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Role Model Caregivers Intervention for Home Management of Childhood Malaria in Rural Community of Rivers State, Nigeria: A Community-Based Study

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ABSTRACT

Background: Malaria remains a major cause of childhood morbidity and mortality in Nigeria. Despite improved access to prevention and treatment, delayed care-seeking and inappropriate home management persist. This study assessed the effect of Role Model Caregivers (RMC) training on malaria knowledge and home management practices under-fives in rural communities of Rivers State, Nigeria.

Methods: A quasi-experimental study was conducted between November 2023 and February 2024 in Usokun (intervention) and Tema (control) communities. A total of 420 caregivers (210 per group) were recruited. Selected caregivers were trained as RMCs to provide malaria education. Outcomes were malaria knowledge and home management practices. Knowledge was measured using a composite score on symptoms, transmission, prevention, and treatment. At the same time, practices were assessed based on reported actions during the most recent febrile episode, including drug use, timing, and referral. Data were analysed using SPSS v27, with logistic regression used to identify predictors.

Results: Most caregivers were women (95.0%), aged 20–39 years (mean 31.8 ± 7.4 years). Adequate malaria knowledge increased from 45.7% to 87.6%, and correct home management improved from 42.9% to 81.9% ($p < 0.001$). Predictors of correct home management were RMC training (AOR = 5.62; 95% CI: 3.21–9.83), higher education (AOR = 2.45; 95% CI: 1.18–5.11), and good malaria knowledge (AOR = 3.09; 95% CI: 1.58–6.04).

Conclusion: RMC training markedly improved caregivers' knowledge of malaria and home management, endorsing a sustainable, community-driven approach to early malaria treatment in a rural community of Rivers State.

Keywords: Malaria; Role Model Caregivers; Home Management; Rivers State

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INTRODUCTION

Malaria remains one of the most persistent threats to global child health, particularly in sub-Saharan Africa, where transmission is intense and perennial. The World Health Organization (WHO) estimated that in 2023, there were about 249 million malaria cases and 608,000 deaths globally, with children under five years accounting for most deaths. Africa bears approximately 94% of this burden, and Nigeria contributes the highest number of cases and deaths, making it the epicentre of the malaria challenge.[1] The disease thus remains an important indicator of inequality, poverty, and limited access to effective care.[2]

Despite national progress in malaria control, major gaps persist. The 2021 Nigeria Malaria Indicator Survey reported that although household ownership of insecticide-treated nets improved, fewer than half of febrile children receive artemisinin-based combination therapy (ACT) within 24 hours.[3] Delay in treatment allows uncomplicated malaria to progress to severe illness, anaemia, or death.[4] Strengthening a timely home-based response remains essential.

In Nigeria, caregivers, mainly mothers and grandmothers, are often the first to respond to a child's fever. Their ability to recognise symptoms, administer ACT correctly, and seek prompt referrals determines survival. Yet, studies consistently show that caregivers have poor knowledge, misconceptions, and a dependence on informal providers.[5,6] These gaps hinder effective home management and timely care-seeking.

Community-driven strategies such as integrated community case management (iCCM), home-based management of malaria (HMM), and the Role Model Caregiver (RMC) concept have emerged as cost-effective ways to expand access to timely care.[7,8] However, adherence to national treatment guidelines in Nigeria remains inconsistent, and reliance on untrained patent medicine vendors persists.[9,10] Caregiver behaviour is shaped by socio-economic, educational and geographical factors: recent work in rural Nigeria shows that maternal education and household wealth significantly influence malaria prevention and treatment behaviours.[11]

In Rivers State, persistent flooding, inadequate drainage, and limited access to healthcare sustain transmission of malaria and delay treatment. Empowering caregivers with the skills to promptly and appropriately manage malaria at home could save lives, particularly in rural areas. The RMC model, which trains respected caregivers to mentor peers, leverages community trust and practical demonstrations to build sustainable change.

This study, therefore, assessed the effect of RMC training on caregivers' knowledge of malaria and home management in a rural community of Rivers State. It also examined predictors of correct home management, such as education, exposure to mentoring, and knowledge level, aligning with WHO and Nigeria's malaria elimination strategies.[12]

METHODOLOGY

Study Design

A quasi-experimental, community-based pre-and post-intervention design was used to assess the effect of training community Role-Model Caregivers (RMCs) on caregivers' knowledge and home management of malaria in children under five years.

Study Area

The study was conducted in two malaria-endemic rural communities in Rivers State, Nigeria: Usokun in Degema Local Government Area, the intervention community, and Tema in Asari-Toru Local Government Area, the control community. The communities are about three kilometres apart. This ensured no contamination of participants. The communities experience perennial malaria transmission due to high rainfall, poor drainage, and mosquito breeding in stagnant water. Access to health facilities is limited, and most residents depend on primary healthcare centres, patent medicine vendors, and community health volunteers for healthcare services. The population primarily engages in fishing and petty trading.

Study Population

The study population consisted of caregivers living with children under five years of age who had resided in the communities for at least 12 months before the data collection.

Inclusion and Exclusion Criteria

Inclusion criteria:

1. Caregivers of children under five years old who resided in the community for at least 12 months.

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2. Caregivers aged 18 years or older who gave informed consent.

Exclusion criteria:
1. Caregivers who participated recently in a similar malaria intervention study.
2. Caregivers with a child reported to have other significant co-morbidities such as Sickle Cell Anaemia.
3. Caregivers who were not psychologically fit to participate in the study.

Sample Size Determination
The study aimed to detect a 20-percentage point increase in the proportion of caregivers who correctly initiate appropriate home management of malaria within 24 hours (from 45% to 65%).
Sample size was calculated using the formula for comparing two independent proportions as follows: [14]

$$n/group = \frac{(Z\alpha/2 + Z\beta)^2 \times [(p1(1-p1) + p2(1-p2)]}{(p1-p2)^2}$$

Where n = minimum sample size.
Z α/2 = Critical value at 95% confidence interval=1.96.
Z β = For a power of 80%, and Critical value=0.84.
(p 1 − p 2) (p 1 −p 2) = the minimum meaningful difference to detect.

$$n = \frac{(1.96+0.84)^2 \times (0.45 \times 0.55 + 0.65 \times 0.35)}{(0.45-0.65)^2}$$

$$= \frac{3.832499}{0.04}$$

= 95.812475 ≈ 96 per group (minimum).

Adjustments and Final Sample Size
To account for field realities, the following adjustments were applied:
a) **Assume a 10% attrition rate:** 96/0.9 = 106.7 ≈ 107 per group.
b) **Design effect (DEFF) for clustering**
Applying a conservative DEFF of 1.8= 107 × 1.8 = 190.8 = 192.6 ≈ 193 per group.
c) **Operational rounding for modelling:**
Rounding to 200 per group to ensure stable multivariable estimates
d) **Operational buffer (5%):**
200 × 1.05 = 210 per group
Final total sample size:
n_(total)= 210 × 2 = 420 caregivers (210 per group)
Notes:
(a) The effect size (20 percentage points) was chosen as a programmatically meaningful target informed by prior community interventions.[13]
(b) The design effect (1.8) is conservative because the intraclass correlation (ICC) and average cluster size are not known.
(c) Rounding is conservative to ensure an adequate sample for subgroup analyses and multivariable modelling.

Sampling Technique
A multistage sampling technique was used.
Stage 1: was the random selection of two Local Government Areas (LGAs) from the 21 rural LGAs of Rivers State by balloting.
Stage 2: involved assigning serial numbers to all wards within each selected LGA and choosing one ward from each LGA by simple random sampling through balloting.
Stage 3: This involved selecting one community from a list of all the communities, serially numbered within the chosen ward in each of the study LGAs, using computer-generated random numbers.
Stage 4: Household lists were obtained from Community Health Extension Workers' registers and served as the sampling frame for participant selection.
Stage 5: Systematic random sampling was employed to select eligible households. Every third household with at least one child under five years old was chosen until the desired sample size was reached. If a selected household did not have an eligible child, the neighbouring household was selected instead.

Selection of participants
The participants were selected as shown in the CONSORT flow diagram (Figure 1).

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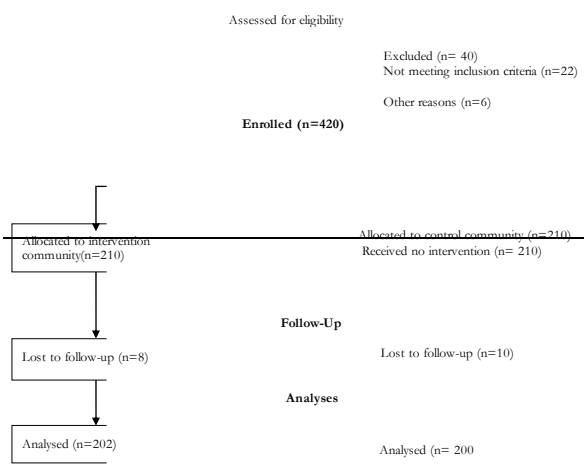

The Intervention

In the intervention community (Usokun), six Role-Model Caregivers (RMCs) were nominated by community leaders based on their reputation, caregiving experience, and commitment to community service. The RMCs received a four-day modular training developed from the WHO Malaria Case Management and Home Management Module and adapted to the local context.[15]

Training modules included:

(1) Overview of malaria epidemiology, transmission, and vector control.
(2) Recognition of malaria symptoms and danger signs.
(3) Correct home administration of ACTs and adherence monitoring.
(4) Indications for referral and emergency care.
(5) Communication and mentoring techniques for peer education.

Each RMC was assigned 35 households for peer education and monthly follow-up sessions for three months. The control community (Tema) did not receive the intervention during the study period but was trained afterwards as part of ethical reciprocity.

Data Collection Instrument

Data were collected using a structured, interviewer-administered questionnaire. The tool was adapted from the WHO Malaria Case Management and Home Management Module.[15] and validated questionnaires used in previous Nigerian studies on malaria knowledge and home treatment practices.[16-18]

The instrument contained four sections:

Section A: Socio-demographic characteristics.
Section B: Knowledge of malaria causation, symptoms, prevention, and treatment.
Section C: Home management practices, including drug type, dosage, source, and referral behaviour.
Section D: Exposure to health information and intervention sessions.

Validity and Reliability

Content validity: The questionnaires were reviewed by three experts in malaria and epidemiology for clarity and relevance. The dataset was further validated using the validation function in SPSS version 27.

Internal reliability: This was measured using Cronbach's alpha, with $\alpha \geq 0.70$ considered acceptable. A pre-test with 20 caregivers from a neighbouring community (not included in the main study) also confirmed the reliability and clarity of the instrument.

Data Collection Procedure

Data collection was conducted in two phases: baseline (November 2023) and post-intervention (February 2024), using the same instrument and four trained research assistants. Interviewers were trained for two days on ethical conduct, confidentiality, and questionnaire administration. Two supervisors reviewed completed forms daily for completeness and accuracy.

Data Management and Statistical Analysis

Data were entered electronically into a password-protected Statistical Product and Service Solution (SPSS) Version 27 (Armonk, NY: IBM Corporation) database, with backup copies stored on an external drive accessible only to the principal investigator. All records were de-identified before analysis by removing personal identifiers and assigning unique study identification codes to each participant.

Data was analysed with SPSS version 27.

Normality testing: Continuous variables were checked using the Shapiro–Wilk test.

Descriptive statistics: Categorical variables were presented as percentages, while continuous variables were reported as mean and standard deviation.

Inferential statistics: Associations between the intervention and control groups, and categorical variables were analysed using the Pearson chi-square test.

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Regression modelling: Multivariate logistic regression identified predictors of adequate knowledge and correct home management (defined as ≥ 50% of expected correct responses). Adjusted odds ratios (AORs) and 95% confidence intervals (CIs) were reported. A p-value less than 0.05 was considered statistically significant at a 95% confidence interval.

Model diagnostics: The Hosmer-Lemeshow test assessed goodness of fit ($p > 0.05$); Nagelkerke R^2 indicated explained variance; predictive validity was assessed with the area under the receiver operating characteristic (ROC) curve (AUC ≥ 0.70); Variance Inflation Factor (VIF< 5) tested multicollinearity.

RESULTS

Socio-demographic Characteristics of Respondents

Table 1 shows the sociodemographic characteristics of the respondents.

A total of 420 caregivers were enrolled, 210 in the intervention (Usokun) and 210 in the control (Tema) community, achieving a 100% response rate at baseline and 95.7% (n = 402) post-intervention.

Most caregivers in both communities were females, 399 (95.0%), aged 20-39 years (mean age 31.8 ± 7.4 years). The majority were married 374 (89.0%); had completed at least primary education 347 (82.6%) and were traders or petty business owners 241 (57.4%).

There were no statistically significant differences in baseline socio-demographic characteristics between the two communities ($p > 0.05$), confirming comparability.

Table 1: Socio-demographic characteristics of caregivers (N = 420)

Variable	Intervention (n)	(%)	Control (n)	(%)	χ^2	p-value
Female caregivers	200	(95.2)	199	(94.8)	0.02	0.88
Age < 30 years	74	(35.2)	71	(33.8)	0.09	0.76
Married	189	(90.0)	185	(88.1)	0.36	0.55
≥ Primary education	171	(81.4)	176	(83.8)	0.42	0.52
Trader/artisan occupation	118	(56.2)	123	(58.6)	0.19	0.66

Baseline Knowledge and Home Management Practices (N=420)

At baseline, malaria knowledge was sub-optimal across both groups. Only 196 (46.7%) of caregivers correctly identified mosquito bites as the cause of malaria, and 177 (42.1%) knew that ACTs were the first-line treatment (Table 2).

Proper home management, defined as initiating ACTs within 24 hours at the correct dose, was observed in 184 (43.8%) of respondents overall. No statistically significant difference was found between intervention and control communities before training ($p > 0.05$).

Table 2: Baseline malaria knowledge and home management practices

Indicator	Intervention (n) (%)	Control (n) (%)	χ^2	p-value
The correct cause of malaria identified	96 (45.7)	100 (47.6)	0.13	0.72
Knowledge of ACT as a first-line treatment	91 (43.3)	86 (41.0)	0.24	0.63
Correct home management within 24 hrs	90 (42.9)	94 (44.8)	0.16	0.69
Use of bed nets daily	135 (64.3)	138 (65.7)	0.08	0.78

Post-intervention Knowledge and Practice

Following the RMC intervention, malaria knowledge and practice scores improved markedly in the intervention community compared with the control (Table 3).

The proportion of caregivers with adequate malaria knowledge (≥ 50%) increased from 45.7% to 87.6% ($p < 0.001$).

The proportion with correct home management improved from 42.9% to 81.9% ($p < 0.001$).

In contrast, the control community showed minimal change (46.2% to 50.0% for knowledge; 44.8% to 46.2% for practice).

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Table 3: Change in caregivers' malaria knowledge and home management practices after intervention

Variable	Intervention Baseline (n) (%)	Intervention Post (n) (%)	Control Baseline (n) (%)	Control Post	χ^2	p-value
Adequate malaria knowledge	96 (45.7)	184 (87.6)	97 (46.2)	105 (50.0)	91.3	<0.001
Correct home management	90 (42.9)	172 (81.9)	94 (44.8)	97 (46.2)	83.7	<0.001

Predictors of Correct Home Management

On multivariate logistic regression (Table 4), significant predictors of correct home management of malaria (post-intervention) were:

(1). Exposure to RMC training (AOR = 5.62; 95% CI: 3.21- 9.83; p < 0.001),

(2). Higher educational attainment (AOR = 2.45; 95% CI: 1.18 -5.11; p = 0.017), and

(3). Good malaria knowledge (AOR = 3.09; 95% CI: 1.58-6.04; p = 0.001).

Table 4: Multivariate Logistic regression analysis of predictors of correct home management (N = 402)

Predictor	Adjusted OR	95% CI	p-value
Exposure to RMC training	5.62	3.21- 9.83	<0.001
≥ Primary education	2.45	1.18 - 5.11	0.017
Adequate malaria knowledge	3.09	1.58 - 6.04	0.001
Age ≥ 35 years	1.14	0.65 - 2.01	0.64
Married	0.92	0.47 - 1.80	0.81

Model diagnostics

The Cronbach's alpha ranged from 0.82 to 0.88 for the sections of the questionnaire, indicating good internal reliability of the data set. The Shapiro-Wilk test for normality reported a normal distribution for caregivers' age (W = 0.94, p = 0.08). As such, parametric summaries were used. All predictors had Variance Inflation Factor (VIF) values less than 2.0, indicating the absence of multicollinearity. Hosmer-Lemeshow χ^2 = 6.08, p = 0.64, indicated a good model fit. The Nagelkerke R^2 = 0.42 showed moderate-to-strong explanatory power for the logistic regression model, suggesting that the independent variables collectively explained about 42% of the variation in the outcome. The remaining 58% is due to factors not included in the model or to random error. The logistic regression model demonstrated good discriminative ability, with an area under the receiver operating characteristic (ROC) curve (AUC) of 0.83, indicating that the model correctly distinguished caregivers who practised appropriate home management of malaria from those who did not in 83% of cases.

DISCUSSION

The findings demonstrated that training Role Model Caregivers substantially improved caregivers' malaria knowledge and home management for under-five children in rural communities of Rivers State. Knowledge improved from 45.7% to 87.6%, and correct home management increased from 42.9% to 81.9% in the intervention group, confirming the effectiveness of structured, community-led education.

These results align with similar interventional studies in Nigeria. For example, caregiver education in South-West Nigeria led to a 35% rise in ACT use, while community mentorships significantly improved fever recognition and treatment accuracy.[16-21] These studies affirm that peer-led, localised health education yields more sustainable behavioural change than one-off campaigns. From an epidemiological perspective, the intervention addressed key determinants of survival, early recognition and correct ACT use. Prompt treatment within 24 hours significantly reduces severe anaemia, cerebral malaria, and mortality.[22,23] In this study, caregivers exposed to RMC mentoring were over five times more likely to treat

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appropriately, an impact that can reduce severe cases and community transmission.[24]

The model's success likely stems from trust and social influence. RMCs, being respected community members, used local language and relatable examples to translate health messages. Behavioural change theories show that people learn better from peers and role models.[25,26] Repeated follow-up visits also reinforced learning and accountability.[27]

Education level remained a strong predictor of correct management. Caregivers with at least a primary education were better able to follow dosage instructions, consistent with evidence linking maternal education to better health practices.[28,29] However, even caregivers with minimal schooling benefitted, showing that interpersonal mentorship can overcome literacy barriers when contextually adapted. [28, 29]
Integrating RMCs into Nigeria's existing Primary Health Care system could strengthen sustainability. The National Malaria Elimination Programme advocates community-based delivery,[30] but supervision, supply chain gaps, and volunteer motivation must be addressed.[31] By complementing facility-based services, the model can reduce hospital burden and enhance early treatment.[32,33] Moreover, integrating RMC training with rapid diagnostic testing (RDT) in future iterations could further enhance rational ACT use and curb emerging resistance.[34,35]

Methodologically, the study-maintained reliability (Cronbach's $\alpha \geq 0.70$) and strong model validity supporting its credibility.[36] The logistic regression model demonstrated good discriminative ability, with an AUC of 0.83, indicating reliable differentiation between caregivers who practised appropriate and inappropriate malaria home management.[36] This reflects the predictive relevance of variables such as RMC training exposure, education level, and malaria knowledge. The Hosmer-Lemeshow test ($p > 0.05$) further confirmed adequate model calibration, suggesting consistency between predicted and observed outcomes.[36] Collectively, these indices show that the fitted model was both valid and robust, providing a clinically meaningful framework for identifying determinants of effective home-based malaria management. Although the short follow-up limits long-term assessment, the results offer clear evidence for scaling up peer-led malaria management interventions.[37,38]

Limitations of the Study

1. Selection bias may be introduced due to a lack of randomisation in the quasi-experimental design; however, baseline comparability between groups minimised this threat.
2. Self-reported measures of home management may be subject to recall or desirability bias. Future studies incorporating objective verification (e.g., blister-pack observation) could mitigate this.
3. The short post-intervention assessment window (three months) precluded assessment of long-term retention; longitudinal follow-up is needed to assess sustainability.

Implications for Practice

This study demonstrates that community-based, peer-led mentorship can significantly improve caregivers' knowledge and home management of childhood malaria. By operationalising a Role Model Caregiver approach, the findings show that trust-based community engagement is an effective alternative to conventional facility-based health education. Improved early recognition of symptoms, timely initiation of ACTs, and correct dosing at the household level indicate that such models can strengthen frontline malaria control in rural settings.

Implications for Research

The study provides epidemiological evidence that behaviour change interventions can impact key factors of severe malaria, improving scientific understanding of household treatment practices. By focusing on rural, flood-prone communities such as Usokun and Tema, the study broadens local malaria epidemiology and emphasises the need for more context-specific research in hard-to-reach populations. The identification of education, knowledge, and exposure to RMC mentorship as independent predictors of correct home management offers a foundation for developing predictive models and guiding future community intervention trials.

Implications for Policy

Field evidence from this study supports integrating community-driven caregiving approaches into Nigeria's malaria control strategies. The Role Model Caregiver

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model aligns with the National Malaria Strategic Plan (2021–2025) and WHO's Global Technical Strategy for Malaria (2016–2030), reinforcing the value of people-centred interventions in malaria elimination efforts. Scaling up structured community mentorship can contribute to achieving Sustainable Development Goal 3 by reducing preventable under-five morbidity and mortality through strengthened household-level malaria management.

The findings of this study have other important implications for strengthening malaria control through practice, research, and policy. The demonstrated effectiveness of the Role Model Caregiver (RMC) approach shows that community-based, peer-led mentorship can meaningfully improve caregivers' knowledge and home management of childhood malaria. This highlights a practical opportunity for integrating structured community mentorship into routine primary healthcare delivery. Embedding the RMC model within the community malaria programmes of the Rivers State Primary Health Care Management Board, supported by PHC staff and LGA social mobilisation officers, would enhance early recognition and appropriate treatment of malaria at the household level.

From a policy perspective, the results provide strong justification for incorporating malaria mentorship into the National Malaria Elimination Programme (NMEP), particularly within integrated community case management (iCCM) activities. Scaling up this model in rural and riverine communities, where malaria transmission remains high, aligns with national and global malaria strategies and can contribute to achieving Sustainable Development Goal 3.

The study also emphasises the need for gender-sensitive and literacy-appropriate communication. Because most caregivers are women and many have limited formal education, training materials and health messages should incorporate pictorial instructions and translations into local dialects to ensure equitable understanding and application of malaria home management practices.
Finally, the identification of education, knowledge, and exposure to RMC mentorship as predictors of correct home management provides a basis for future research aimed at refining behavioural models and designing targeted community interventions. Together, these implications show that strengthening caregiver capacity through community-driven approaches can produce measurable public health impact and should be prioritised in ongoing malaria control efforts.

CONCLUSION

This study showed that the Role Model Caregiver (RMC) intervention significantly improved caregivers' malaria knowledge and correct home management of under-five malaria in rural Rivers State, with exposure to RMC mentoring, higher education, and good malaria knowledge identified as key predictors of appropriate home treatment. By enabling caregivers to recognise symptoms early, initiate timely treatment, and seek referral when needed, the intervention reduces progression to severe disease and child mortality while strengthening community ownership and complementing primary healthcare delivery. Aligning with Nigeria's National Malaria Strategic Plan and the WHO Global Technical Strategy, the findings support integrating RMCs into existing PHC frameworks with supervision, refresher training, and supply-chain support to sustain gains. Overall, the RMC approach represents a practical, low-cost, and scalable strategy to bridge households and health systems, advancing malaria elimination and improving child health outcomes in high-burden, resource-limited settings.

Authors contributions: Nduye C.T. Briggs conceptualised and designed the study, supervised the data analyses, interpreted the data, and wrote the initial manuscript. Obeleye T-George developed the study instrument, conducted the literature review, supervised data collection, collation, and wrote part of the manuscript. All the authors read and approved the final manuscript.

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