Effectiveness of Social Networks in Enhancing the Uptake of Artemisinin-Based Combination Therapy (ACT) In Malaria-Prone Zones of Kenya

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Abstract
Background: *Malaria remains an important health issue in Kenya, with those below five years being most vulnerable to its severe consequences. Artemisinin-based combination therapy (ACT) is generally preferred for treating uncomplicated malaria, although its promotion is not balanced due to variations in socio-economic settings, geographical disparities, and social networks. It would be crucial to gain an understanding of the impact of social networks, specifically those defined by religious affiliations, on ACT to formulate appropriate strategies for improving outcomes for those affected by malaria in areas identified to be prone to it.*
Methods: *Data for this research were drawn from the Kenya Malaria Indicator Survey, conducted in 2020, which adopted a cross-sectional design with stratified two-stage cluster sampling. For analysis, it included socio-demographic variables, geographic variation, and social network effects via religious affiliations. Differences were evaluated via chi-squared tests for independence for categorical variables, while t-tests or, for non-normal distributions, Mann-Whitney tests for normally or not-normally distributed variables, respectively. Logistic regression analysis was employed to ascertain individual, caregiver, religion, or setting-related predictors for ACT drug use.*
Results: *ACT uptake among children under five was 52%. Male children were less likely to receive ACTs, with probabilities 6.3% lower in rural areas and 3.1% lower in urban areas. Younger children in rural areas, particularly those aged one, had a 5.7% higher likelihood of ACT usage, while uptake declined with age. Caregivers' education significantly enhanced ACT uptake in rural areas, increasing the likelihood by 25%. Rural Muslim households were 17.2% more likely to use ACTs, while urban Christian households showed modest improvements. Wealth disparities also affected uptake, with wealthier urban households less likely to use ACTs.*
Conclusion: *This study emphasizes how social networks and especially religious connections significantly influence ACT uptake in areas of Kenya affected by malaria. By using these networks to address obstacles to access, there is strong potential to boost the use of ACT and improve health outcomes. Community-based strategies and partnerships with religious organizations may help ensure fairer malaria treatment for at-risk groups.*

Keywords: *Artemisinin-based Combination Therapy (ACT), Malaria treatment in under-five, Social networks, Religious affiliations*

What is already known on this topic
Caregiver education has been consistently identified as a key factor in improving health service utilization, including malaria treatment, due to increased awareness and understanding of the benefits of ACT.

What this study adds
The study offers new evidence on how social networks, particularly religious affiliations (Christian and Muslim), influence the uptake of ACTs among children under five in malaria-prone areas. This highlights the potential of leveraging community and religious structures for health interventions.

How this study might affect research, practice or policy
This study advances research by emphasizing the critical role of social networks, particularly religious affiliations, in shaping health behaviors, providing a basis for future interdisciplinary investigations into the dynamics of community influence on malaria treatment. It informs practice by highlighting the potential of engaging religious and community leaders to promote ACT uptake and designing tailored interventions addressing disparities in education and wealth. For policy, the findings advocate for leveraging religious partnerships to amplify health messaging, prioritizing targeted resources to reduce socio-economic and geographic barriers, and integrating community-driven approaches into malaria control strategies to achieve equitable health outcomes.

Introduction

Malaria remains one of the most significant public health challenges globally, with an estimated 249 million cases and 608,000 deaths reported in 2022, the majority occurring in sub-Saharan Africa [1]. Kenya is among the high-burden countries, where malaria contributes substantially to morbidity and mortality, especially among children under five and pregnant women [2]. The disease not only undermines health outcomes but also perpetuates cycles of poverty by imposing economic burdens on households and health systems [3-4].

The introduction of Artemisinin-based Combination Therapy (ACT) marked a turning point in malaria treatment policy. ACT is the WHO-recommended first-line treatment for uncomplicated Plasmodium falciparum malaria due to its efficacy in reducing parasite resistance [1]. In Kenya, ACT has been rolled out nationwide, but uptake remains inconsistent due to barriers such as limited awareness, delayed healthcare seeking, drug stock-outs, and socio-cultural influences [5-6]. Despite policy commitments, gaps persist in ensuring equitable and consistent use of ACT, especially in malaria-prone rural zones.

From a theoretical perspective, social and behavioral factors are increasingly recognized as critical in shaping health-seeking behaviors. Social network theory posits that individuals' decisions are embedded within webs of relationships that influence perceptions, access to information, and adoption of new behaviors [7-8]. Similarly, the Health Belief Model (HBM) suggests that individuals' uptake of preventive or curative health measures depends on perceived susceptibility, perceived benefits, and cues to action, which can be strongly mediated by peer influence and religious norms [9-11].

Existing empirical research underscores the pivotal role of social determinants in shaping health behaviors, highlighting how trust, social cohesion, and the diffusion of knowledge within communities influence the uptake of health interventions [12-14]. These studies indicate that collective demand and shared community norms can significantly guide individual healthcare decisions. For instance, a study in Zambia demonstrated that effective supply chain management particularly the availability and accessibility of antimalarial drugs was crucial for ensuring optimal ACT utilization [15] Similarly, research in Uganda and Senegal emphasized that socio-demographic factors, caregiver knowledge, and access to healthcare services are key determinants of ACT uptake, illustrating how both individual and structural factors interact to shape malaria treatment behaviors [16]. In addition, social learning and group norms significantly influence treatment adherence, where households are more likely to follow recommended ACT regimens when malaria knowledge is diffused through community interactions [17-19].

Furthermore, religious communities significantly influence health-related behaviors. Faith-based networks have been found to influence caregivers' treatment choices, often determining whether children receive formal healthcare, alternative medicine, or home-based remedies [20-21]. In some cases, religious leaders' endorsements of malaria treatment programs significantly increased ACT acceptance and utilization [22]. However, misconceptions and traditional healing practices within religious communities sometimes lead to treatment delays, highlighting the need for culturally sensitive malaria education strategies. The persistence of traditional medicine use, as in empirical studies reveal a complex landscape where ACTs are often used alongside or replaced by alternative treatments [23-24].

While existing literature highlights the importance of social determinants in malaria treatment decisions [12-21], few studies explicitly quantify the impact of community-level malaria drug demand on individual caregiver choices. This paper examines the effectiveness of social networks in enhancing the uptake of ACT in malaria-prone zones of Kenya. By integrating insights from social network theory and behavioral models, it highlights how interpersonal interactions, religious affiliations, and community support mechanisms influence treatment decisions. Findings from this study provide evidence to inform policies aimed at leveraging social structures to improve access to effective malaria treatment and reduce the disease burden in endemic settings.

Methods

The study adopts an observational, cross-sectional design using secondary data from the 2020 Kenya Malaria Indicator Survey (KMIS) [23]. The KMIS dataset provides nationally representative data on malaria prevalence, prevention, and treatment practices. In rural areas, clusters are typically villages or groups of villages, while in urban settings, they are city blocks. The 2020 KMIS survey was nationally representative, covering a total of 30,252 weighted households. From this, a sample of 7,952 households was selected, and 6,771 women aged 15-49 years were interviewed, with a high response rate of 96% for women and 97% for households. This comprehensive dataset allows the study to explore not only the effectiveness of malaria treatments but also the influence of social interactions on treatment decisions within diverse environmental and socio-economic contexts.

Study Population and Sampling

The study utilizes a stratified, two-stage cluster sampling design employed in KMIS 2020. The dataset includes demographic, socioeconomic, and malaria treatment-related information collected from households across malaria-endemic regions in Kenya. Only individuals and households with complete malaria-related data have been included in the analysis [25].

Variables and Measures

Dependent variables include the uptake and utilization of malaria treatment interventions, such as ACT use and other antimalarial drug coverage among children under five. Independent variables include child characteristics, caregiver attributes, household characteristics, and malaria-related knowledge, attitudes, and perceptions. Control variables include socioeconomic status, education level, and geographic location.

Data Analysis

Descriptive statistics summarize key demographic and malaria-related variables (Table 1). Logistic regression models were employed to assess the association between social interactions and malaria treatment-seeking practices, controlling for potential confounders (Analytical model in additional materials). The logistic regression model is appropriate for this study as it allows for the estimation of the probability of ACT uptake based on various predictor variables, including social and economic factors. Sensitivity analysis was conducted to assess the robustness of the results by testing alternative model specifications and variable definitions. The data analysis conducted using STATA software, with statistical significance set at $p < 0.05$.

Ethical Consideration

The 2020 KMIS received ethical clearance from the Kenyatta National Hospital, University of Nairobi Scientific and Ethics Review Committee as well as approval from the ICF Institutional Review Board [25]. Participation in the survey was entirely voluntary, and written informed consent was obtained from every respondent. Permission to access and use the KMIS data was provided by the Kenya National Bureau of Statistics. All identifiable respondent details were anonymized to ensure privacy and maintain confidentiality throughout the study [25].

Empirical findings

Summary Statistics

Table 1 below presents data categorized by location (Urban) and totals, with corresponding percentages and counts in parentheses. The categorical variable "Urban" distinguishes between urban and non-urban (implied by absence) populations, allowing for comparison between these groups. Each row shows the proportion (in percentage) and the absolute count of cases for each category, which helps in understanding the distribution of the sample across different settings.

Statistically, the percentages represent the share of each subgroup within the broader category, while the numbers in parentheses indicate the actual sample size. For example, in the "Urban" row, 18.0% (43 cases) and 82.0% (196 cases) illustrate the distribution of the sample within urban settings. The "Total" row sums to 100% for each column, confirming that all cases are accounted for, and providing a basis for comparing urban and overall distributions.

Building on the descriptive and statistical insights from the table, it is important to highlight specific values that further elucidate the relationships among variables and ACT drug usage. For instance, looking at continuous variables, the mean age of children in the group that used ACT drugs was 2.61 years (SD = 1.68), with a median age of 3 years (IQR: 1–4), while the corresponding group that did not use ACT drugs had a slightly higher mean age of 2.9 years (SD = 1.53) and the same median. The comparison between these groups, as indicated by the t-test statistic ($t = -1.6772$, $p = 0.094$), suggests that there is no statistically significant difference in child age between users and non-users of ACT drugs.

Similarly, the age of the child caregiver was virtually identical in both groups: those who used ACT drugs had a mean age of 28.9 years (SD = 6.63), and those who did not had a mean age of 28.97 years (SD = 6.43), with medians of 28 years and interquartile ranges of 24–34 and 24–33.5, respectively. The result of the t-test ($t = -0.0492$, $p = 0.961$) confirms the lack of a significant difference. Household size also showed no significant difference, with means of 5.9 (SD = 2.65) for ACT users and 6 (SD = 2.8) for non-users, and medians of 5 (IQR: 4–7) in both groups ($t = -0.3577$, $p = 0.721$).

In contrast, several categorical variables demonstrated statistically significant associations with ACT drug usage. For example, the education level of the child caregiver ($\chi^2(3) = 7.968$, $p = 0.047$) revealed that 6.7% (17) of ACT users had no education, compared to 17.8% (71) of non-users. Primary education was the most common category among both groups, with 45.1% (84) of ACT users and 45% (244) of non-users, while secondary education accounted for 34.3% (38) and 26.4% (141), and higher education for 13.9% (5) and 10.8% (49), respectively.

Similarly, the wealth index was significantly associated with ACT drug usage ($\chi^2(4) = 11.050$, $p = 0.026$). Among ACT users, 20.2% (36) were in the poorest category, 31.9% (45) in poorer, 21.4% (28) in middle, 19.2% (23) in richer, and 15.2% (12) in the richest. In contrast, non-users were more likely to be in the richest group (84.8%, 67) and less likely to be in the poorer or poorest categories.

Religion also demonstrated a strong association with ACT drug usage ($\chi^2(1) = 20.586$, $p = 0.000$). Among ACT users, the majority were Christian (25.4%, 139), while only 5% (5) were Muslim. Non-users were predominantly Christian as well (74.6%, 409), but the proportion of Muslims was much higher in this group (95%, 96), suggesting a notable disparity in ACT drug usage by religious affiliation.

Type of residence yielded a statistically significant difference as well ($\chi^2(1) = 3.859$, $p = 0.049$), with 24.6% (101) of rural residents using ACT drugs compared to 18.0% (43) of urban residents. This indicates a higher proportion of ACT drug usage in rural settings relative to urban ones.

Table 1: Descriptive Statistics of Variables used in the Estimations

Variables	Category	Used ACT drugs n = 144(22.2%)	Did not Use ACT drugs n = 505(77.8%)	Test Statistic-ttest or χ² (df)	p-value	Total %(n=649)
Continuous Variables		**Mean ± SD / Median (IQR)**	**Mean ± SD / Median (IQR)**			
Child Age		2.61 ± 1.68 /3(1-4)	2.9 ± 1.53/3(2-4)	t = -1.6772	p = 0.094	100(649)
Age of child care giver		28.9 ± 6.63 / 28 (24–34)	28.97 ± 6.43 / 28 (24–33.5)	t = -0.0492	p=0.961	100(649)
Household Size		5.9 ± 2.65 / 5(4–7)	6 ± 2.8 / 5(4–7)	t = -0.3577	p=0.721	100(649)
Categorical variables		**% (n)**	**% (n)**			
Child gender				$\chi^2(1)$=.0213	p= 0.884	
	Female	22.0(88)	78.0(312)			61.6 (400)
	Male	22.5 (56)	77.5(193)			38.4(249)
Education level of child caregiver				χ2(3)=7.968	P=0.047	
	No education	6.7(17)	17.8(71))			13.6(88)
	Primary	45.1(84)	45(244)			50.5(328)
	Secondary	34.3(38)	26.4(141)			27.6(179)
	Higher	13.9(5)	10.8(49)			8.3(54)
Wealth Index				χ2(4)=11.050	P=0.026	
	Poorest	20.2(36)	79.8(142)			27.4(178)
	Poorer	31.9(45)	68.1(96)			21.7(141)
	Middle	21.4(28)	78.6(103)			20.2(131)
	Richer	19.2(23)	80.8(97)			18.5(120)
	Richest	15.2(12)	84.8(67)			12.2(79)
Religion				χ2(1)=20.586	P=0.000	
	Christian	25.4(139)	74.6(409)			84.4(548)
	Muslim	5.0(5)	95.0(96)			15.6(101)
Type of residence				χ2(1)=3.859	p=0.049	
	Rural	24.6(101)	75.4(309)			63.2(410)
	Urban	18.0(43)	82.0(196)			36.8(239)
Total		**100(144)**	**100(505)**			**100(649)**

Religion also demonstrated a strong association with ACT drug usage ($\chi^2(1) = 20.586$, $p = 0.000$). Among ACT users, the majority were Christian (25.4%, 139), while only 5% (5) were Muslim. Non-users were predominantly Christian as well (74.6%, 409), but the proportion of Muslims was much higher in this group (95%, 96), suggesting a notable disparity in ACT drug usage by religious affiliation.
Type of residence yielded a statistically significant difference as well ($\chi^2(1) = 3.859$, $p = 0.049$), with 24.6% (101) of rural residents using ACT drugs compared to 18.0% (43) of urban residents. This indicates a higher proportion of ACT drug usage in rural settings relative to urban ones.
Overall, the reported values and statistical tests underscore that while some socio-demographic factors such as child age, caregiver age, and household size do not differ significantly between ACT drug users and non-users, other variables particularly education level, wealth index,

religion, and type of residence exhibit meaningful associations. These findings point to the importance of considering socioeconomic and contextual factors when analyzing patterns of ACT drug usage and may inform targeted interventions or policy measures aimed at addressing disparities within the population.

Results

The findings on the uptake of artemisinin-based combination therapy (ACT) by children under five reveal significant variations based on rural versus urban residence and religious social interactions religious affiliation (Christianity and Islam) are shown in Tables 2.

Urban vs. Rural Differences in ACT Uptake

The analysis identified notable disparities in ACT uptake between rural and urban areas. In rural regions, male children were less likely to receive ACT treatment (-0.072, p<0.001), whereas gender had a positive impact on treatment uptake in urban settings (+0.015, p<0.001). Age also played a significant role, with younger children (particularly those aged 1 to 2 years) in rural areas having a higher likelihood of receiving ACT (age 1: +0.134, p<0.001; age 2: +0.087, p< 0.001) compared to their urban counterparts. Additionally, household wealth influenced ACT usage differently across settings; wealthier households in rural areas were more inclined to use ACT (middle-income households: +0.067, p<0.001), while in urban areas, higher household wealth was associated with reduced ACT uptake (-0.017, p<0.001). These findings suggest that socio-economic and demographic factors differentially impact malaria treatment practices across rural and urban contexts

Influence of Religious Affiliations

The analysis highlighted the significant impact of religious affiliations on ACT uptake. In rural Christian households, the education level of caregivers was a strong determinant, with those having secondary education being more likely to seek ACT treatment for their children (+0.253, p<0.001). Conversely, in predominantly Muslim rural areas, factors such as child age and household wealth had a negative influence on ACT uptake (e.g., age 2: -0.212, p<0.001; richest households: -0.370, p<0.001). This suggests that social norms and health-seeking behaviors differ between religious groups, influencing the prioritization of malaria treatment in these communities.

Urban vs. Rural Differences in ACT Uptake

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Table 2: Logistic Regression Estimation results of the Uptake of ACT Drugs by Children Under 5 Years by Residence in Kenya, 2020

Variable	Before Interactions		Christianity		Islam	
	Rural (mfx)	Urban (mfx)	Rural_i	Urban_i	Rural_i	Urban_i
Child gender	-0.072*** (0.003)	0.015*** (0.004)	-0.068*** (0.004)	0.015*** (0.004)	-0.061*** (0.015)	-0.138*** (0.012)
Child age (Reference group 0)						
1	0.134*** (0.006)	-0.006 (0.009)	0.122*** (0.005)	-0.008 (0.007)	0.029 (0.023)	-0.246*** (0.017)
2	0.087*** (0.006)	0.093*** (0.008)	0.081*** (0.005)	0.106*** (0.006)	-0.212*** (0.022)	-0.405*** (0.015)
3	0.095*** (0.006)	-0.020 (0.008)	0.084*** (0.005)	-0.019*** (0.006)	-0.057*** (0.024)	-0.293*** (0.016)
4	0.087*** (0.005)	-0.070*** (0.008)	0.065*** (0.004)	-0.080*** (0.006)	0.086*** (0.022)	-0.248*** (0.016)
5	0.033*** (0.005)	0.021*** (0.008)			-0.249*** (0.021)	-0.071*** (0.018)
Age of child caregiver	-0.001 *** (0.000)	0.005*** (0.000)	0.001*** (0.000)	0.001*** (0.000)	-0.001 (0.001)	0.002*** (0.001)
Education caregiver (mother)						
Primary	0.214*** (0.006)	0.352*** (0.007)	0.255*** (0.006)	0.352*** (0.008)	0.100*** (0.015)	0.208*** (0.0110)
Secondary	0.201*** (0.006)	0.371*** (0.008)	0.253*** (0.005)	0.341*** (0.009)	0.212*** (0.017)	0.285*** (0.010)
Higher level	0.209*** (0.006)	0.311*** (0.007)	0.245*** (0.006)	0.282*** (0.009)	-	0.266*** (0.018)
Household Size	-0.038*** (0.000)	-0.018*** (0.001)	-0.039*** (0.001)	-0.023*** (0.001)	-0.017*** (0.003)	0.000 (0.002)
Household wealth (Reference group-poorest)						
Poorer	0.044*** (0.004)	-0.067*** (0.009)	0.050*** (0.005)	-0.131*** (0.009)	-0.001 (0.019)	0.007 (0.025)
Middle	0.067*** (0.005)	0.039 (0.008)	0.073*** (0.005)	0.031*** (0.009)	-0.209*** (0.025)	-0.213*** (0.022)
Richer	0.159*** (0.005)	-0.017*** (0.007)	0.165*** (0.005)	-0.028*** (0.008)	-0.001 (0.028)	-0.236*** (0.018)
Richest	0.051*** (0.008)	-0.103*** (0.006)	0.068*** (0.009)	-0.094*** (0.008)	-	-0.370*** (0.016)
Knowledge of uses of nets	-0.062*** (0.004)	0.005 (0.005)	-0.027*** (0.002)	-0.005*** (0.002)	0.008** (0.004)	0.020** (0.008)
Perception of uses of nets	-0.038*** (0.004)	0.121*** (0.006)	-0.013*** (0.001)	0.043*** (0.002)	-0.035*** (0.007)	0.049*** (0.006)
Observations	100,223	67,339	100,223	67,339	100,223	67,339

Standard errors rounded off to 3 decimal places are specified in parentheses.
Superscripts indicate significance at the a *p < 0.1, ** p < 0.05, *** p < 0.01

Influence of Religious Affiliations

The analysis showed that religious affiliations strongly affected ACT uptake. In rural Christian households, the education level of caregivers made a big difference. Caregivers with secondary education were more likely to seek ACT treatment for their children, with an increase of +0.253 ($p<0.001$). In contrast, in mostly Muslim rural areas, factors like child age and household wealth negatively impacted ACT uptake. For example, children aged 2 saw a decrease of -0.212 ($p<0.001$), while the wealthiest households experienced a decrease of -0.370 ($p<0.001$). This shows that social norms and health-seeking behaviours vary between religious groups, influencing how malaria treatment is prioritized in these communities.

Role of Caregiver Education and Household Characteristics

Caregiver education and household characteristics significantly influenced ACT uptake. Mothers with higher education levels, particularly in rural areas, were more likely to seek ACT treatment for their children. For example, primary education resulted in an increase of +0.214 ($p<0.001$), while secondary education led to an increase of +0.201 ($p<0.001$). However, larger household sizes were associated with lower ACT adoption in both rural and urban areas, with a decrease of -0.038 ($p<0.001$). This suggests that limited resources in larger households may delay access to malaria treatment. These findings highlight the need to focus educational programs on caregivers and tackle household resource challenges to improve malaria treatment uptake.

Discussion

The findings of this study indicate that ACT uptake is shaped by a combination of child characteristics, caregiver demographics, religious affiliation, and household context. Child gender emerged as an important determinant, particularly in rural Christian households where boys were more likely to receive ACT. In contrast, Islamic households demonstrated a negative association between being male and receiving treatment. These results reflect broader regional patterns documented in earlier studies, which have shown that gender norms and cultural expectations influence health-seeking behaviors for febrile illnesses [26-27]. Child age also played a significant role: in Christian households, younger children in urban areas received more prompt treatment, whereas older children benefited more in rural settings. This contrasts with Islamic households, where ACT uptake declined among older children. These findings are consistent with evidence from Nigeria and other malaria-endemic countries, where caregivers often perceive older children as less vulnerable to severe malaria, resulting in reduced urgency in seeking treatment [28-29].

Maternal socio-demographic factors further influenced ACT uptake. Although maternal age in Christian households showed only modest positive associations mainly in urban areas older mothers in rural Islamic households were markedly more likely to ensure their children received ACT. This suggests that age-related experience and accumulated health knowledge may operate differently across religious contexts. Maternal education also demonstrated divergent effects: primary education substantially increased ACT uptake in rural Islamic households, while higher educational attainment in Christian households was associated with reduced uptake. Similar complexities have been reported in previous literature, where the role of maternal education varies depending on contextual factors such as autonomy, perceived efficacy of biomedical care, and social norms [13-14,30].

Caregiver attitudes toward malaria treatment were among the strongest predictors of ACT uptake. Positive attitudes in rural households particularly within Islamic communities were strongly associated with increased treatment uptake. This finding is aligned with earlier research demonstrating that caregiver knowledge, perceived severity of malaria, and confidence in health facilities contribute significantly to timely treatment-seeking behaviors [31]. Conversely, negative attitudes in urban households were associated with reduced ACT uptake, indicating that structural barriers, misinformation, or mistrust may hinder treatment in these settings. These patterns mirror findings from Ghana, where caregiver beliefs and treatment literacy have been shown to directly influence proactive healthcare-seeking behavior [32-33].

Conclusion

The findings of this study highlight the pivotal role that social dynamics, especially those shaped by religious communities, play in encouraging the uptake of ACT for malaria treatment among Kenyan children. The influence of peer relationships and shared beliefs within faith groups is particularly evident, reinforcing the need to address the socio-cultural and economic challenges that can impede access to care. Efforts to improve malaria outcomes for children under five must prioritize the removal of social, educational, and perceptual barriers, as these factors are often deeply intertwined with local contexts.

Targeted interventions are especially important in urban Muslim communities, where overcoming negative perceptions and attitudes toward malaria treatment is essential. In contrast, rural areas present opportunities to enhance caregiver education and leverage positive social networks to support timely treatment. Central to these efforts is the ongoing promotion of ACT as the recommended therapy, accompanied by strategies that address the complex factors influencing treatment decisions. Achieving equitable access to effective malaria care will require a nuanced understanding of the diverse drivers of medication uptake within different communities.

Looking ahead, future research should adopt longitudinal approaches to observe how social networks and interactions develop and influence health behaviors. Such studies will provide deeper insights into the long-term effects of social influences on malaria treatment-seeking behaviors, ultimately guiding more responsive and context-sensitive public health strategies

Declarations

Authors' Contributions: FNN, JKG, and GM were actively involved in the analysis and interpretation of the study's findings. FNN drafted the initial version of the manuscript, while all authors contributed to revisions and approved the final version. FNN serves as the guarantor of the manuscript.

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