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Self-Medication Practices with Antimalarial Drugs among Under-five Children attending Muhimbili National Hospital in Tanzania

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Abstract

Background

Self-medication with antimalarial drugs among children may contribute to inappropriate treatment of febrile illness, antimalarial drug resistance and unwarranted drug side effects. However, evidence on self-medication with antimalarials among children under five years in Tanzania is limited. This study assessed the prevalence of antimalarial self-medication and associated factors among children under five years attending Muhimbili National Hospital, Tanzania.

Methods

A hospital-based cross-sectional study was conducted among caregivers of children under five years attending the paediatric outpatient clinic at Muhimbili National Hospital between April and June 2023. Caregivers were recruited using convenience sampling and interviewed using a structured questionnaire. Antimalarial self-medication was defined as use of an antimalarial drug for the child without consultation with a healthcare provider. Associations between participant characteristics and self-medication were assessed using logistic regression adjusting for key confounders; p values < 0.05 was considered statistically significant.

Results

Of 385 enrolled children, the estimated prevalence of antimalarial self-medication in the preceding six months was 14.7% (95% CI 11.2–19.2) using multiple imputation; among 340 children with complete data, 49 (14.4%) had been self-medicated. Artemether-lumefantrine was the most commonly used antimalarial, accounting for 47/49 (95.9%) of reported cases of self-medication. Pharmacies were the most common source of antimalarial drugs 42 (85.7%). The most frequently reported reasons for self-medication were receiving advice to self-medicate 23 (46.9%) and proximity to a pharmacy 19 (38.8%). In multivariable analysis, older child age was independently associated with antimalarial self-medication (adjusted odds ratio [aOR] 1.03, 95% CI 1.01–1.05; p = 0.01). Children with health insurance, caregiver education, and number of children were not independently associated with self-medication.

Conclusion

Antimalarial self-medication occurred among a sizeable proportion of children attending a tertiary hospital in Tanzania, with artemether-lumefantrine accounting for most reported use. Advice to self-medicate and accessibility of pharmacies were commonly reported factors, highlighting the importance of interventions addressing caregiver treatment decisions and engagement with medicine outlets. Strengthening access to appropriate malaria assessment and reinforcing rational antimalarial use may

help reduce inappropriate self-medication among under-five children, minimising the risk of suboptimal treatment and potentially contributing to efforts to prevent antimalarial drug resistance.

Background

Self-medication refers to the use of drugs by patients on their own initiative in an attempt to treat illness without consulting a physician (1). While reported in many African countries, studies that have explored self-medication in Tanzania found it to be a common practice in the country (2–4). Self-medication can negatively affect health through delayed care-seeking, adverse drug reactions and interactions, and masking of serious underlying conditions. It can also contribute to the emergence of drug resistance due to sub-optimal treatment (1).

Malaria is a common cause of illness in children in Africa. In 2024, 75% of all malaria deaths in the African region were of children aged under-five years (5). The 2022 Tanzania Demographic and Health Survey and Malaria Indicator Survey shows an 8.1% malaria parasite prevalence among under-fives in mainland Tanzania (6). While there is a declining trend in malaria transmission in Tanzania, children remain at high risk of developing symptomatic infection, due to their immature immune system (7). The common occurrence of febrile illness in children may increase their chance of receiving antimalarial medications.

Antimalarial drug resistance is a recurring public health concern (5). Resistance is likely to occur when a large proportion of the population is exposed to the drug, resulting in selection pressure on malaria parasites, favouring the survival and proliferation of drug-resistant parasites. (8). Private pharmacies make antimalarial medications widely available leading to a rise in drug-use-related challenges including; wrong dosage, use of counterfeit medication, and monotherapy which predispose to resistance (9). Therefore, a high prevalence of self-medication with antimalarials poses a potential risk for antimalarial drug resistance which threaten the prior success of malaria control strategies, treatment, and elimination efforts (8).

Currently, artemisinin-based combination therapies (ACTs) are effective against most malaria infections across Africa (5). However, artemisinin partial resistance is spreading, with Tanzania being one of four countries where delayed parasite clearance has been documented alongside validated molecular markers of resistance (5).

Although there is extensive documentation on overdiagnosis of malaria and overtreatment of febrile illnesses with antimalarial drugs in the absence of proven diagnosis, little is known on the inappropriate caregiver-initiated usage of antimalarial drugs among children in malaria-endemic regions including Tanzania(10, 11). The few available studies on this subject have focused on adults (3, 12–14), university students (15, 16), and pregnant mothers (2, 17). This study aimed to determine the prevalence of self-medication with antimalarial drugs among children under-five years of age in Tanzania and the associated factors.

Methods

Study design and setting

This was a cross-sectional hospital-based study conducted at the outpatient clinic at the paediatric department of Muhimbili National Hospital (MNH), from April to June, 2023. MNH is the national tertiary-level hospital located in Dar es Salaam, Tanzania, which receives referral cases from public and private health facilities all over the country. The paediatric outpatient clinic of MNH caters for 30–70 children a day, providing routine national child health services such as vaccination and growth monitoring, and consultations in general paediatrics, haemato-oncology, neurology, endocrinology, and nephrology.

Sample size

The sample size of 385 was calculated from Cochran's formula (18), at a confidence interval of 95%, margin of error 5%, and a prevalence p = 50% since there was no prior study in a similar setting. We included all consenting caregivers with children under five years of age. Caregivers with under-five children attending the outpatient paediatric clinic were conveniently recruited to reach the required sample size. This approach was selected for feasibility of data collection within the study period.

Data collection

Data collection took place at the outpatient clinic. Parents/caregivers were individually approached in the waiting area and invited to participate. Following informed consent, trained research assistants administered a questionnaire to collect data from parents/caregivers in an area away from patients and caregivers to maintain privacy. The questionnaire consisted of a series of closed and open-ended questions in Kiswahili (local language in Tanzania) to enable easy understanding and response to questions. The questionnaire was adapted from prior studies on antimalarial self-medication (3, 19). It was divided into two sections: sociodemographic characteristics of the child and the caregiver (15 questions), and self-medication practices (14 questions).

Data analysis

Data were entered into Microsoft Excel and R statistical software version 4.4.1 was used for analysis (20). Categorical data on sociodemographic characteristics (age groups and sex for caregivers and child, marital status of caregivers, health insurance status of child, number of household members and number of children under-five) was summarized in frequencies and proportions. Continuous variables with skewed distribution were summarized using median with interquartile ranges. The prevalence of antimalarial self-medication was defined as the proportion of children under five who had received an antimalarial through self-medication in the preceding six months, reported with 95% confidence intervals (CIs). In bivariate analysis, chi-square test was used to assess the association between categorical

socio-demographic characteristics and self-medication with antimalarial drugs. Fishers' exact test was used when expected cell counts were below 5. Continuous variables such as age of the child and age of the caregiver were assessed for association with the primary outcome using the Mann-Whitney *U* test since the distributions violated the normality assumption. Potential exposure variables for multivariable logistic regression were identified a priori from previous studies of antimalarial use among children and their plausibility as determinants of caregiver treatment decisions (child age, caregiver education, number of children and health insurance status) (21–23). A p-value < 0.05 was considered statistically significant.

Handling missing data

The extent of missing data was assessed for all variables. The missingness mechanism for the outcome was explored using a logistic regression model with missing status as the dependent variable and the covariates of the analysis model and primary caregiver status as predictors, as non-primary caregivers were considered less likely to know the child's treatment history. As this model provided evidence against data being missing completely at random (MCAR), and outcome missingness was associated with a variable outside the analysis model, complete-case analysis was considered potentially biased. Missing values in the outcome and covariates were therefore imputed using multiple imputation by chained equations (MICE) under a missing at random (MAR) assumption, using the mice package in R, and this was the primary analysis.

The imputation model included the outcome, all variables in the multivariable analysis model, and caregiver age and primary caregiver status as auxiliary variables, as these were considered potentially related to the outcome or its missingness. Binary variables were imputed using logistic regression and continuous variables using predictive mean matching. Twenty imputed datasets were generated and each run for five iterations.

The prevalence of self-medication and the multivariable model were estimated in each imputed dataset and pooled using Rubin's rules; the primary prevalence estimate therefore includes all 385 children. As a sensitivity analysis, both were repeated as a complete-case analysis, including only participants with complete data on the relevant variables, to assess the robustness of findings to the handling of missing data. For the complete-case prevalence, the 95% CI was calculated using the Wilson score method.

Results

Among the 385 children enrolled, missing data were minimal (< 3%) across all covariates. The median age was 23 months (IQR 29), 54.2% were male with caregivers at a median age of 30 (IQR 8.3). Most caregivers had two or more children (67.2%), and 64.9% of children were health insured. The majority of respondents were primary caregivers (91.7%) and mothers (79.7%), with most caregivers married (80.7%) and having secondary education or higher (61.3%). Most children lived in households of 5 or more people (59.7%), while 64.7% lived in households with one child under five years of age (Table 1).

Table 1
Sociodemographic characteristics of respondents

Characteristic	Category	n (%)
Age of child (months)	0–11	120 (31.2)
	12–23	73 (19.0)
	24–35	72 (18.7)
	36–47	82 (21.3)
	48–59	38 (9.9)
Sex of the child	Female	176 (45.8)
	Male	208 (54.2)
	Missing	1 (0.3)
Number of children the mother has	One child	126 (32.8)
	Multiple Children	258 (67.2)
	Missing	1 (0.3)
Health Insurance status of child	Insured	250 (64.9)
	Not insured	135 (35.1)
Age of caregiver (years)	18–24	48 (12.5)
	25–34	217 (56.4)
	35–44	101 (26.2)
	45 and above	10 (2.6)
	Missing	9 (2.3)
Primary caregiver	Yes	353 (91.7)
	No	32 (8.3)
Respondent relationship to child	Mother	307 (79.7)
	Father	41 (10.6)
	Other caregiver	37 (9.6)
	Missing	0 (0.0)
Marital status	Married	311 (80.7)
	Not married	67 (17.4)
	Missing	7 (1.8)

Characteristic	Category	n (%)
Caregiver education level	Primary school or less	145 (37.6)
	Secondary school or higher	236 (61.3)
	Missing	4 (1.0)
Household size	2–4 people	152 (39.5)
	5 or more people	230 (59.7)
	Missing	3 (0.8)
Number of under-fives in household	One	249 (64.7)
	Multiple	136 (35.3)

Prevalence of antimalarial self-medication

Of the 385 children enrolled, 45 (11.7%) had missing information on self-medication status. Missingness was strongly associated with the respondent not being the child's primary caregiver (aOR 0.21, 95% CI 0.08–0.51; $p < 0.001$), and was not associated with child age, caregiver education, number of children or health insurance status.

Using multiple imputation, the pooled prevalence of antimalarial self-medication among all 385 children was 14.7% (95% CI 11.2–19.2). In the complete-case analysis (n = 340), 49 children (14.4%, 95% CI 11.1–18.5) had received antimalarial self-medication in the preceding six months. Among these 49 children with reported self-medication, 47 (95.9%) used artemether–lumefantrine (ALU), while 2 (4.1%) used dihydroartemisinin–piperaquine (DP).

Reasons for self-medication and sources of antimalarials

Among the 49 children who received antimalarial drugs through self-medication, advice to self-medicate was the most frequently reported reason (46.9%), followed by proximity to a pharmacy (38.8%) (Table 2).

Table 2
Reasons for self-medication

Reasons for self-medication	n (%)
Received advice to self-medicate	23 (46.9)
Proximity to a pharmacy	19 (38.8)
Long distance to health facility	5 (10.2)
Previous experience of medicine shortages	4 (8.2)
Freedom to choose preferred medication	3 (6.1)
Unable to afford healthcare costs	1 (2.0)

Antimalarial medicines were predominantly obtained from pharmacies 42 (85.7%), while hospitals 4 (8.2%), retail drug shops 3 (6.1%), and leftover medication 1 (2.0%) accounted for a smaller proportion of reported sources.

Bivariate chi square analysis

In bivariate analysis (Table 3), antimalarial self-medication was significantly associated with child age, number of children the mother had, and caregiver education ($p < 0.05$). No statistically significant associations were observed with sex of the child, health insurance status of the child, caregiver age, respondent relationship to the child, primary caregiver status, marital status, household size, or number of under-fives in the household ($p > 0.05$).

Table 3
Bivariate association between sociodemographic characteristics and antimalarial self-medication

Variable		Antimalarial Self-medication		
	Category	No n (%)/ Median (IQR)	Yes n (%)/ Median (IQR)	P-value
Age of child (months)		20 (29)	34 (22)	0.005*
Sex of child	Female	126 (81.8)	28 (18.2)	0.075
	Male	164 (88.6)	21 (11.4)	
Number of children the mother has	One	104 (91.2)	10 (8.8)	0.035*
	Multiple	187 (82.7)	39 (17.3)	
Health insurance status of child	No	100 (80.6)	24 (19.4)	0.049*
	Yes	191 (88.4)	25 (11.6)	
Age of caregiver (years)		30 (8)	31 (9)	0.32
Respondent relationship with child	Father	28 (77.8)	8 (22.2)	0.323†
	Mother	242 (86.8)	37 (13.2)	
	Other caregiver	21 (84.0)	4 (16.0)	
Primary caregiver	No	16 (80.0)	4 (20.0)	0.508†
	Yes	275 (86.0)	45 (14.0)	
Marital status of caregiver	Married	240 (86.3)	38 (13.7)	0.273
	Not married	46 (80.7)	11 (19.3)	
Caregiver education	Primary or less	99 (79.8)	25 (20.2)	0.023*
	Secondary or higher	191 (88.8)	24 (11.2)	
Household size	2–4 people	114 (85.1)	20 (14.9)	0.871
	5 or more people	174 (85.7)	29 (14.3)	
Number of under-fives in household	One	187 (85.4)	32 (14.6)	0.888
	Two or more	104 (86.0)	17 (14.0)	

Pearson's χ^2 test unless otherwise indicated; † Fisher's exact test; * $p < 0.05$

Multivariable logistic regression

After adjustment for caregiver education, number of children, health insurance status, older child age (aOR 1.03, 95% CI 1.01–1.05; p = 0.01) remained independently associated with antimalarial self-medication (Table 4).

Table 4
Multivariable logistic regression

Variable	Category	Crude OR (95% CI)[]	P value	Adjusted OR (95% CI)[]	P value	Complete-case aOR (95% CI)[]	P value
Age of the child (months)	–	1.02 (1.00–1.04)	0.01*	1.03 (1.01–1.05)	0.01*	1.03 (1.01–1.04)	0.01*
Caregiver education	Primary or less	Ref	–	Ref	–	Ref	–
	Secondary or higher	0.51 (0.28–0.94)	0.03	0.68 (0.35–1.30)	0.24	0.68 (0.36–1.31)	0.25
Number of children the mother has	1 child	Ref	–	Ref	–	Ref	–
	2 or more children	2.20 (1.02–4.76)	0.05	1.88 (0.85–4.20)	0.12	1.83 (0.86–3.90)	0.12
Health insurance status of child	No	Ref	–	Ref	–	Ref	–
	Yes	0.59 (0.32–1.07)	0.08	0.55 (0.29–1.04)	0.07	0.53 (0.28–1.02)	0.06

[] *Multiple imputation, n = 385 (20 imputed datasets, pooled using Rubin's rules).* [] *Complete-case sensitivity analysis, restricted to participants with complete data on the outcome and all model variables n = 339.* * *p < 0.05*

In the sensitivity analysis using complete case analysis, estimates were consistent with the multiple imputation, with older child age remaining independently associated with antimalarial self-medication (aOR 1.03, 95% CI 1.01–1.04; p = 0.01).

Discussion

Antimalarial self-medication may be a major driver of antimalarial drug resistance. Here, we show that over 14% of children under five years of age attended at a paediatric outpatient clinic at the Muhimbili National Hospital, particularly older ones were self-medicated with antimalarial drugs. Almost all

children who were self-medicated received artemether–lumefantrine (ALU), mostly from pharmacy outlets.

A study among 210 under-five children presenting with fever at a tertiary hospital in Uganda reported the prevalence of antimalarial self-medication of 10.0% (21/210), which was lower than the 14.7% observed in our study (21). Previously chloroquine was commonly used for self-medication of children in Kibaha district, Tanzania (24). More recently, ALU was the most commonly used antimalarial in the Ugandan study, accounting for 83.3% of children who had received antimalarials. The broadly comparable findings, particularly the predominance of ALU, reflect similarities in the availability and use of ACTs in the two settings.

Similar to a study done across five Low-and-Mid-Income Countries (Guinea, Kenya, Mali, Nigeria, and Sierra Leone), our study found that the older children among the under-fives were associated with self-medication practice, suggesting that caregivers may approach treatment differently according to the child's age (21, 23). One possible explanation for this is that caregivers may become more familiar with managing febrile illness as children grow older, particularly if they have previously experienced similar illnesses. Further research would be required to determine whether previous malaria episodes, or caregiver experience, explain the observed association. Caregivers of older under-five children may also require targeted messages regarding appropriate assessment and treatment of febrile illness.

The lack of health insurance was associated with self-medication in bivariate analysis, although it did not reach statistical significance in multivariable analysis. The likely explanation for this is that caregivers of children without health insurance prefer bypassing hospital visits in fear of extended healthcare costs (25). Furthermore, in bivariate analysis, we observed that caregivers who had primary education or less had a higher prevalence of children who were self-medicated than those whose caregivers had secondary education or higher, although the level of education did not remain independently associated with self-medication after adjustment. This is consistent with evidence from Nigeria (22), where mothers without formal education were more likely to administer antimalarials to under-five children without malaria testing. Similarly, national survey data from Tanzania show that more educated caregivers more commonly used higher-level facilities as their first source of care for sick children (26). However, the attenuation of the association after adjustment in our study suggests that caregiver education may partly reflect other characteristics associated with healthcare-seeking and treatment decisions.

Among the 49 children who received antimalarial medicines through self-medication, advice to self-medicate was the most frequently reported reason (46.9%), followed by proximity to a pharmacy outlet (38.8%). The importance of advice is consistent with evidence that caregivers in malaria-endemic settings commonly rely on sources outside formal healthcare facilities when managing childhood fever (27). The predominance of pharmacies as the source of antimalarial medicines further supports the importance of medicine accessibility in the self-medication pathway. In this study, 85.7% of antimalarials used for self-medication were obtained from pharmacies, while hospitals, retail drug shops, and leftover

medication accounted for substantially smaller proportions. This finding is consistent with the Tanzanian survey, which identified pharmacies and Accredited Drug Dispensing Outlets as important sources of treatment and advice for childhood fever (6, 26). Even among fatal malaria cases, antimalarials from shops were a common first resort (28). This also suggests that the pharmacy outlets represents an important setting for interventions aimed at promoting appropriate antimalarial use (29). Similarly, evidence from a study including 19 Low- and Middle-Income Countries demonstrated the widespread use of antimalarials among children under five through sources outside qualified healthcare providers, with 87.1% of children receiving an antimalarial prescription from unqualified sources (30). A systematic review of qualitative studies similarly found that childhood fever is frequently managed at home or within the community in malaria-endemic settings (27). However, our study did not assess the interaction between caregivers and pharmacy personnel, whether malaria testing was requested or performed, or whether medicines were dispensed according to national guidelines. Further research examining the pathway from caregiver decision-making to medicine purchase, including the role of pharmacy personnel, would therefore be useful.

Our study had a particular strength in being among the few studies to evaluate antimalarial drugs usage among under-fives in Tanzania. Nonetheless, there are important limitations that are acknowledged. Firstly, participants were conveniently recruited from a single tertiary referral hospital. The findings may therefore not be generalizable to caregivers of under-five children in the wider Tanzanian population, particularly those attending primary healthcare facilities or living in rural settings However, given that Muhimbili National Hospital receives referrals from across the country, the study may capture experiences from caregivers originating from diverse settings, potentially broadening the relevance of our findings. Secondly, self-medication was based on caregiver report over the preceding six months and was not independently verified, creating the possibility of recall and reporting bias. However, interviewers provided participants with clear explanations of the study questions and encouraged them to provide accurate and honest responses, which may have helped minimise reporting inaccuracies. Thirdly, our study had a relatively small number of outcome events which may have limited the statistical power to detect associations. The study also did not assess several potentially important determinants of self-medication, including who provided the advice to self-medicate, whether malaria testing had been performed before treatment, previous malaria episodes, exact dosage and duration of treatment, treatment adherence, and the circumstances of medicine dispensing. Further studies are warranted that will carefully evaluate the effect of these determinants on antimalarial self-medication.

Conclusion

Caregiver self-medication of under-five children with antimalarials is not uncommon in Tanzania. Older children are particularly vulnerable, and proximity to pharmacy outlets was a commonly reported reason. These findings suggest that addressing antimalarial self-medication among children may require interventions directed not only at caregivers but also at the private medicine sector, alongside continued efforts to promote appropriate assessment and treatment of childhood febrile illnesses.

Abbreviations

ALU
Artemether–lumefantrine
ACTs
Artemisinin–based combination therapies
DP
Dihydroartemisinin–piperaquine
MNH
Muhimbili National Hospital
LMIC
Low–Middle–Income–Country

Declarations

Ethical approval

Ethical approval was obtained from the Muhimbili University of Health and Allied Sciences (MUHAS) Research Ethics Committee, reference number DA.282/298/01.C/1555. Permission to conduct the study was sought from the administration of Muhimbili National Hospital. Verbal informed consent was obtained from all parents or caregivers before participation, after the study purpose, procedures, and their right to decline or withdraw without affecting their child's care were explained. Interviews were conducted in a private area away from other patients and caregivers. No personal identifiers were recorded, and data were stored on protected devices accessible only to the research team.

Consent for publication

Not applicable

Availability of data and materials

The datasets used and/or analysed during the current study are available from the corresponding author on reasonable request.

Competing interests

The authors declare that they have no competing interests

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Author Contribution

AI, MAm and EB conceptualised and designed the study. AI was the principal investigator, obtained funding, adapted the data collection tool, analysed and interpreted the data, and wrote the manuscript. DS and PJ contributed to data acquisition. MAp, MAm and EB supervised study implementation. IK provided statistical guidance on the analysis. MAm, EB, BJN, IK and CM critically revised the manuscript for important intellectual content. All authors read and approved the final manuscript. AI is the guarantor.

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