

Urbanization and Malaria Transmission in Imo State, Nigeria: An Epidemiological Study

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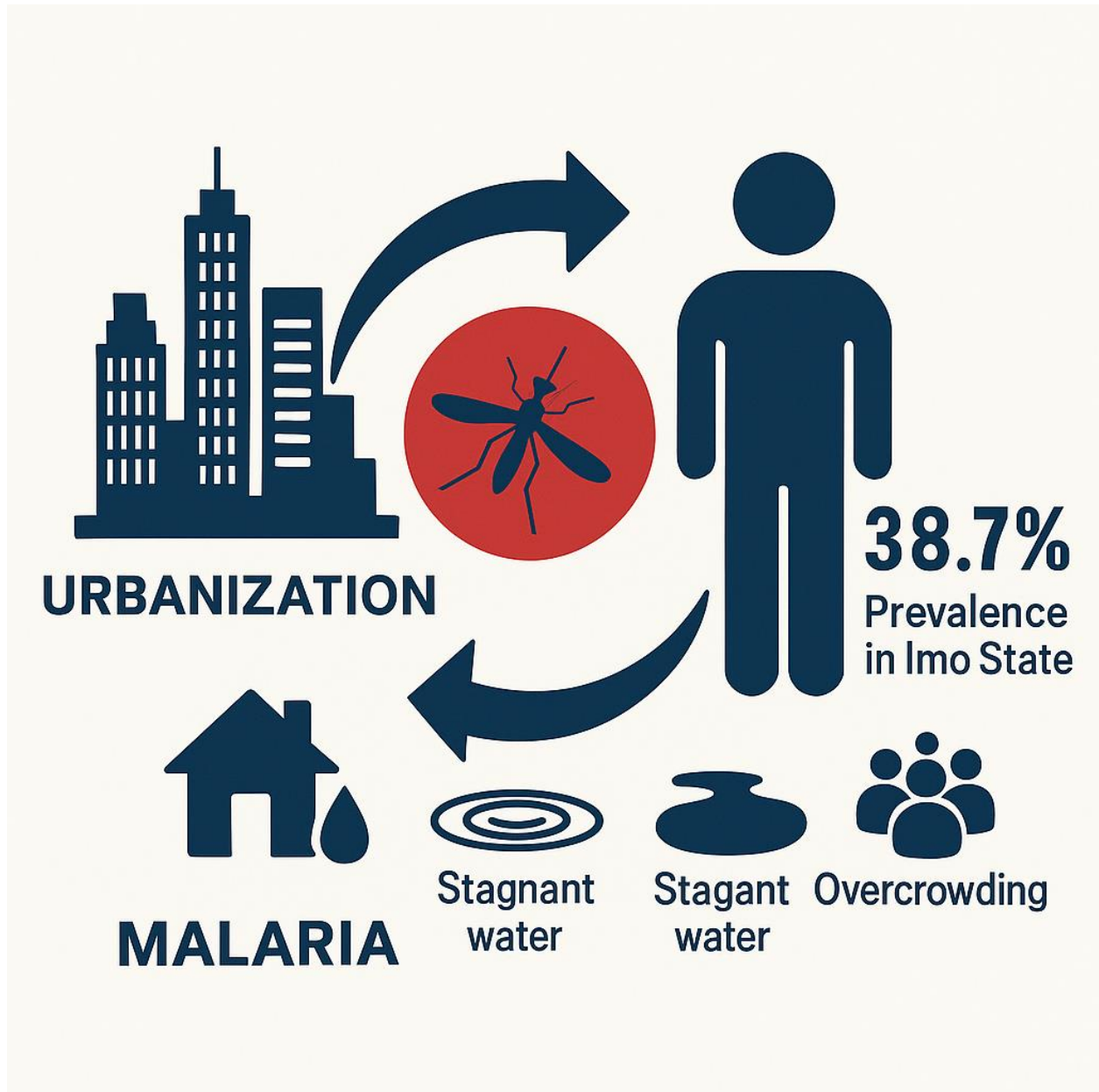
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Abstract

Malaria remains a major public health burden in sub-Saharan Africa, and the rapid pace of urbanization is reshaping its transmission patterns. This study investigated the relationship between urbanization and malaria prevalence in selected urban centers of Imo State, Nigeria—Owerri, Orlu, and Okigwe. A hospital-based cross-sectional survey was conducted among 600 randomly selected participants. Data were obtained through structured questionnaires assessing demographic and environmental variables, while venous blood samples were analyzed using rapid diagnostic tests (RDTs) and microscopy for malaria detection. The overall malaria prevalence was **38.7%**, with males (41.5%) showing higher infection rates than females (36.0%). Age-specific analysis revealed that **children under five years** and **young adults (20–39 years)** were the most affected groups. Environmental risk factors such as **poor drainage systems, stagnant water, and overcrowded living conditions** were significantly associated with higher malaria incidence. The findings demonstrate that unplanned urban growth, coupled with inadequate sanitation and poor housing, contributes to sustained malaria transmission within urban settings. The study concludes that effective malaria control in urbanized areas requires a multidisciplinary approach that integrates **urban planning, environmental management, and public health interventions**. Strengthening community awareness and improving urban infrastructure are essential steps toward reducing malaria transmission and achieving sustainable disease control in Imo State and similar urban environments across Nigeria.

Keywords: Urbanization, Malaria Transmission, Environmental Factors, Public Health, Imo State



Introduction

Particularly in sub-Saharan Africa, malaria still ranks among the most important public

health problems worldwide in tropical and subtropical areas. Malaria is mostly brought

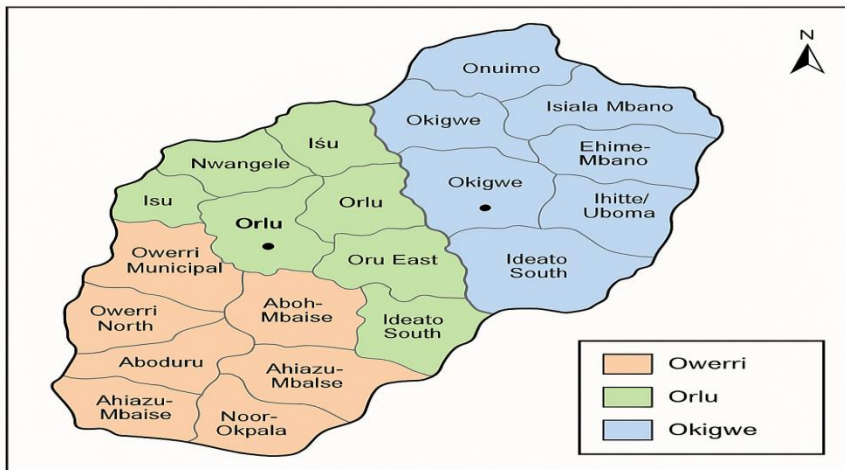
on by *Plasmodium falciparum*, the strain most linked to major morbidity and mortality (World Health Organization [WHO], 2020), transmitted through infected *Anopheles* mosquitoes. With children under five and expectant mothers disproportionately affected, Nigeria bears a disproportionate burden—approximately 27% of worldwide malaria incidence and 31% of malaria-related fatalities. being the most susceptible (Severe Malaria Observatory, 2024).

Once thought of as a rural disease, malaria is becoming more common in cities as fast, sometimes unplanned, urbanization throughout Africa changes demographics. According to United Nations 2018 data, almost 70% of Africans are projected to live in urban areas by 2050. Migration and infrastructural development propelled urban growth in Imo State, Nigeria in line with this trend. Unregulated development promotes Persistent transmission is aided by informal settlement conditions,

waste buildup, stagnant water, and bad drainage (Doumbe Belisse et al., 2021). Moreover, vector species like *Anopheles arabiensis* have evolved to reproduce in contaminated urban water bodies (Oduola et al., 2007; Sogbedji et al., 2024), therefore previous ideas on urban malaria risk.

This duality is exemplified in Imo State. Rapidly growing cities include Owerri, Orlu, and Okigwe, but they remain hindered by traffic, poor sanitation, and infrastructural deficiencies sustaining malaria. Constant rural–urban migration brings new parasite reservoirs that hinder management attempts. Though national and regional statistics are available, there is a lack of epidemiological data and spatial analysis unique to Imo State, therefore restricting targeted intervention planning.

Methodology



Map of Imo State showing Owerri, Orlu and Okigwe zones

Figure 1. Geographical map of Imo State, Nigeria, depicting the three geopolitical zones and study local government areas (Owerri Municipal, Orlu, Okigwe), major rivers (Imo, Njaba, Otamiri), and principal roads. Scale bar included.

(Adapted from sources on Imo geography, river basins, and political boundaries)

The study was carried out in Imo State, southeastern Nigeria ($4^{\circ}45'N-7^{\circ}15'N$, $6^{\circ}50'E-7^{\circ}25'E$), three political zones: Owerri, Orlu, and Okigwe covering around 5,100 km². Chosen from each of Owerri Municipal, Orlu, and Okigwe, one urban Local Government Area (LGA) was selected from each zone. Ranging from 22°C to 30°C, the state features an annual rainfall of around 2,000 mm,

and its vegetation is mostly tropical rainforest (Nigerian Meteorological Agency [NiMet], 2021).

The Imo State University's Institutional Ethics Committee, the State Ministry of Health, and pertinent local health agencies all approved ethics. After the Declaration of Helsinki (World Medical Association, 2013), informed consent was acquired and secrecy was preserved.

Between April and July 2024, a cross-sectional hospital-based survey was carried out in Owerri Specialist Hospital, Orlu Teaching Hospital, Okigwe General Hospital (including Ivory Clinic). Regardless of age, a total of 600 people were recruited—200 per zone. Lemeshow et al.'s (1990) formula for population studies at a 95% confidence

level was used to determine the sample size. Along with venous blood sampling, data gathering comprised arranged questionnaires on demographic, socioeconomic, and behavioral characteristics. Within 72 hours, around 5 ml of venous blood was gathered into EDTA vials for malaria diagnosis using Car eStart™ Malaria Pf (HRP2) Ag. Microscopy and quick diagnostic tests (Access Bio, 2020). 10% staining of all slides was performed after thick and thin smears were created and thin

films were methanol-fixed. Using procedures suggested by the WHO, parasite density was determined before being seen under oil immersion following 10 minutes of giemsa. A senior microscopist reviewed all positive slides and 10% of negative slides as quality assurance. STATA version 17 (StataCorp, 2021) was used to analyze data in order to investigate links between urbanisation-related variables and malaria prevalence.

Results

Table 1

Migrants accounted for 41.2% of respondents across the three study areas; non-migrants made up

58.8%. Owerri had the highest migration at 50%, followed by Orlu at 42.5% and Okigwe at 31%.

Migration Patterns of Respondents across Urban Zones of Imo State

Zone	Migrants, n (%)	Non-migrants, n (%)	Total, n
Orlu	85 (42.5)	115 (57.5)	200
Okigwe	62 (31.0)	138 (69.0)	200
Owerri	100 (50.0)	100 (50.0)	200
Total	247 (41.2)	353 (58.8)	600

Table 2

63.4% of respondents lived in places with poor drainage; 57.1% resided in unpaved

streets; 52.6% lived close to stagnant water. Orlu exhibited most severe manifestations of these circumstances.

Housing and Environmental Conditions in the Study Zones

Condition	Orlu n (%)	Okigwe n (%)	Owerri n (%)	Total n (%)
Poor drainage	140 (70.0)	108 (54.0)	132 (66.0)	380 (63.4)
Unpaved streets	125 (62.5)	104 (52.0)	114 (57.0)	343 (57.1)
Stagnant water nearby	118 (59.0)	97 (48.5)	100 (50.0)	315 (52.6)

Table 3:

Malaria infestation was confirmed in 38.7% of subjects by

microscopy. Males (41.5%) had a prevalence higher than that of females (36.0%). The highest prevalence rates were seen in children under 5 and adults 20–39.

Prevalence of Malaria by Sex and Age Group

Category	Examined n	Positive n (%)
Sex		
Male	300	124 (41.5)
Female	300	108 (36.0)
Age group		
<5 years	80	39 (48.8)
5–19 years	140	55 (39.3)

Category	Examined n	Positive n (%)
20–39 years	200	86 (43.0)
≥40 years	180	52 (28.9)
Total	600	232 (38.7)

Discussion

This research emphasizes how important urbanization is in maintaining malaria transmission in Imo

State. Collectively, Anopheles mosquitoes benefit from migration, poor drainage, unpaved roads, and still water as suitable breeding grounds.

Comparable results have been observed in African urban centers, where quick, unchecked development compromises malaria control programs (Doumbé Belisse et al., 2021; Sogbedji et al., 2024).

Observed gender variations in malaria prevalence and preventative behaviors represent both biological susceptibility and cultural roles. Men had greater infection rates, yet women showed more awareness and use of preventative measures. This fits research showing that women—especially mothers—are more involved in household malaria prevention (Nankabirwa

et al., 2010).

Consistent with national trends (Severe Malaria Observatory, 2024), young adults and kids under five were most impacted. This underlines the need for focused initiatives, especially in companies with large young adult populations and in daycare facilities. The results make clear that urban malaria is not only a medical issue but also a socioeconomic-environmental one. Good management calls for the merging of epidemiological monitoring with urban design, drainage networks, and waste management.

Public Health Implications

1. Urban Planning: Reducing mosquito breeding grounds requires improvement of trash disposal and drainage systems in urban areas.
2. Programs should use women's preventive health habits while also acknowledging men's

s higher risk of exposure with gender-sensitive interventions.

3. Campaigns aimed specifically at migrants and informal settlement residents, who are at greater risk, should drive community-based health education.

4. Maintaining dual diagnostic techniques (RDT and microscopy) will help hospitals to be accurate.

According to the study, urbanization via bad housing, overcrowding, and environmental hazards greatly affects malaria transmission in Imo State. Dealing with urban malaria calls for a multidisciplinary strategy including public health policy, urban design, and epidemiology. For Imo State, this study offers baseline information and asks for integrated programs to help to lower the increasing urban malaria burden.

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