Availability and Prices of Antimalarials and Staffing Levels in Health Facilities in Embu County, Kenya

S. NDWIGAH[1*], A. STERGACHIS[2,3], K. ABUGA[1], H. MUGO[1] AND I. KIBWAGE[1]

[1]*Department of Pharmaceutical Chemistry, School of Pharmacy, University of Nairobi, P.O. Box 19676-00202, Nairobi, Kenya.*
[2]*Department of Pharmacy, School of Pharmacy, University of Washington, P.O. Box 357236, Seattle, WA 98105*
[3]*Department of Global Health, School of Public Health, University of Washington, P.O. Box 357236, Seattle, WA 98105.*

Effective treatment of malaria relies on the availability of quality medicines while pricing is a major determinant of affordability. In addition, adequate numbers of competent staff of different cadres is essential for a well-functioning health system and effective health service delivery. The aim of the study was to determine the availability and prices of antimalarial medicines as well as staffing levels in healthcare facilities located in Embu County, Kenya. Antimalarials were sampled from 11 public (government owned) facilities, 29 private pharmacies, 5 private-for-profit and 3 not-for-profit mission health facilities in May-June 2014. The majority of public facilities (91%) had artemether-lumefantrine (AL) tablets in stock. Government and mission facilities did not stock second line antimalarials or sulfonamide-pyrimethamine (SP). All public facilities provided antimalarials free-of-charge to patients. Private pharmacies stocked a wider variety of antimalarials. The facilities studied were stocked with recommended antimalarials both in the private and public domains. No oral artemisinin monotherapies were encountered during the study. Only 45% percent of public facilities employed pharmacists. Of the remaining facilities, 27% employed pharmaceutical technologists while in the rest of the facilities pharmaceuticals were in the custody of nurses. Notably, none of the private-for-profit or mission facilities had pharmacists employed in their establishments; one facility employed a pharmaceutical technologist, while the rest were staffed by nurses. The number of private pharmacies superintended by pharmacists and pharmaceutical technologists were 7 (24%) and 22 (76%), respectively.

Key words: Antimalarials, artemisinin-based combination therapy, staffing level, Embu County

INTRODUCTION

An estimated 3.2 billion people live in areas at risk of malaria transmission globally [1]. The risk and burden of malaria and associated sequelae is greatest in the sub-Saharan African region, where an estimated 92% of all malaria deaths occur in children under 5 years of age accounting for 70% of the global mortality [2]. Nearly 70% of the population in Kenya is at risk of malaria infection [3]. Malaria is a preventable and treatable disease, provided that recommended, evidence-based interventions are implemented. These include vector control through the use of long-lasting insecticidal nets (LLINS) and indoor residual spraying (IRS), chemoprophylaxis for vulnerable populations, and timely treatment with appropriate antimalarial medicines [2].

Adequately trained human resources in sufficient numbers are essential for well-functioning health systems and effective health service delivery. A shortage of health workers undermines the public sector capacity to meet population healthcare needs [4]. Low- and middle-income countries (LMICs) that have lost many of their highly qualified healthcare

*Author to whom correspondence may be addressed. Email: sndwigah@yahoo.com

professionals increasingly rely on mid-level healthcare workers for service delivery [5]. Additionally, there is increased incidence of task shifting resulting in non-pharmaceutical cadres performing dispensing and other pharmacy related functions.

The World Health Organization (WHO) recommends the use of artemisinin-based combination therapy (ACT) as first line treatment for uncomplicated malaria caused by *P. falciparum* [6]. The Ministry of Health of Kenya recommends artemether-lumefantrine (AL) as first line for uncomplicated malaria [7]. Thus, artemether-lumefantrine is available as a co-formulated regular or child-friendly dispersible tablet. The second line treatment for uncomplicated malaria is dihydroartemisinin-piperaquine (DHAP) while severe malaria is managed using parenteral quinine or artesunate. Sulfadoxine-pyrimethamine combination is recommended for intermittent preventive treatment of malaria in pregnancy (IPTp) for women living in malaria-endemic areas [7].

Effective treatment of malaria relies on the availability of quality medicines while pricing determines their affordability. Governments, civil society groups and community workers concerned about the pricing of medicines are encouraged to carry out surveys as a way of exploring policy options and actions to reduce prices hence improving the availability and affordability of essential medicines [8]. Further, governments should ensure that the policy environment is supportive of access to essential medicines, such as antimalarials [9].

There are three primary supply chains for the distribution of medicines in Kenya. Kenya Medical Supplies Authority (KEMSA) is the government corporate tasked with procuring, storing and distributing medical commodities to all public health facilities. The Mission for Essential Drugs & Supplies (MEDS) is jointly owned by the Kenya Conference of Catholic Bishops (KCCB) and the Christian Health Association of Kenya (CHAK) and mostly supplies church owned (mission) facilities with drugs and medical supplies. Kenya also has a robust private sector which manufactures, exports, imports, distributes, and supplies medicines and medical devices in Kenya.

The aim of this study was to determine the availability and price of antimalarials recommended by WHO and the Ministry of Health for treatment or prevention of malaria at health facilities and assess staffing of health facilities that provide antimalarials in Embu County, Kenya.

METHODS

Ethical considerations

Study approval was granted by Kenyatta National Hospital/University of Nairobi Ethics and Research Committee (KNH/UoN-ERC) under approval number P428/08/2013.

Study area and sampling

The study was conducted within Embu County, Kenya, in May-June 2014. Administratively, the county is divided into 5 sub-counties namely, Embu West, Embu North, Embu East, Mbeere North and Mbeere South. Each sub-county has one government hospital plus several health centers and dispensaries. All the 5 public hospitals were sampled along with 6 of the largest health centers across the sub-counties. There was only one mission hospital in the county which was also included in the study in addition to two mission health facilities. Five private-for-profit health facilities distributed across the sub-counties were sampled while 29 private pharmacies were included in the study. The private pharmacies sampled were proximal to the health facilities hence considered as alternative sources of medications in case of stock-outs at the health facilities. Thus, for each government hospital and private-for-profit health facilities, 2 adjacent pharmacies were sampled while for health centers one pharmacy was selected.

Availability and price of antimalarial medicines

A structured questionnaire was used to determine the availability and price of originator

brands and generic products for first line (AL), second line treatments and other ACTs. Additionally, the existence and prices of monotherapies, injectables, SPs, quinolones and herbal preparations were collected. A facility with enough stock to last 3 months based on the average monthly consumption was considered adequately stocked.

Staffing of health facilities

The number of staff within the different cadres involved in handling antimalarial commodities was determined for all the facilities sampled. The persons in-charge of each of the health facilities were interviewed face-to-face to provide responses to specific aspects of the questionnaire. In hospital settings, both the medical superintendent and the pharmacist/pharmaceutical technologist-in-charge were interviewed while for health centers, clinical officers or nurses served this purpose. As for private pharmacies, the superintendent pharmacists/pharmaceutical technologists were interviewed. In all applicable cases part-time staff were categorized as employees.

RESULTS

Availability of antimalarial medicines

Table 1 shows the availability of antimalarials according to active pharmaceutical ingredient(s) and number of facilities stocking the products. Ten out of 11 public facilities (91%) had adequate stocks of artemether-lumefantrine (AL) tablets at the time of study. One public facility that did not have adequate stock reported their AL supplies ran out one week earlier and had initiated the process of acquiring new stock. Some facilities stocked only the 24's packs of Coartem® thus dispensing fractions of packets to children. All AL stocks were supplied by Kenya Medical Supplies Authority (KEMSA). The public facilities supplied all antimalarials at no charge to the patients.

The most available dosage form in all facilities was AL 24's (AL-IPCA®) provided through the Affordable Medicines Facility for malaria (AMFm) programme. This product was found in 6 (54.5%) of public facilities and 21 (53.8%) of private facilities. None of the government facilities sampled stocked SP for IPTp. Instead, staff interviewed indicated that they advised pregnant women to sleep under insecticide-treated nets for malaria prophylaxis.

In one of the government facilities staff stated that they were not trained on the use of artesunate injection, stocks of which had not been used for two years. The facility had an oversupply of antimalarials and rapid diagnostic tools (RDTs) supplied by KEMSA due to the 'push system' resulting in expiry of some drugs such as Coartem® 6's.

The 29 private pharmacies sampled stocked a wide variety of antimalarials as shown in Table 1. A total of 11 SP brands were stocked in these facilities. The majority (58.6%) of the respondents said they prescribed and issued the SPs for malaria prophylaxis for all clients including pregnant women. Four (13.8%) of the private pharmacies reported dispensing SP combinations for treatment of malaria.

Proguanil was found in 3 private pharmacies while amodiaquine suspension was found in 7 private facilities (24%) even though the latter is not recommended for management of malaria.

Six (20%) of the private pharmacies stocked Remoxe®, a herbal preparation made from extracts of *Ajuga remota*. The use of this plant in malaria treatment is based on folkloric information with no supporting clinical data.

Table 1: Availability and prices of antimalarials

Product name	Number of products		Number of stocking facilities				Prices of products (KSh**)		
	Innovator	Generic	Public	Private-for- profit	Mission	Private pharmacies	Lowest price	Median price	Highest price
Artemether-Lumefantrine ACT									
Coartem® 24's (AL) tablets	1	0	5	1	0	1	150	N/A	345
Coartem® 18's (AL) tablets	1	0	4	0	0	0	N/A	N/A	N/A
Coartem® 12's (AL) tablets	1	0	7	1	2	3	20	75	120
Coartem® 6's (AL) tablets	1	0	9	0	1	3	20	50	65
Artemether-Lumefantrine 24's tablets	0	5	6	5	2	27	20	100	420
Artemether-Lumefantrine 18's tablets	0	2	2	0	0	0	80	N/A	N/A
Artemether-Lumefantrine 12's tablets	0	3	0	0	1	0	50	250	420
Artemether-Lumefantrine 6's tablets	0	3	4	2	0	10	30	250	370
Artemether-Lumefantrine forte 12's tablets	0	1	0	0	0	2	180	215	250
Artemether-Lumefantrine suspension	0	1	0	0	0	10	150	300	350
Artemether-Lumefantrine suppositories	0	1	0	0	0	1	245	N/A	N/A
Dihydroartemisinin-piperaquine ACT									
Duo-Cotexin® tablets	1	0	0	3	0	18	350	450	600
Duo-tab® tablets	0	1	0	1	0	5	200	300	450
P-Alaxin® tablets	0	1	0	3	0	22	250	300	500
Rid mal® tablets	0	1	0	0	0	2	200	N/A	450
Darte-Q® tablets	0	1	0	0	0	1	360	N/A	380
Other ACTs									
Asaq® ACTm tablets (artesunate-amodiaquine)	1	0	0	0	0	11	50	100	100
Artequick® tablets (artemisinin-piperaquine)	1	0	0	1	0	11	300	450	506
Arco® tablets (artemisinin-napthoquine)	1	0	0	0	0	12	400	460	580

Table 1 (Contd): Availability and prices of antimalarials

Product name	Number of products		Number of stocking facilities				Prices of products (KSh**)		
	Innovator	Generic	Public	Private-for- profit	Mission	Private pharmacies	Lowest price	Median price	Highest price
Artequin® tablets (artesunate-mefloquine)	1	0	0	0	0	4	850	980	1030
Artequin® pediatric (artesunate-mefloquine)	1	0	0	0	0	1	400	N/A	N/A
Co-arinate® (artesunate-sulfamethoxypyrazine-pyrimethamine) tablets	1	0	0	0	0	2	375	400	454
CO-arinate® for infants	1	0	0	0	0	2	350	367.5	385
Injectables									
Paluther® (artemether) ampoule	1	0	0	1	0	0	290	N/A	N/A
Artenam® (artemether) ampoule	0	1	0	3	1	6	100	150	300
Larither® (artemether) ampoule	0	1	0	3	1	5	120	187.5	280
Artesiane® (artesunate) ampoule	1	0	10	2	3	3	0	95	280
Quinine ampoule	0	1	11	5	2	9	25	40	80
Other anti-malarials									
Quinine tablets	0	1	9	2	1	8	0	6	12
Quinine suspension	0	3	0	3	0	0	100	150	200
Mephaquin® tablets (mefloquine)	1	0	0	0	0	2	600	875	1150
Amodiaquine suspension	0	2	0	2	0	7	50	75	100
Sulfamethoxypyrazine-pyrimethamine tablets	0	4	0	0	0	9	30	65	100
Sulfadoxine-pyrimethamine tablets	1	5	0	5	0	25	50	100	150
Paludrine® tablets (proguanil)	1	0	0	0	0	3	15	21.50	28
Herbal preparations									
Remoxe®* tablets /suspension	N/A	0	0	0	0	6	180	215	250

* Contains extracts of *Ajuga remota*; **100 KSh (Kenyan shillings) ≈ 1 USD; ACT - Artemisinin combination therapy; N/A - not applicable

Prices of antimalarial medicines

Artemether-lumefantrine

All public facilities supplied artemether-lumefantrine tablets free-of-charge to all patients having a positive malaria test. Table 1 shows prices in Kenya shillings, (100 KSh ≈ 1 USD) of artemether-lumefantrine tablets in private sector facilities.

The recommended price of AL-24's (AL-IPCA®) provided through AMFm was Ksh 40 [10]. Most facilities however, marked up by Ksh. 60 to Ksh. 100. One facility was selling the product at Ksh. 420. Artemether-Lumefantrine was the least costly antimalarial. However, approximately 30 % of healthcare workers preferred to use other treatments including herbal remedies such as Remoxe®.

Dihydroartemisinin-piperaquine

Dihydroartemisinin-piperaquine (DHAP) was the second line treatment of malaria according to WHO and Division of Malaria Control (DOMC) malaria treatment guidelines. This product was preferred by some practitioners to AL because they believed it was "more effective". Five brands were encountered during the survey whereby P-Alaxin® was the most popular with a frequency of 25 facilities while Duo-cotexin® was found in 21/39 private facilities (Table 1). The lowest and the highest prices for DHAP were Ksh. 200 and Ksh. 600, respectively. None of the public and mission facilities had DHAP in stock.

Other artemisinin combination therapies

Artemisinin-piperaquine (Artequick®), artemisinin-napthoquine (Arco®) and artesunate-amodiaquine (Asaq® ACTm) were the most commonly found ACTs in this category (Table 1). Asaq® AMFm was found in 11 private pharmacies (37.3 %) at a price range of Ksh 50–100 but was not stocked by public nor mission facilities. Considering the aims of AMFm, and the low price, it was expected that Asaq® would be more available. The non-AMFm ACTs were retailing at Ksh. 350-1030 as depicted in Table 1.

Mefloquine was found in 2 facilities for Ksh. 600-1150. No oral artemisinin monotherapies were encountered during the study which demonstrated compliance with WHO recommendations. Quinine tablets were found in 9 public facilities and 11 private facilities.

Injectable antimalarials

The injectable antimalarials found in Embu County are listed in Table 1. Quinine injection was available in all public facilities while artesunate (Artesiane®) was the only artemisinin-based injectable found in 10 public facilities. Quinine and artemether injections were found in 16 and 15 private facilities, respectively, while only 8 private facilities stocked artesunate injection.

Herbal medicines

There was only one herbal preparation, Remoxe® which was encountered in 6 private pharmacies at a price of Ksh. 180 in 3 facilities and Ksh. 200, Ksh. 240 and Ksh. 250 in the remaining three.

Staffing of health facilities

Public facilities

Table 2 summarizes staff serving in both government and private health facilities during the study. Five of the public facilities (45%) were staffed by pharmacists and medical officers. One public facility also had pharmacist interns (trainees) in service. Three public facilities (27%) had pharmaceutical technologists as superintendents while the other 3 (27%) had nurses managing antimalarial drugs. Only 2 public facilities had dentists as staff. In two of the facilities, pharmacists were involved in dispensing, ward rounds, commodity management, patient counseling, and provision of continuous medical education (CME). Pharmacists in these three facilities also had specific clinical tasks allocated to them, such as pharmaceutical care services for persons with HIV/AIDS.

Private-for-profit and mission facilities

Six (86%) private-for-profit (PFP) and all 3 mission facilities sampled, did not have pharmacists working therein. One PFP facility had 4 medical specialists on-call whose primary job station was a public facility. Only one PFP hospital engaged dentists while two PFP hospitals and 1 mission facility had dental technologists in service. One mission facility had 4 pharmaceutical technologists and 4 medical officers seconded from the Ministry of Health. The other 2 facilities were staffed solely by nurses who handled pharmaceutical commodities. The mission facilities sourced antimalarials from Mission for Essential Drugs and Supplies (MEDS).

Private pharmacies

Table 2 summarizes the staffing of the 29 private pharmacies (P1-P29) sampled during the survey. Seven private pharmacies (24%) located in Embu and Runyenjes towns were supervised by pharmacists. The other 22 private pharmacy outlets (76%) were supervised by pharmaceutical technologists wherein 7 had two individuals of this cadre in service.

Table 2: Staffing of health facilities

Facility	Facility category	Total Number of workers	Pharmacists	Pharmaceutical technologists	Medical specialists	Medical officers	Dentists	Dental technologists	Clinical officers	B.Sc. Nurses	Diploma Nurses	Laboratory technologists	Laboratory technicians	Others**
1	Public	417	12+6*	0	12	17	4	1	26	6	241	18	2	60
2	Public	22	1	0	0	1	0	0	2	0	14	2	1	1
3	Public	66	5	0	0	2	0	0	7	0	35	0	0	24
4	Public	29	0	2	0	0	0	0	3	0	18	3	0	3
5	Public	17	0	1	0	0	0	0	2	0	11	1	0	2
6	Public	64	3	1	1	3	1	0	7	0	37	2	1	9
7	Public	27	0	2	0	0	0	0	3	0	11	3	0	8
8	Public	39	2	3	0	1	0	0	4	0	24	2	0	3
9	Public	15	0	0	0	0	0	0	1	0	9	0	2	3
10	Public	6	0	0	0	0	0	0	0	0	5	0	0	1
11	Public	11	0	0	0	0	0	0	1	0	8	1	0	1
12	Private-for-profit	11	0	0	4	1	0	0	1	0	5	1	0	0
13	Private-for-profit	13	1	2	0	4	0	0	0	0	3	3	0	0
14	Private-for-profit	2	0	0	0	0	0	0	1	0	0	0	0	1
15	Private-for-profit	3	0	0	0	0	0	0	1	0	1	1	0	0
16	Private-for-profit	21	0	2	0	1	2	1	2	0	8	2	0	3
17	Private-for-profit	4	0	0	0	0	0	1	0	0	1	1	0	1
18	Private-for-profit	1	0	0	0	0	0	0	0	0	1	0	0	0
19	Mission	58	0	4	0	4	0	2	3	0	40	3	0	2
20	Mission	3	0	0	0	0	0	0	0	0	1	1	0	1
21	Mission	2	0	0	0	0	0	0	0	0	1	1	0	0
P1-P29	Private pharmacies	82	7	29	0	0	0	0	4	0	1	0	0	41

*Pharmacists interns ; **The category of "others" represented secretaries, cleaners, cooks and messengers who work as support staff in the facilities.

DISCUSSION

Availability of antimalarial medicines

Malaria case management remains a vital component of malaria control strategies. Treatment of uncomplicated *P. falciparum* malaria with ACTs is recommended by WHO as first-line treatment. Injectable artesunate or quinine are recommended for the treatment of severe *P. falciparum* malaria in adults. The WHO also recommends that artemisinin and its derivatives should not be used as monotherapy [7]. In this study, most drugs were available as per WHO recommendations. Most public facilities (91%) had adequate artemether-lumefantrine tablets in stock. The most common dosage form across the spectrum of facilities including private pharmacies was AL 24's (AL-IPCA®) provided through the Affordable Medicines Facility for malaria (AMFm).

Private pharmacies were the best stocked with a wide variety of antimalarial commodities. Government and mission facilities did not stock second line antimalarials and sulfadoxine-pyrimethamine for IPTp. The World Malaria Report [2] reported that the proportion of women receiving three or more doses of IPTp still remains below universal coverage. The results obtained demonstrate that Embu County was stocked with recommended antimalarials in both private and public sectors. No oral artemisinin monotherapies were encountered during the study which showed compliance with WHO recommendations. Therefore, the use of the herbal product, Remoxe® could not be attributed to unavailability of recommended anti-malarials.

Prices of antimalarial medicines

All public facilities dispensed artemether-lumefantrine (AL) tablets free-of-charge to malaria patients. Most private facilities sold AL at 100 KSh per dose including the AMFm AL products whose recommended retail price was 40 KSh. It was revealed that the second line treatment of malaria was preferred by some practitioners because they were "more effective". The median price for DHAP was 400 KSh and was only available in private pharmacies and for-profit-health facilities. The price of Remoxe® was higher than many available conventional medicines indicating that cost was not a factor in choice of this product, but rather folklore influence.

Staffing of facilities:

In Embu County, few public facilities were staffed by healthcare workers with university level training i.e. pharmacists, physicians and dentists. Only one government facility had dentists in service. There was limited variety of cadres of healthcare workers and a shortage of qualified health workers in remote and rural areas which were primarily served by nurses and pharmaceutical technologists. This situation impedes access to life-saving interventions. According to WHO Global Health Observatory (GHO), statistics show that over 44% of WHO member states have less than 1 physician per 1000 population [11]. It also reports that health workers are distributed unevenly across the globe. Specifically, the African Region suffers more than 24% of the global burden of disease but has access to only 3% of health workers and less than 1% of the world's financial resources [11]. Embu County does not meet the minimum threshold of 23 doctors, nurses and midwives per 10,000 population that was established by WHO as being necessary to deliver essential maternal and child health services. Countries that fall below this threshold struggle to provide skilled care at birth to significant numbers of pregnant women, as well as emergency and specialized services for newborns and young children.

CONCLUSION

Embu County was stocked with recommended antimalarials both in private and public facilities. No oral artemisinin monotherapies were encountered during the study which showed compliance with WHO recommendations. All public facilities dispensed antimalarials free-of-charge to patients. In private facilities, antimalarial medicines generally appeared to be priced appropriately. There was substantial lack of qualified personnel offering services in

public, private-for-profit and private-not-for-profit hospitals as well as in private pharmacies. The cadres in short supply were medical officers, pharmacists and dentists. A comprehensive approach is therefore needed to ensure high caliber, skilled and motivated health workers are deployed in Embu County.

ACKNOWLEDGEMENTS

The authors acknowledge funding from Partnership for Innovative Medical Education in Kenya - Medical Education Partnership Initiative (PRIME-K/MEPI) from National Institutes of Health (NIH) grant number R24 TW008889-02.

REFERENCES

[1] Centers for Disease Control and Prevention. Impact of Malaria. CDC, Atlanta, 2017. https://www.cdc.gov/malaria/malaria_worldwide/impact.html. Accessed 20th Aug 2018

[2] World malaria report 2017. World Health Organization, Geneva. 2017, p 12.

[3] Kenya Institute for Public Policy Research and Analysis (KIPPRA). Kenya Economic Report 2013: Creating an Enabling Environment for Stimulating Investment for Competitive and Sustainable Counties. KIPPRA, Nairobi. 2013, pp 37, 43 &187.

[4] K. Sherr, A. Mussa, B. Chilundo, S. Gimbel, J. Pfeiffer, *et al.* PLoS ONE **7**(4), 2012, e35840.

[5] E. Mcauliffe, C. Bowie, O. Manafa, F. Maseko, M. Maclachlan, D. Hevey, C. Normand and M. Chirwa. Hum. Resour. Health. 7, 2009, 13.

[6] WHO. Guidelines for treatment of malaria. Third edition. World Health Organization, Geneva. 2015, pp 31-94.

[7] Ministry of Public Health and Sanitation. National guidelines for the diagnosis, treatment and prevention of malaria in Kenya. Division of Malaria Control, Nairobi, 2010. Available at http://www.nmcp.or.ke Accessed 20 Aug 2018.

[8] WHO and HAI. Measuring medicine prices, availability, affordability and price components, 2nd edition. WHO, Geneva, 2008. http://www.who.int/iris/handle/10665/70013 Accessed 20th August 2018.

[9] J. C. Cohen-Kohler. Clin. Pharmacol. Ther. 82, 2007, 610-614.

[10] Health Action International. Retail prices of ACTs co-paid by the AMFm and other antimalarial medicines: Ghana, Kenya, Madagascar, Nigeria, Tanzania and Uganda. Report of price tracking surveys. HAI, Amsterdam, 2012. www.haiweb.org and www.haiafrica.org Accessed 20th Aug 2018.

[11] WHO. Density of physicians (total number per 1000 population). Situations and trends. WHO, Geneva, 2018. http://www.who.int/gho/health_workforce/physicians_density_text/en/ Accessed 20th Aug 2018