

Availability of Antimalarial Medicines in Community Pharmacies of Lusaka District, Zambia: Implications on Compliance to Malaria Treatment Guidelines

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Abstract

Background: Malaria remains a major cause of morbidity and mortality in Zambia, affecting all levels of society, with children under the age of five and pregnant women being most at risk of serious illness. The availability of antimalarial medicines is one of the key interventions of malaria management. This study assessed the availability of antimalarial medicines in community pharmacies in Lusaka district, Zambia. **Materials and Methods:** This was a cross-sectional study that was conducted among 210 community pharmacies from September to November 2022 using a well-structured checklist in selected areas of Lusaka district. The availability was verified by a physical check of the product. The checklist contained the medicines listed both in the guidelines for diagnosis and treatment of malaria in Zambia as well as in the World Health Organization (WHO) malaria treatment guidelines. **Results:** This study found that all antimalarials listed in the local treatment guidelines for malaria were available in community pharmacies, though with the varying distribution. Of the 210 community pharmacies, 209 (99.5%) had artemether/lumefantrine in stock. The lowest available antimalarial was quinine/clindamycin, which was only available in 3 (1.4%) of the outlets. Conversely, 3 out of 16 (18.8%) antimalarials that were available in community pharmacies were not listed in the local treatment guidelines of malaria in Zambia, despite being listed in the WHO malaria treatment guidelines. This translated into a compliance level of 81.2% based on the local malaria treatment guidelines. **Conclusion:** This study concluded that antimalarials were

available for all categories of malaria management in community pharmacies, though with a varying distribution. The presence of antimalarials not listed in the Zambian treatment guidelines is of public health concern which may have an impact on antimicrobial resistance in the future.

Keywords

Antimalarials, Antimalarial Medicines, Availability, Community Pharmacies, Zambia

1. Introduction

Malaria has been and continues to be one of the most public health concerns, as well as a global challenge, contributing to morbidity and mortality, with children under the age of five and pregnant women being the most vulnerable [1] [2] [3]. In 2015, there were 212 million new cases of malaria and a mortality of 429,000, whereas, in 2020, 241 million malaria cases and 627,000 malaria deaths were reported worldwide [4] [5]. Underestimation of the disease burden has contributed to malaria deaths, especially in young children, for the past two decades, with Africa having an even greater crisis than previously known [3]. One of the World Health Organization's (WHO) goals is to reduce global malaria incidence and mortality rates by 90% by 2030, with malaria elimination in at least 35 endemic countries [6].

In Zambia, malaria is endemic throughout the country and is still a significant public health problem in many areas of the country [7] [8]. Scaling up of interventions has been done for malaria control, such as the use of long-lasting insecticide-treated nets (LLIN), indoor residual spraying, and prompt, effective case management, including early diagnosis and treatment with an effective antimalarial drug, and intermittent preventive treatment during pregnancy (IPTp) [7] [8].

In Africa, accessibility to interventions for the prevention and treatment of the disease is still low due to shortfalls in funding and, in some cases, fragile health systems, which have an impact on the attainment of global targets [5]. Availability and affordability of medicines are key determinants of universal health coverage, though this remains a challenge in most low-income countries [9]. The effective management of malaria depends on access to healthcare services, and for the large proportion of patients in sub-Saharan Africa, the private sector supplies antimalarial medicines and provides many service delivery points for malaria treatment [9] [10].

Medicine retailers have played an important role that has been recognized in the distribution of antimalarial medicines [11]. In Uganda, the majority of antimalarial medicines were distributed through the private sector (54.3%) [10]. The availability of artemether/lumefantrine and sulfadoxine/pyrimethamine in Malawi was high in public and Christian Health Association of Malawi (CHAM) fa-

cilities (93% and 100%), with CHAM charging their patients for medicines [12]. Further, the availability and usage of antimalarials were very high in sub-Saharan African countries with over 92.9% of clients who purchased antimalarial medicines [13]. In Zambia, the government facilities have been a major source of antimalarial drugs for among febrile children under five years of age, accounting for 77% in 2021.

The WHO has provided recommendations on the antimalarial to use depending on the type (uncomplicated or complicated) as well as other patient factors such as pregnancy [14]. However, the WHO recommends that each country develops its own policy/treatment guidelines [14] [15]. The WHO further guides that in deciding which artemisinin-based combination therapies (ACTs) to adopt in national treatment policies, national policy-makers should take into account the pattern of resistance to antimalarials in their country, the relative efficacy and safety of the combinations, their cost, the availability of paediatric formulations, and the availability of co-formulated products [14] [15].

In Zambia, artemether/lumefantrine is the first-line treatment for uncomplicated *Plasmodium falciparum* (*P. falciparum*) malaria in children and adults (except pregnant women in their first trimester). The antimalarials listed in the guidelines for the diagnosis and treatment of malaria in Zambia are shown in **Table 1** [16].

Table 1. Malaria treatment guidelines in Zambia

Uncomplicated malaria	<ul style="list-style-type: none"> • Artemether/lumefantrine • Dihydroartemisinin/piperaquine • Alternative: Quinine
Uncomplicated malaria in the first trimester of pregnancy	<ul style="list-style-type: none"> • Quinine/clindamycin
Mixed infections	<ul style="list-style-type: none"> • Artemether/lumefantrine, Dihydroartemisinin/piperaquine • Anti-relapse treatment with primaquine can be given for 14 days if <i>P. malariae</i> is confirmed in a mixed infection
Treatment failure	<ul style="list-style-type: none"> • Quinine tablets
Pre-referral treatment for complicated malaria	<ul style="list-style-type: none"> • Artesunate injection, • Rectal artesunate at the community level
Complicated malaria	<ul style="list-style-type: none"> • Injectable artesunate • Alternatives: Artemether (intramuscular [IM]) or quinine (intravenous [IV]/IM)
Malaria Prophylaxis	<ul style="list-style-type: none"> • Sickle cell disease—Pyrimethamine/dapsone • Visitors (non-immunes) to Zambia—mefloquine, atovaquone-proguanil and doxycycline
Intermittent Presumptive Treatment in pregnancy	<ul style="list-style-type: none"> • Sulfadoxine/pyrimethamine

Therefore, this study assessed the availability of antimalarials in community pharmacies in the Lusaka district of Zambia and compared the stocking with the antimalarials listed in the guidelines for the diagnosis and treatment of malaria in Zambia.

2. Materials and Methods

The study was conducted from September to November 2022 in Lusaka district, targeting community pharmacies in high-density areas, including Mtendere/Kalingalinga, Chilenje/Libala, Chawama, Kabwata/Kamwala, Chelstone, Kaunda Square, Ng'ombe, Kanyama/Garden, Chipata, Mandevu, Matero, and the central business area. Lusaka district has the largest number of community pharmacies compared to any other district in Zambia, and it hosts the largest portion of the country's population. In Zambia, community pharmacies are privately owned by individuals or companies.

2.1. Sample Size Estimation and Sampling Technique

The determination of sample size was done using Yamane's sample size formula [17]. The sample size calculation was done at a 95% confidence level with a 5% margin of error. A total of 210 pharmacies were sampled using simple random sampling from the 444 registered pharmacies with Zambia Medicines Regulatory Authority (ZAMRA) in Lusaka district at the time of the study.

2.2. Data Collection and Analysis

A well-structured checklist was developed and used to collect information on the availability of a particular medicine for malaria. The Reported availability of a particular medicine was verified through a physical stock check. The checklist contained the medicines listed both in the 2017 Guidelines for Diagnosis and Treatment of Malaria in Zambia (GDTMZ) [16] as well as in the 2021 WHO guidelines for malaria [15]. The data collected was entered into the excel spreadsheet, analysed and presented in table form.

2.3. Ethical Approval

The study was approved by the University of Zambia Health Sciences Research Ethics Committee (UNZAHSREC), protocol ID: 202211231145. A permission letter from the University of Zambia to conduct the research was submitted to the community pharmacies, and the participants consented to be part of the study.

3. Results

A total number of 210 respondents participated in this survey and included 126 (60%) pharmacy technologists, 71 (33.8%) pharmacists, and 13 (6.2%) pharmacy dispensers (Table 2).

The distribution of community pharmacies that were included in the study are shown in Table 3. Most (21.9%) of the community pharmacies were sampled

Table 2. Background characteristics.

		Count	Percent (%)
Age (years) of respondents	15 - 24	32	15.2
	25 - 34	147	70.0
	35 - 44	28	13.3
	Above 45	3	1.4
Sex of respondent	Female	90	42.9
	Male	120	57.1
Education status	Certificate	13	6.2
	Pharmacy technologist	126	60.0
	Degree	71	33.8
Marital status	Married	70	33.3
	Unmarried	32	15.2
	Divorced	3	1.4
	Widowed	2	1.0
	Single	103	49.0
Years of experience	1 - 2	90	42.9
	3 - 4	73	34.8
	Above 5	47	22.4

Table 3. Distribution of community pharmacies.

Location of Pharmacy	Count	Percentage (%)
Libala/Chilenje	46	21.9
Ng'ombe	13	6.2
Kaunda Square	9	4.3
Chelstone	8	3.8
Kabwata/Kamwala	29	13.8
Mtendere/Kalingalinga	23	11.0
Mandevu/Chipata	19	9.0
Chawama	13	6.2
Kanyama/Garden	13	6.2
Matero	9	4.3
Central business area	28	13.3
Total	210	100

from Libala and Chilenje townships.

Of the 210 community pharmacies that were involved in the study, they all

stocked thirteen (13) antimalarials listed under the 2017 Guidelines for Diagnosis and Treatment of Malaria in Zambia (GDTMZ), with artemether/lumefantrine being highly available in 209 (99.5%) premises. However, 3/16 (18.8%) of the antimalarials were not listed in the GDTMZ but were listed in the 2021 WHO guidelines for malaria (**Table 4**).

Table 4. Availability of antimalarials in community pharmacies.

Drug Name	Availability		Listed in the GDTMZ	Listed in WHO Guidelines
	YES (%)	NO (%)		
Artemether/Lumefantrine	209 (99.5)	1 (0.5)	Yes	Yes
Dihydroartemisinin/Piperaquine	31 (14.8)	179 (85.2)	Yes	Yes
Artesunate/amodiaquine	22 (10.5)	188 (89.5)	No	Yes
Artesunate/mefloquine	13 (6.2)	197 (93.8)	No	Yes
Artesunate/sulfamethoxypyrazine/ pyrimethamine	158 (75.2)	52 (24.8)	No	Yes
Sulfadoxine/pyrimethamine	198 (94.3)	12 (5.75)	Yes	Yes
Injectable artesunate	109 (51.9)	101 (48.1)	Yes	Yes
Mefloquine	26 (14.1)	184 (85.9)	Yes	Yes
Artemether Injection	36 (17.1)	174 (82.9)	Yes	Yes
Quinine tablets	64 (30.5)	146 (69.5)	Yes	Yes
Quinine Injection	24 (11.4)	186 (88.6)	Yes	Yes
Dapsone/pyrimethamine	117 (55.7)	93 (44.3)	Yes	Yes
Primaquine	16 (7.6)	194 (92.4)	Yes	Yes
Quinine/clindamycin	3 (1.4)	207 (98.6)	Yes	Yes
Doxycycline	208 (99)	2 (0.1)	Yes	Yes
Atovaquone/Proguanil	15 (7.1)	195 (92.9)	Yes	Yes

GDTMZ: Guidelines for diagnosis and treatment of malaria in Zambia.

4. Discussion

To our knowledge, this is the first study to report on the availability of antimalarial medicines in community pharmacies of Lusaka district, Zambia. The availability of antimalarial medicines is key to the effective management of malaria. The Zambia National Malaria Strategic Plan emphasizes on prompt diagnosis and treatment with an effective antimalarial drug whenever a case of malaria is confirmed [18]. Community Pharmacies in Zambia contribute immensely to the availability of malaria medicines in the country and stand as an alternative solution whenever a particular malaria drug is not available in public health facilities where the services are free [19].

Our study revealed that 100% of the drugs listed in the 2017 guidelines for

diagnosis and treatment of malaria in Zambia that were under consideration were available in community pharmacies in Lusaka district though with the varying distribution. Artemether/lumefantrine, which is used for the treatment of uncomplicated malaria, was available in 99.95% of the community pharmacies. This high availability finding is similar to the finding by Kioko *et al.*, 2013 in Kenya in which the availability of artemether/lumefantrine was 91% [20].

In Zambia, dihydroartemisinin/piperaquine is also one of the first-line treatments for uncomplicated malaria; however, it was only available in 14.8% of community pharmacies, similar to the study findings by Kioko and colleagues in Kenya where it was available in 21% of the outlets [20]. In Zambia this drug has been used for mass drug administration as one of the intervention in parasite burden reduction and the guidelines recommends that it should not be used as first line treatment in areas where there is active mass drug administration of dihydroartemisinin/piperaquine [16]. This drug was used as the second-line treatment in Kenya [20].

Doxycycline was available in 99% of the community pharmacies. Though its use in malaria spheres is for prophylaxis for travellers (non-immune) to Zambia, its high availability can also be attributed to its use as an antibacterial for a wide range of bacterial infections [21].

The first-line drug for severe malaria, artesunate injection was available in 52% of the community pharmacies whereas, quinine and artemether injections were only available in 11.1% and 17.4% respectively. This low availability can be attributed to the fact that severe malaria cases are admissions mostly managed from public health facilities which are well stocked with antimalarials for treating severe malaria. This usually creates a low demand in private pharmacies hence the low availability, especially quinine injection. However, some pharmacies in Zambia are under National Health Insurance Management Authority (NHIMA) accreditation and readily stock essential medicines for those insured in case of no required drug in the public health facilities. As artesunate injection is the first line for severe malaria, it can be the reason why it was found in over 50 % of the community pharmacies compared to quinine injection and artemether injection.

Although not all the community pharmacies had the prophylactic drug, dapson/pyrimethamine (deltaprim) was available in 55% of the private pharmacies in Lusaka. In Zambia, This combination of drugs is used for malaria prophylaxis, especially in individuals with sickle cell disease and this drug needs to be available as the sickle cell trait is carried by 20-25% of the population and 1-2% of babies are born with the disease [22]. Mefloquine and atovaquone/proguanil were found in a few pharmacies (14.1% and 7.1% respectively). Sulfadoxine/pyrimethamine was stocked in 94.3% of the community pharmacies. In many countries, sulfadoxine/pyrimethamine is used for Intermittent Presumptive Treatment in pregnancy as recommended by the WHO [14] [15] [23] [24] [25] [26] [27]. This is similar to the practices and guidelines in Zambia and may be the reason for its high availability in community pharmacies.

Even though all the antimalarials stocked in community pharmacies were

listed in the WHO malaria treatment guidelines, 19% were not listed in the guidelines for diagnosis and treatment of malaria in Zambia, with artesunate/sulfamethoxyipyrazine/pyrimethamine (co-artimate) being the mostly (75.2%) distributed in community pharmacies in Lusaka. Artesunate/amodiaquine was available in 10.5% of the community pharmacies where as artesunate/mefloquine was available in 6.2% of the premises. These three drug combinations are among the recommended first-line treatments for uncomplicated malaria besides artemether/lumefantrine and dihydroartemisinin/piperaquine by the WHO [14]. The high availability of artesunate/sulfamethoxyipyrazine/pyrimethamine implies its high demand by the population. Unfortunately, it is not listed in the Zambia local treatment guidelines for malaria because artemether/lumefantrine is still effective and recent therapeutic efficacy studies have shown that the artemether/lumefantrine is still 98% effective against *P. falciparum* [28] [29] [30]. The stocking and dispensing of antimalarials not listed in the malaria local treatment guidelines may limit treatment options in case of drug resistance challenges.

Irrational use of ACTs poses a risk for drug resistance, emerging cases which have been reported in some countries like Cambodia [31] [32] [33]. It is very important to protect the effectiveness of the current ACTs and WHO recommends monitoring the effectiveness of these ACTs through therapeutic efficacy studies [14] [34]. It is also important to have reserve drugs as options when there is reported drug resistance to the medicines in use [35]. For example, in Nigeria, artemether/lumefantrine is the medicine of choice with artesunate/amodiaquine as an alternative, and in Tanzania, artemether/lumefantrine is the first-line treatment for uncomplicated malaria in both adults and children, with dihydroartemisinin/piperaquine as a second-line treatment in cases of treatment failure [36] [37].

This study provides an insight on the stocking of antimalarials in community pharmacies based on the Zambian guidelines for malaria diagnosis and treatment. However, the study was conducted in one district of Lusaka province, affecting the generalisation of the findings.

5. Conclusion

This study concluded that antimalarials were available for all categories of malaria management in community pharmacies of Lusaka district, though with a varying distribution from pharmacy to pharmacy. The presence of antimalarials not listed in the Zambian guidelines for the treatment of malaria is of public health concern with consequences on treatment options in the future. Therefore, there is a need to regulate the stocking and dispensing of antimalarials based on local treatment guidelines and this may be beneficial in preventing future occurrence of antimalarial drug resistance.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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Appendix

Identification #.....

Availability of Antimalarial Drugs in Community Pharmacies of Lusaka District, Zambia: Implications on Compliance to Malaria Treatment Guidelines

Dear Respondents,

You have been randomly sampled to help in this research, referring to the above topic. You are kindly requested to answer as honestly as possible.

INSTRUCTIONS

- 1) Please do not indicate your name on the questionnaire.
- 2) Tick the answer that expresses your view as shown.
- 3) Only one response is required for each question. On questions where you have to write your response, you may be as brief as possible by filling in the spaces provided.

Please Note: this research is purely for academic purposes. Therefore, you are assured that the information obtained will be treated with the utmost confidentiality. Your cooperation will highly be appreciated.

Date.....

Location of facility.....

No.	Questions	Coding Categories		For official use
RESPONDENT'S BACKGROUND				
Q01	Sex	1. Male 2. Female	[] []	
Q02	Age	1. 15 - 24 2. 25 - 34 3. 35 - 44 4. 45+	[] [] [] []	
Q03	Qualification	1. Certificate 2. Pharm technologist 3. Degree	[] [] []	
Q04	Years of experience	1. 1 - 2 yrs 2. 3 - 4 yrs 3. Above 5yrs	[] [] []	
Q05	Marital status	1. Married 2. Unmarried 3. Divorced 4. Widowed 5. Single	[] [] [] [] []	

ANTIMALARIAL TREATMENT GUIDELINES STANDARDS				
No.	Questions	Coding Categories		For official use
B1	Are malaria guideline standards followed?	1. Yes 2. No	[] []	
Q7	Do you have antimalarial drugs in stock?	1. Yes 2. No	[] []	
Q8	Do you have Artemether/Lumefantrine (AL)?	1. Yes 2. No	[] []	
Q9	Artesunate/amodiaquine;	1. Yes 2. No	[] []	
Q10	Artesunate /mefloquine;	1. Yes 2. No	[] []	
Q11	Artesunate/sulfamethoxypyrazine/pyrimethamine.	1. Yes 2. No	[] []	
Q12	Do you have Sulphadoxine/pyrimethamine (SP)?	1. Yes 2. No	[] []	
Q13	Do you have Dihydroartemisinin/Piperaquine (DHA-PQ) tablet?	1. Yes 2. No	[] []	
Q14	Do you have Mefloquine?	1. Yes 2. No	[] []	
Q15	Do you have Injectable artesunate?	1. Yes 2. No	[] []	
Q16	Do you have Artemether (intramuscular [IM])?	1. Yes 2. No	[] []	
Q17	Do you have Quinine tablet?	1. Yes 2. No	[] []	
Q18	Do you have quinine (IV/IM)?	1. Yes 2. No	[] []	
Q19	Do you have Dapsone/pyrimethamine (Deltaprim)?	1. Yes 2. No	[] []	
Q20	Do you have primaquine?	1. Yes 2. No	[] []	
Q21	Do you have Quinine/clindamycin?	1. Yes 2. No	[] []	
Q22	Do you have Doxycycline?	1. Yes 2. No	[] []	
Q23	Do you have Atovaquone/Proguanil?	1. Yes 2. No	[] []	
Q24	Do you have Chloroquine?	1. Yes 2. No	[] []	
Q25	Do you have any other antimalarial? if yes specify...	1. Yes 2. No	[] []	