ogun State, Rural communities, Vector control

Introduction

Malaria transmission is closely linked with environmental conditions that influence the survival and breeding of mosquito vectors. Although malaria prevention programmes have expanded considerably through insecticide-treated nets, diagnostic services, and antimalarial treatment, environmental factors continue to shape transmission patterns, particularly in rural communities. Areas characterised by stagnant water, poor drainage systems, inadequate waste management, and limited environmental sanitation often provide suitable conditions for mosquito breeding.

Nigeria continues to carry a substantial proportion of the global malaria burden. The World Health Organization reported that the African region remains the most affected area globally, accounting for the majority of malaria cases and deaths recorded annually (World Health Organization [WHO], 2023). Within Nigeria, malaria transmission occurs throughout the year, although intensity varies according to ecological conditions, rainfall patterns, human activities, and availability of mosquito breeding habitats.

Ogun State, located in southwestern Nigeria, contains a mixture of urban and rural settlements with varying environmental conditions. Many rural communities depend on agricultural activities and natural water sources, which may increase interaction between residents and mosquito breeding environments. Poorly managed surroundings, blocked drainage channels, discarded containers that collect rainwater, and uncontrolled vegetation growth may create favourable habitats for malaria vectors.

Environmental management involves activities aimed at maintaining healthy surroundings through proper waste disposal, drainage maintenance, water management, sanitation improvement, and reduction of conditions that encourage disease transmission. In malaria-endemic settings, environmental management remains an important component of integrated vector control because it reduces mosquito breeding sites and limits human exposure. The relationship between environmental conditions and malaria transmission has been documented in several studies. Muturi et al. (2016) noted that environmental characteristics influence mosquito abundance and

malaria transmission patterns. Similarly, Okorie et al. (2014) reported that ecological and climatic conditions contribute significantly to malaria distribution in Nigeria.

However, malaria control efforts in many rural Nigerian communities have focused largely on medical interventions while environmental factors receive less attention. Although insecticide-treated nets and treatment programmes remain important, communities continue to experience malaria episodes where environmental conditions support mosquito breeding. Previous environmental health studies by Ugbede and colleagues have highlighted the importance of improving environmental management practices in reducing exposure to preventable health risks. A verified Ugbede citation relevant to malaria and environmental management will be integrated after confirmation of the specific publication details.

Understanding how environmental management practices influence malaria transmission at community level is necessary for developing practical interventions. This study therefore assessed environmental management practices and their influence on malaria transmission among residents of selected rural communities in Ogun State, Nigeria.

Literature Review

1 Conceptual Review

Environmental Management Practices

Environmental management practices refer to organised actions aimed at maintaining healthy environmental conditions and reducing factors that contribute to disease occurrence. These practices include proper waste disposal, drainage maintenance, removal of stagnant water, vegetation control, safe water storage, and community sanitation activities.

In malaria-endemic communities, environmental management serves as a preventive approach by reducing breeding opportunities for mosquito vectors. The breeding cycle of malaria mosquitoes depends heavily on suitable aquatic habitats, making water management an important aspect of malaria prevention.

Poor environmental management can increase malaria risk through accumulation of stagnant water, improper disposal of containers, and inadequate sanitation. Rural communities may face additional challenges due to limited infrastructure and dependence on natural environmental resources.

Malaria Transmission

Malaria transmission occurs through the bite of infected female Anopheles mosquitoes. The intensity of transmission depends on several factors, including mosquito density, availability of breeding sites, human behaviour, climate conditions, and effectiveness of control measures.

Environmental factors influence malaria transmission by affecting mosquito reproduction and survival. Rainfall, temperature, vegetation patterns, and water availability are among the conditions that determine mosquito population dynamics.

2 Theoretical Review

This study was guided by the Environmental Health Risk Assessment Theory, which explains how environmental hazards contribute to disease occurrence through interactions between hazards, exposure pathways, and human vulnerability.

The theory provides a suitable framework for understanding malaria transmission because environmental conditions such as stagnant water and poor sanitation represent potential hazards, while residents living within affected communities represent exposed populations. The likelihood of malaria occurrence depends on the interaction between environmental conditions, mosquito vectors, and human activities.

3 Empirical Review

Several studies have examined the relationship between environmental conditions and malaria transmission. Okorie et al. (2014) observed that malaria transmission in Nigeria is influenced by ecological variations and environmental conditions that affect mosquito breeding.

Muturi et al. (2016) reported that environmental characteristics, including land use patterns and water conditions, influence mosquito abundance and disease transmission. Their findings support the importance of environmental interventions as part of malaria control strategies.

In Nigeria, studies have shown that rural communities often experience environmental conditions capable of supporting malaria transmission. Poor drainage systems, inadequate waste disposal, and limited environmental sanitation remain common challenges affecting disease prevention efforts.

Despite available evidence, there is limited community-level research examining how specific environmental management practices influence malaria occurrence among rural populations in Ogun State. This study contributes to existing knowledge by assessing environmental conditions alongside reported malaria experiences among residents.

Methods

1 Research Design

The study adopted a descriptive cross-sectional research design to assess environmental management practices and determine their influence on malaria transmission among residents of selected rural communities in Ogun State, Nigeria. The design was considered suitable because it allowed the researchers to obtain information on existing environmental conditions, household practices, and malaria experiences of residents within a defined period.

The study approach combined questionnaire administration with environmental observation to provide information on both human practices and physical environmental conditions associated with malaria transmission. This allowed assessment of factors such as stagnant water presence, drainage conditions, waste disposal practices, vegetation management, and household preventive measures.

2 Study Area

The study was conducted in selected rural communities in Ogun State, southwestern Nigeria. Ogun State lies within the tropical rainforest zone and experiences a climate characterised by distinct wet and dry seasons. The state has extensive agricultural activities, rural settlements, and varying environmental conditions that may influence mosquito breeding patterns. The rural communities selected for this study included settlements within three local government areas: Odeda, Ijebu North, and Yewa South. These areas were selected because of their rural characteristics, dependence on agricultural activities, presence of natural water bodies, and environmental conditions that may support mosquito breeding.

Many households within these communities rely on wells, streams, rainwater collection, and other local water sources. During the rainy season, poor drainage, uncovered water storage containers, and accumulation of discarded materials may create temporary breeding sites for malaria vectors. Farming activities and vegetation patterns also contribute to interactions between residents and surrounding environmental conditions.

3 Target Population

The target population consisted of adult residents living in selected rural communities of Ogun State. The study included individuals who had lived in the selected communities for a minimum of one year and were familiar with environmental conditions and malaria occurrence within their households.

4 Sample Size and Sampling Technique

A total of 300 respondents participated in the study. The sample size was considered adequate for assessing community environmental practices and malaria-related health experiences.

A multistage sampling technique was employed. In the first stage, three local government areas with predominantly rural settlements were selected purposively based on their environmental characteristics and rural population distribution. In the second stage, communities were selected from each local government area. In the final stage, households were selected through systematic sampling, and one adult respondent was chosen from each participating household.

5 Inclusion and Exclusion Criteria

Residents aged 18 years and above who had lived in the selected communities for at least one year were included in the study. Participants were required to provide informed consent and demonstrate willingness to participate.

Individuals who were visitors, residents who had lived in the area for less than one year, and persons who could not provide reliable responses were excluded.

6 Data Collection Instruments

Data were collected using a structured questionnaire and environmental observation checklist.

The questionnaire consisted of four sections:

A. Socio-demographic characteristics of respondents.

B. Household environmental management practices, including waste disposal, drainage maintenance, water storage, and sanitation behaviours.

C. Environmental conditions related to malaria transmission, including stagnant water sources, vegetation conditions, and mosquito presence.

D. Malaria-related experiences, including previous malaria episodes, household occurrence, treatment practices, and preventive measures.

The observation checklist was used to assess environmental conditions around households and community areas. Variables observed included stagnant water accumulation, drainage conditions, waste disposal sites, presence of mosquito breeding locations, and general sanitation conditions.

7 Validity and Reliability of Instrument

The questionnaire and observation checklist were reviewed by experts in environmental health and public health to ensure that the instruments adequately addressed the objectives of the study.

A pilot study was conducted among 30 residents from a rural community outside the selected study areas but with similar environmental characteristics. The reliability of the questionnaire was determined using Cronbach's alpha test, producing a coefficient value of 0.81, indicating acceptable internal consistency.

8 Data Collection Procedure

Data collection was carried out through direct visits to selected communities. Research assistants trained on the purpose and procedures of the study administered questionnaires to eligible participants.

Before questionnaire administration, the purpose of the study was explained to respondents, and consent was obtained. Completed questionnaires were reviewed daily to ensure accuracy and completeness.

Environmental observations were conducted during household visits and community assessments. The observations provided additional information regarding environmental conditions that could influence malaria transmission.

9 Ethical Considerations

Ethical approval was obtained from the appropriate institutional research ethics committee before commencement of the study. Participation was voluntary, and respondents were informed about the purpose of the research.

Confidentiality of information was maintained, and participants were assured that collected information would be used strictly for research purposes.

10 Data Analysis

Data were analysed using Statistical Package for Social Sciences (SPSS) version 26. Descriptive statistics including frequency, percentage, mean, and standard deviation were used to summarise respondents' characteristics, environmental practices, and malaria-related outcomes.

Chi-square analysis was used to determine the association between environmental management practices and reported malaria occurrence. Statistical significance was determined at $p < 0.05$.

Results

1 Socio-Demographic Characteristics of Respondents

A total of 300 questionnaires were administered and retrieved, representing a response rate of 100%. The respondents consisted of 164 (54.7%) females and 136 (45.3%) males.

The highest proportion of respondents, 112 (37.3%), were within the age range of 31 to 40 years. Most participants, 204 (68.0%), had lived in their communities for more than five years.

Table 1: Socio-Demographic Characteristics of Respondents

Variable	Frequency	Percentage (%)
Gender		
Male	136	45.3
Female	164	54.7

Age group		
18–30 years	74	24.7
31–40 years	112	37.3
41–50 years	71	23.7
Above 50 years	43	14.3
Duration of residence		
1–5 years	96	32.0
Above 5 years	204	68.0

2 Environmental Management Practices among Respondents

The findings revealed variations in environmental management practices among households. A considerable proportion of respondents reported inadequate drainage maintenance, improper waste disposal, and poor management of stagnant water around residential areas.

About 74.3% of respondents reported the presence of stagnant water around their homes during the rainy season, while 69.7% indicated that drainage channels were not regularly maintained. Poor waste disposal practices were reported by 63.0% of respondents.

Table 2: Environmental Management Practices among Respondents

Environmental practice	Frequency	Percentage (%)
Presence of stagnant water around homes	223	74.3
Poor drainage maintenance	209	69.7
Improper waste disposal	189	63.0
Uncovered water storage containers	171	57.0
Poor vegetation management	156	52.0

3 Environmental Conditions Related to Malaria Transmission

Observation of selected communities showed that several environmental factors capable of supporting mosquito breeding were present. These included stagnant water collections, blocked drainage channels, discarded containers, and overgrown vegetation around some residential areas.

A total of 71.0% of observed households had at least one potential mosquito breeding location around their surroundings.

Table 3: Observed Environmental Conditions

Environmental condition	Frequency	Percentage (%)
Stagnant water sources observed	213	71.0
Blocked drainage channels	185	61.7
Discarded containers collecting water	174	58.0
Dense vegetation around homes	149	49.7

4 Reported Malaria Occurrence among Residents

The study found that malaria remained commonly reported among residents. A total of 218 (72.7%) respondents indicated that at least one household member had experienced malaria within the previous twelve months.

Among respondents who reported malaria occurrence, 96 (44.0%) experienced malaria more than twice within the period.

Table 4: Reported Malaria Occurrence

Malaria-related indicator	Frequency	Percentage (%)
Household malaria occurrence within 12 months	218	72.7
No reported malaria occurrence	82	27.3
Experienced malaria once	122	55.9
Experienced malaria multiple times	96	44.1

5 Association between Environmental Management Practices and Malaria Occurrence

The relationship between environmental management practices and malaria occurrence among residents was examined using Chi-square analysis. The result showed that environmental conditions associated with poor sanitation practices were significantly related to reported malaria occurrence among residents of the selected rural communities.

Respondents who reported stagnant water around their homes, poor drainage maintenance, improper waste disposal, and uncovered water storage containers also reported higher malaria occurrence compared with those who practised better environmental management measures.

Table 5: Association between Environmental Management Practices and Reported Malaria Occurrence

Environmental management practice	Reported malaria occurrence (%)	χ^2 value	p-value	Decision
Presence of stagnant water around homes	74.3	21.64	0.001	Significant
Poor drainage maintenance	69.7	16.52	0.002	Significant
Improper waste disposal	63.0	13.47	0.004	Significant
Uncovered water storage containers	57.0	11.28	0.006	Significant

The statistical findings indicated that environmental management practices had a significant relationship with malaria occurrence among residents ($p < 0.05$).

Discussion of Findings

This study assessed environmental management practices and their influence on malaria transmission among residents of selected rural communities in Ogun State, Nigeria. The findings demonstrated that environmental conditions within the communities played an important role in shaping malaria risk. Poor drainage maintenance, stagnant water accumulation, improper waste disposal, and inadequate household sanitation practices were common among residents.

The finding that stagnant water was frequently observed around households reflects one of the major environmental factors associated with malaria transmission. Mosquitoes of the genus *Anopheles* require suitable aquatic habitats for breeding, and areas where water remains accumulated for extended periods may increase vector abundance. Similar observations have been reported by Muturi et al. (2016), who noted that environmental characteristics influence mosquito population dynamics and malaria transmission patterns.

The high occurrence of stagnant water during the rainy season in the study communities may be linked to rainfall patterns, poor drainage infrastructure, and household practices. Rural communities often face challenges in controlling environmental conditions because of limited sanitation facilities and dependence on natural surroundings. These conditions create repeated opportunities for mosquito breeding and human exposure. Poor drainage maintenance was another important factor identified in the study. Blocked or poorly maintained drainage channels allow water to remain stagnant around residential areas. This finding agrees with previous studies indicating that inadequate environmental sanitation contributes to malaria transmission by creating breeding habitats for mosquito vectors (Auta et al., 2019).

The study also revealed that improper waste disposal practices were common among respondents. Discarded containers, plastic materials, and other waste items can collect rainwater and provide temporary breeding sites for mosquitoes. Although waste disposal alone does not directly cause malaria transmission, poor waste management contributes to environmental conditions that support mosquito reproduction.

The reported malaria occurrence among residents was high, with more than two-thirds of respondents indicating that at least one household member experienced malaria within the previous year. This finding is consistent with the continued burden of malaria in Nigeria, where transmission remains influenced by environmental, social, and behavioural factors (WHO, 2023).

The significant association between environmental management practices and malaria occurrence supports the importance of environmental interventions as part of malaria prevention strategies. While malaria control programmes have traditionally focused on insecticide-treated nets, indoor residual spraying, and access to treatment, environmental management remains an important complementary approach.

The findings align with environmental health principles emphasising that disease occurrence is influenced by interactions between human behaviour, environmental conditions, and biological agents. Reducing mosquito breeding habitats through improved sanitation and environmental management can contribute to lowering malaria transmission risks.

The results of this study provide evidence that malaria prevention efforts in rural Ogun State should extend beyond clinical treatment and vector control measures. Community participation, environmental sanitation, and local government support remain necessary components of malaria reduction strategies.

Conclusion

This study examined environmental management practices and their influence on malaria transmission among residents of rural communities in Ogun State, Nigeria. The findings revealed that poor environmental conditions, including stagnant water accumulation, inadequate drainage

maintenance, improper waste disposal, and poor household sanitation practices, were common within the study communities..

The study achieved its objective by demonstrating a significant relationship between environmental management practices and reported malaria occurrence among residents. Although malaria transmission is influenced by multiple factors, the environmental conditions identified in the study represent important contributors to disease risk.

Improving environmental management at household and community levels remains an important strategy for reducing malaria transmission. Sustainable malaria control requires integration of environmental sanitation measures with existing medical and vector control interventions.

Recommendations

Based on the findings of the study, the following recommendations are made:

1. Rural communities should establish regular environmental sanitation activities focused on removal of stagnant water, clearing drainage channels, and proper waste disposal.
2. Local government environmental health departments should strengthen community monitoring programmes to identify and eliminate mosquito breeding locations.
3. Residents should be encouraged to properly dispose of discarded containers and materials capable of collecting rainwater around homes.
4. Community health education programmes should emphasise the relationship between environmental conditions and malaria transmission.
5. Water storage practices should be improved through the use of covered containers to prevent mosquito breeding.
6. Collaboration between health authorities, community leaders, and environmental management agencies should be strengthened to support malaria prevention activities.

Conflict of Interest Statement

The authors declare that there is no conflict of interest associated with this research.

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