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ENVIRONMENTAL AND CAREGIVER DETERMINANTS OF CHILDHOOD MALARIA IN YENAGOA PRIMARY CARE FACILITIES

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Introduction

Malaria remains a major public health challenge in sub-Saharan Africa, with Nigeria contributing substantially to the global burden. Children are particularly vulnerable to malaria and its complications, while transmission in riverine and flood-prone environments may be sustained by environmental conditions, household practices and health-system constraints. In Yenagoa, Bayelsa State, perennial flooding, inadequate drainage, stagnant water, vegetation and irregular waste disposal may create conditions favourable to mosquito breeding. Caregiver knowledge and practices, socioeconomic circumstances and access to timely diagnosis and treatment may further influence malaria prevention and case management. Although national malaria surveys provide important population-level estimates, they provide limited information on the interaction between household environmental conditions, caregiver practices, and primary healthcare readiness within specific Niger Delta communities (Morufu *et al.,* 2021; Vivian & Morufu, 2026; Jennifer *et al.,* 2026; German *et al.,* 2026; Oyintonyo *et al.,* 2026). This study therefore integrated malaria case data, household environmental assessment, caregiver knowledge-attitudes-practices (KAP), and primary healthcare facility assessment to characterize potentially modifiable determinants of malaria prevention and treatment in Yenagoa. The study aimed to characterize malaria case burden and describe environmental, caregiver, socioeconomic, and health-system factors relevant to malaria prevention and treatment among children attending selected primary healthcare (PHC) facilities in Yenagoa Local Government Area, Bayelsa State. Specifically, it assessed the distribution of malaria cases, environmental risk conditions, reported health and well-being indicators, caregiver KAP and treatment-seeking behaviour, and healthcare-worker and facility-level barriers to malaria diagnosis and treatment. Because the supplied dataset does not

provide the total number of children tested or the number testing negative, a population prevalence estimate could not be validly calculated; the analysis therefore focuses on case distribution and associated characteristics rather than malaria prevalence.

Methodology

A descriptive cross-sectional study incorporating quantitative and qualitative components was conducted in selected PHC facilities in Yenagoa LGA. Caregivers of children attending participating facilities and healthcare workers involved in malaria case management were included. The original sampling plan involved six wards and one functional PHC per ward, with systematic recruitment of eligible caregivers. The Cochran calculation produced a target sample of 417 caregivers after adjustment for non-response; however, only 140 caregiver–child pairs were available for the present analysis. Consequently, estimates derived from these 140 pairs should be interpreted as describing the analysed sample and should not be generalized to the wider Yenagoa population without appropriate qualification. Caregiver information was collected using a structured questionnaire adapted from the Roll Back Malaria Monitoring and Evaluation Reference Group framework. A facility assessment checklist based on the WHO Service Availability and Readiness Assessment approach documented malaria commodities, diagnostic capacity, staffing, infrastructure and referral arrangements. Healthcare-worker information was obtained through key-informant interviews. Questionnaires were administered face-to-face in English and Pidgin English, while facility information was obtained through observation, inventory checks, and record review. Knowledge, attitude, and practice scores were standardized to 0–100 scales. Internal consistency of the relevant instrument was reported as acceptable (Cronbach's $\alpha = 0.78$). Descriptive statistics included frequencies, percentages, means, and standard deviations. Chi-square tests were used for categorical associations. Multivariable logistic regression was used to examine predictors of adequate knowledge and adequate practices. Although a mixed-effects model with PHC as a random intercept was specified, only three PHCs contributed case data; therefore, facility-level variance and intraclass correlation estimates should be interpreted cautiously because three clusters provide limited information for reliable random-effects estimation. Key-informant interviews were analysed thematically. Statistical significance was set at $P < 0.05$, and ethical approval and written informed consent were obtained.

Results

A total of 280 malaria case records were reported across three PHCs between January and June. These records should not be interpreted as 280 unique children unless deduplication was confirmed. Among the 140 caregiver–child pairs available for the individual-level analysis, the reported age distribution was 20.0% aged 0-1 year, 39.3% aged 2-5 years, 24.3% aged 6-9 years and 16.4% aged 10-12 years. This distribution demonstrates an important inconsistency with the stated under-five study population: 40.7% of the analysed children were aged ≥6 years. Accordingly, the findings are reported for the analysed children rather than being described exclusively as an under-five population. Sex distribution was approximately balanced (51.4% male and 48.6% female). Ovom PHC recorded 107 of the 280 reported cases (38.2%), followed by Okutukutu with 88 (31.4%) and Swali with 85 (30.4%). Reported monthly counts increased from 45 cases in January to 62 in June, with 58 cases in May. However, because counts for February-April and corresponding rainfall or meteorological measurements were not provided, a progressive temporal increase or seasonal relationship cannot be statistically established from the reported data alone. Environmental conditions potentially favourable to malaria transmission were common among assessed households, including poor drainage (64.3%), stagnant water around homes (60.7%), irregular waste disposal (53.6%) and overgrown vegetation near residences (51.4%). Among malaria-positive children, 72.9% reportedly experienced fever for at least three days before treatment, 41.4% had haemoglobin below 11 g/dL, 26.4% had been admitted to hospital during the preceding three months, 31.4% reportedly missed at least five school days and 35.0% reported more than two malaria episodes during the preceding six months. These indicators describe morbidity and reported consequences but do not establish that malaria alone caused the observed outcomes. Mean caregiver

knowledge, attitude and practice scores were 72.4 (SD 15.8), 76.1 (SD 14.2) and 63.5 (SD 17.6), respectively. Adequate knowledge was reported for 57.9%, favourable attitudes for 65.0% and adequate practices for 42.1% of caregivers. LLIN ownership was 75.0%, compared with 62.1% reporting use on the previous night. Care-seeking within 24 hours of fever onset was reported by 47.9%, diagnostic confirmation before treatment by 54.3%, and completion of the prescribed ACT course by 67.9%. Traditional or herbal remedies were reported as the first response by 29.3%. In adjusted analyses, secondary or higher caregiver education (aOR 2.3, 95% CI 1.2-4.2; P = 0.01), higher household wealth (aOR 1.8, 95% CI 1.0-3.3; P = 0.046) and recent exposure to health education (aOR 2.6, 95% CI 1.4-4.9; P = 0.002) were associated with higher odds of adequate knowledge. Adequate knowledge (aOR 3.0, 95% CI 1.6-5.6; P < 0.001) and secondary or higher education (aOR 1.9, 95% CI 1.0-3.5; P = 0.036) were associated with adequate practices, whereas reported use of traditional remedies as a first action was associated with lower odds of adequate practices (aOR 0.45, 95% CI 0.24-0.86; P = 0.015). Given the small number of PHCs, these adjusted estimates should be interpreted as associations within the analysed sample rather than definitive population-level effects. Treatment-seeking responses indicated that 62.0% of caregivers identified public PHCs as their first point of care, 25.0% used patent medicine vendors, 8.0% used home-based remedies, and 5.0% used private clinics or pharmacies. Reported facility barriers included ACT and RDT supply interruptions, requests for caregivers to purchase medicines externally, staffing limitations, inadequate recent refresher training, limited ITN availability, cold-chain deficiencies, poor waiting-area conditions, prolonged waiting times, informal charges and weak referral arrangements. Because the denominators underlying the reported facility percentages were not specified, these figures should be interpreted as reported facility-assessment indicators rather than population estimates. The analysis identifies a substantial gap between caregiver knowledge and reported preventive practices. LLIN ownership exceeded reported previous-night use, while fewer than half of caregivers reported seeking care within 24 hours of fever onset. Environmental conditions conducive to mosquito breeding were also frequently reported. Higher caregiver education, household socioeconomic position, and recent health education were associated with better knowledge, while knowledge itself was strongly associated with reported preventive practices. Traditional-remedy use was inversely associated with adequate practices. However, the cross-sectional design prevents determination of causality, and the available data do not establish that environmental exposures caused individual malaria infections.

Conclusion

The findings indicate that malaria case management and prevention in the assessed Yenagoa facilities occur within a complex context of household environmental risks, caregiver knowledge-practice gaps, socioeconomic differences, and health-system constraints. The analysis supports the importance of improving LLIN utilization, timely care-seeking, diagnostic confirmation, and access to effective treatment. However, the results should be interpreted cautiously because only 140 caregiver–child pairs were analysed against a planned sample of 417, three PHCs contributed facility-level case data, and the reported age distribution extends beyond the stated under-five population. Most importantly, malaria prevalence cannot be estimated from the supplied dataset without a denominator comprising children tested or assessed for malaria. Future analyses should resolve these denominator, age-eligibility, and clustering issues before making population-level prevalence or causal claims. Malaria interventions in Yenagoa should combine caregiver-focused behavioural communication with practical measures to improve consistent LLIN use and prompt care-seeking. Community environmental management should prioritize drainage improvement, reduction of stagnant water, and improved waste management in high-risk residential areas. PHCs should strengthen uninterrupted availability of recommended antimalarial medicines and diagnostic commodities, staff training, referral systems, and essential infrastructure. Engagement with patent medicine vendors may also improve early referral and appropriate treatment pathways. Future studies should use a clearly defined denominator for prevalence estimation, ensure consistency between eligibility criteria and reported age groups, distinguish unique children from repeated malaria case records, and document the number of individuals tested and testing results. Larger

multisite studies with substantially more PHCs should be used for facility-level multilevel modelling. Longitudinal designs incorporating rainfall, flooding, mosquito-density, and environmental measurements would be better suited to evaluating seasonal transmission. Qualitative research should also be undertaken to examine cultural beliefs and household decision-making processes in greater depth.

References

German, I. C., Oghenekewve, J. J., Olalekan, R. M., & Bibi, O. J. (2026). *Heterogeneous facility-level malaria prevalence change following R21/Matrix-M vaccine roll-out is independent of vaccine dose coverage: A retrospective analysis in Ogbia, Niger Delta, Nigeria*. Preprints. https://doi.org/10.20944/preprints202609.0689.v1

Morufu, O. R., Aziba-anyam, G. R., & Teddy, C. A. (2021). *'Silent pandemic': Evidence-based environmental and public health practices to respond to the COVID-19 crisis*. IntechOpen. https://doi.org/10.5772/intechopen.100204

Oghenekewve, J. J., Charles German, I., Joy Bibi, O., & Morufu Olalekan, R. (2026). *R21/Matrix-M malaria vaccine uptake and dose completion among rural Niger Delta children*. Preprints. https://doi.org/10.20944/preprints202609.0523.v1

Oyintonyo Michael-Olomu, O., Uzobo, E., Baratuaipre, R. J., *et al.* (2026, August 27). *Environmental exposure to crude oil pollution is associated with under-five morbidity and mortality in Nigeria's Niger Delta* [Preprint]. Research Square. https://doi.org/10.21203/rs.3.rs-10157384/v1

Vivian, I. P., & Morufu, O. R. (2026). *Determinants, barriers, and completion patterns of routine childhood immunization in Bayelsa State, Nigeria*. medRxiv. https://doi.org/10.64898/2026.05.20.26353707