

UON SORT IT- March 2024 Supplement

TRACKING THE TESTING AND TREATMENT OF UNCOMPLICATED MALARIA USING ROUTINE DATA IN PUBLIC HEALTH FACILITIES IN KENYA, 2022

Robert Mwaganu, Ministry of Health, Kenya, Fredrick Ouma Odhiambo, Ministry of Health, Kenya, Regina Kandie, Ministry of Health, Kenya, Ahmeddin Omar, Ministry of Health, Kenya, Lenson Kariuki, Ministry of Health, Kenya, Charles Chege, Ministry of Health, Kenya, James Kiarie, Ministry of Health, Kenya, Paul Murima, Ministry of Health, Kenya, Edith Ramaita, Ministry of Health, Kenya, Joy Gakenia Murangiri, Ministry of Health, Kenya, Beatrice Machini, Ministry of Health, Kenya, Faustina Sakari, County Government of Kakamega, Department of Health Services, Kakamega, Kenya, Edwin Onyango, County Government of Busia, Department of Health and Sanitation, Busia, Kenya, Erolls Cheruiyot Sigei, Kenya Medical Training College (KMTC), Nairobi, Kenya, Catherine Kilonzo, Ministry of Health, Kenya, Edward Meru Kamau, Special Programme for Research and Training in Tropical Diseases (TDR), World Health Organization, Geneva, Switzerland, Rose Jepchumba Kosgei, University of Nairobi, Department of Obstetrics and Gynecology, Kenya, David Gathara, KEMRI Wellcome Research Programme, Nairobi, Kenya, Anne-Beatrice Kihara, University of Nairobi, Department of Obstetrics and Gynecology, Kenya, International Federation of Gynecology and Obstetrics (FIGO).

Corresponding author: Robert Mwaganu, Ministry of Health, Kenya.

Email: robmwauram@gmail.com

TRACKING THE TESTING AND TREATMENT OF UNCOMPLICATED MALARIA USING ROUTINE DATA IN PUBLIC HEALTH FACILITIES IN KENYA, 2022

R. Mwaganu, F. O. Odhiambo, R. Kandie, A. Omar, L. Kariuki, C. Chege, J. Kiarie, P. Murima, E. Ramaita, J. G. Murangiri, B. Machini, F. Sakari, E. Onyango, E. C. Sigei, C. Kilonzo, E. M. Kamau, R. J. Kosgei, D. Gathara, and A. B. Kihara

ABSTRACT

Objective: To assess consistency in testing and treating uncomplicated malaria in public health facilities, Kenya 2022. Specifically, the study aimed at determining the treatment rate for malaria-positive cases, the proportion of health facility reports with correct treatment of malaria-positive cases, the proportion of health facility reports with correct Artemether-Lumefantrine (AL) dosing, and concordance of malaria-positive cases and correct AL dosing.

Design: Retrospective cross-sectional review of routinely collected data by public health facilities reported on the Kenya Health Information System (KHIS).

Setting: Government-owned (public) primary health facilities in Kenya, 2022.

Main outcome measures: Concordance on malaria-positive cases treated and AL dosing.

Results: Overall treatment rate was 98.2%, with health facilities in level 3 having the highest treatment rate (99.5%). Level 4 health facilities recorded a treatment rate (102.1%), hence an overtreatment rate of 2.1%. Reports on the treatment of only patients that tested positive were 53.7% across the three levels of care, with level 2 (56.2%), level 3 (50.5%), and four health facilities having the lowest proportion

(38.7%). Only 57.1% of the reports had the correct number of tablets dispensed based on the patient's weight band. The overall performance on reports concordance with patients who tested positive and were treated with the right number of tablets based on their weight band. Levels 2 and three achieved 43.8% and 39.5%, respectively, while level performed lowest at 26.3%.

Conclusion: Gaps in data concordance on treating malaria-positive cases and AL dosing were evident, alluding to non-adherence to malaria treatment guidelines.

INTRODUCTION

Malaria is a life-threatening disease caused by parasites from infected female Anopheles mosquitoes. Climate change poses global health risks in mosquito-borne diseases like malaria due to rising temperatures, changes in rainfall patterns, and greenhouse gas emissions(1). Vegetation acclimation catalyzed by elevated carbon dioxide (CO₂) under climate change influences breeding and malaria transmission (2). Globally, there were an estimated 247 million malaria cases in 2021, with Africa bearing 95% of these cases and 96% of deaths (691,000). Kenya accounted for 1.3% and 1.9% of global malaria cases and deaths, respectively (3).

Malaria can be confirmed through microscopy or Malaria Rapid Diagnostic Tests (mRDTs). This is well anchored within objective 2 of the Kenya Malaria Strategy (KMS), which aims to manage 100% of suspected malaria cases according to guidelines for diagnosis, treatment, and prevention of malaria (4)(5). Proactively enforcing the Malaria Prevention Act and collaborating with different government agencies and other stakeholders can help prevent malaria in populations exposed to mosquito breeding sites, reducing malaria cases and commodity needs (6).

To support this objective, the National Malaria Control Program (NMCP) and other partners have invested in the procurement and distribution of the recommended first-line

treatment for uncomplicated malaria is Artemether Lumefantrine (AL) 20mg/120mg, mRDT, capacity building health workers on malaria case management and parasitological quality assurance, provision of job aids and treatment guidelines to health workers among other interventions(7). In 2022, 9.4 million patients were tested for malaria, 36% testing positive, 4 million doses of artemether-lumefantrine (AL) were dispensed, and over 3.3 million patients were treated (8).

The guidelines for the diagnosis, treatment, and prevention of malaria in Kenya recommend treatment of only positive cases (correct treatment) and dosage per unit pack according to patients' weight category (correct dosage)(9). Overtreatment or undertreatment could lead to anti-malaria resistance and misuse of limited resources. Previous studies have indicated variations in health worker compliance with the test and treatment guidelines across different malaria risk zones in Kenya(10). About 42% of children who sought treatment and reported fever were not subjected to a parasitological test (3). The lack of an adequate supply chain for diagnostics and AL sometimes leads to presumptive treatment and substitution due to inadequate stocks. A 2021 survey showed that 20% of the health facilities experienced total absence of diagnostic services, 31% had no AL, and 83% had at least one pack of AL(7). Therefore, health facilities need to ensure the concordance of reported data continually. This ensures that

only positive malaria cases are treated using the correct dosage per patient's weight band. This study assesses consistency in testing and treating uncomplicated malaria in Kenya's public health facilities in 2022. Specifically determined by the level of care: treatment rate for malaria-positive cases, the proportion of health facility reports with correct treatment of malaria-positive cases, the proportion of health facility reports with accurate AL dosing, and concordance of malaria-positive cases and correct AL dosing.

MATERIALS AND METHODS

Study design: The study was a retrospective cross-sectional review of routinely collected Malaria Program data using the malaria commodities reporting tool (MOH 743) in 2022. **Specific setting:** The organization of the healthcare service delivery system in Kenya is structured hierarchically: level 1 (Community Units), level 2 (Dispensaries), level 3 (Health centers), Level 4 (Primary referral facilities), Level 5 (Secondary referral facilities), and Level 6 (Tertiary referral facilities) (11). Public health facilities receive ALs, mRDTs, and other malaria commodities funded by the

Government and other partners through the Kenya Medical Supplies Authority (KEMSA) and Mission for Essential Drugs and Supplies (MEDS). Reports are uploaded to the Kenya Health Information System (KHIS) by the 15th of each month for the preceding month to assess timelines, reporting rates, stock status, and completeness of data, among others. The daily activity register (DAR) MOH 645 is used to get monthly aggregate data into MOH 743, which is uploaded to KHIS.

Table 1 exhibits the administered doses of AL based on patient weight defined by the malaria treatment guidelines. The malaria treatment guidelines recommend treatment of patients who test positive using the correct dosing schedule (9). To ensure the proper medicine dosage is administered, the patient's weight must always be factored in when considering the substitution of AL. For instance, if a patient weighs 18kg, falling within the range of 15kg to less than 25kg, they should ideally receive one dose of AL 12, consisting of 12 tablets taken over three days. Alternatively, the patient could receive two doses of AL 6, each pack containing six tablets, to achieve 12 tablets.

Weight (kg)	Tablets/Dose (n)	Total Tablets (n)
5-15	1	6
15 to <25	2	12
25 to <35	3	18
≥35	4	24
^a Dosing should be based on total body weight.		

Figure 1: Administration doses of Artemether Lumefantrine based on patient weight (12)

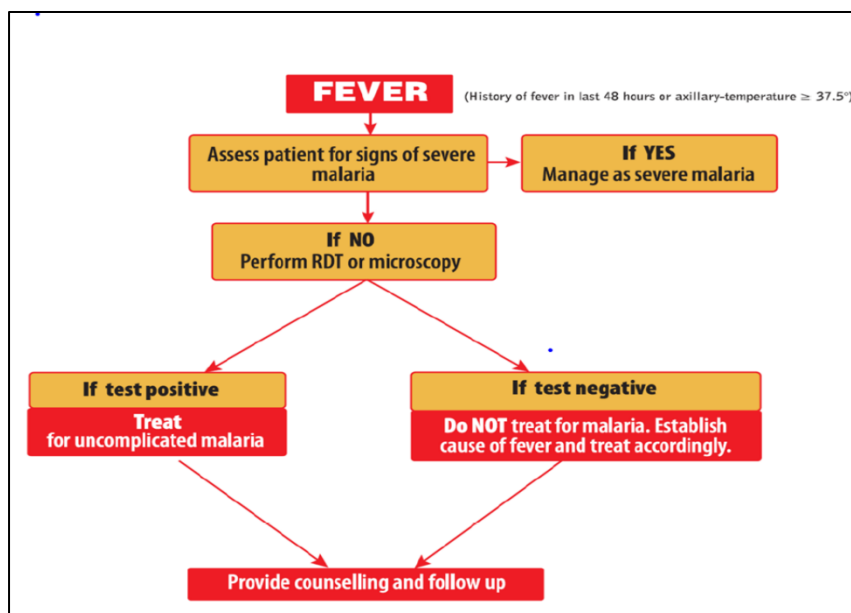


Figure 2: Flow chart showing the outpatient malaria case-management recommendation algorithm (10)

Study population: The data presented for this analysis is from 40,111 reports for levels 2, 3, and 4. Levels 1, 5, and 6 were excluded because they did not report on MOH 743.

Data variables

The data variables collected were the treatment rate for malaria-positive cases, the proportion of health facility reports with correct treatment of malaria-positive cases, the proportion of health facility reports with accurate AL dosing, and the concordance of malaria-positive cases and correct AL dosing.

Data collection: Data was abstracted from MOH 743 from KHIS in February 2023 and uploaded to a Microsoft Excel spreadsheet software v. 16.33 (Microsoft Corporation, Redmond, WA, USA) for cleaning and analysis.

Data Analysis

Microsoft Excel spreadsheet software v. 16.33 (Microsoft Corporation, Redmond, WA, USA) was used to clean, sort, and check for data

consistency, accuracy, and completeness. Quantitative data was summarized descriptively using frequencies, absolute numbers, and proportions and reported per objective using tables.

Ethics Considerations

Scientific and ethical approval to carry out the research was granted by the Maseno University Scientific and Ethics Review Committee (MUSERC), number MUSERC/01234/23. Permission to use the data for this study was granted by Kenya's National Malaria Control Program.

RESULTS

The overall treatment rate was 98.2%, with health facilities in level 3 having the highest treatment rate (99.5%). Level 4 health facilities recorded a treatment rate of 102.1%, hence an overtreatment rate of 2.1% (Table 1)

Table 1*Treatment rate for malaria-positive cases in levels 2, 3, and 4 in 2022*

Level of care	Total number of patients treated	Total number of patients tested positive	Treatment rate (%)
Level 2	2,234,393	2,297,656	97.2
Level 3	778,208	782,001	99.5
Level 4	309,764	303,328	102.1
TOTAL	3,322,365	3,382,985	98.2

Almost 54% of the reports across the three levels proportion at 56.2%, whereas level 4 facilities of care had malaria-positive cases treated attained the lowest proportion at 38.7%, as correctly. Level 2 health facilities had the highest shown in Table 2.

Table 2*Proportion of health facility reports with correct treatment of only malaria-positive cases by level of care in 2022*

Level of care	Total no. of reports	No. of reports having treatment of only patients that tested positive	% of reports with correct treatment of only malaria-positive cases
Level 2	28,845	16,200	56.2
Level 3	8,531	4,312	50.5
Level 4	3,035	1,175	38.7
TOTAL	40,411	21,687	53.7

Correct treatment according to the dosing Performance within this parameter varied from schedule was documented in 57.1% of the 49.9% to 58.1% (Table 3). reports across all three levels of care.

Table 3*Proportion of reports with correct no. of tablets dispensed based on patient's weight band by level of care in 2022*

Level of HF	Total no. of reports	No. of reports having correct AL dosing	The proportion of reports with the correct no. of tablets dispensed based on the patient's weight band by the level of care
Level 2	28,845	16,765	58.1
Level 3	8,531	4,785	56.1
Level 4	3,035	1,514	49.9
TOTAL	40,411	23,064	57.1

AL- Artemether Lumefantrine, HF- Health Facilities

From a broader perspective, health facility facilities exhibited the lowest achievement at reports indicated a concordance rate of 41.6% for 26.3%, while dispensaries achieved the highest treating malaria-positive cases and accurately at 43.8% (Table 4). dispensing prescribed dosages. Notably, Level 4

Table 4

Proportion of reports having concordance on patients who tested positive and treated with the correct no. of tablets based on patient's weight band in levels 2, 3, and 4 in 2022

Level of HF	Total no. of reports	No. of reports having concordance	% of reports having concordance
Level 2	28,845	12,645	43.8
Level 3	8,531	3,372	39.5
Level 4	3,035	797	26.3
TOTAL	40,411	16,814	41.6

HF- Health Facilities

DISCUSSION

This study sought to assess the consistency in testing and treating uncomplicated malaria in public health facilities in Kenya in 2022. The main findings are: 98.2% of the positive malaria cases were treated with notable overtreatment in level 4 facilities, 53.7% of the reports across the three levels of care had treatment for only patients that tested positive for malaria, correct treatment according to the dosing schedule was documented in 57.1%, while concordance on patients tested positive and treated with correct no. of tablets dispensed based on patient's weight band was 41.6% of the reports across all three levels of care.

The results showed that almost all patients who tested positive were treated across all care levels, which was in line with Kenya's Malaria Strategy of treating 100% of malaria cases. This could be attributed to the availability of malaria commodities, both diagnostics and ALs. A previous outpatient report observed that health facilities could provide malaria parasitological tests to patients (7). The overtreatment in health facilities for level 4 correlates with a study on inpatient malaria investigation and treatment in Western Kenya hospitals (13) that had resulted in high presumptive treatment. This could be attributed to data quality issues and reliance on clinical treatment, translating to non-adherence to the malaria treatment guidelines.

Treatment guideline recommends that all malaria-suspected cases be subjected to a diagnostic test before treatment. Despite the high treatment rate, a closer look at the reports indicated that the indicator's performance on malaria-positive cases treated was relatively poor, signaling gaps in adherence to malaria treatment guidelines. A survey carried out in 2020 showed that only 51% of facilities had updated daily activity registers, and 82% had submitted monthly summary forms (14). Data capture and lack of updating data collection tools could have contributed to the discrepancies. Patients' treatment-seeking behavior and health worker skills and attitudes could also imply data quality.

Healthcare workers are guided by malaria treatment guidelines on AL dosing for positive malaria cases based on the weight band of the patient. There was a gap between the number of malaria-positive cases treated and the doses of AL dispensed. A study on provider knowledge of treatment policy and dosing indicated that 20% of staff in public health facilities had not been trained on treatment policy on AL. Furthermore, about 16% did not know AL dosing (15). The sub-optimal performance of AL dosing could be because of the knowledge gap.

Health facility data quality assessment, mentorships, and supervision are frequently used to address service needs and reporting gaps. Results of producing routine malaria

data study revealed that discrepancies were concealed in aggregated monthly reports entered into the health information system (16). On the other hand, a study on improving the quality and use of routine health information system data advocated for data quality assessment, and feedback systems were found helpful in improving data quality (17). The poor performance in data concordance could be due to a lack of effective interventions to strengthen data quality and human resource capacity, especially in level 4, which had the lowest performance.

Strengths

The digitization of and availability of routine data in KHIS enabled the assessment and generated the study's outcome. Proper documentation of patient data is vital in decision-making in patient management, capacity building of health workers, and supply chain management of commodities. The study demonstrated documentation gaps and can be incorporated into malaria intervention strategies.

Limitation

The study could not examine the reasons behind the overtreatment of patients in level 4 and the missed opportunities in treating malaria-positive cases in levels 2 and 3. Factors such as the level of training of the health workers and patients' treatment-seeking behavior were also not evaluated and may have contributed to the treatment practices.

Policy implications

The high treatment rate (98.2%) of the total number of patients who tested positive and treated for malaria, though falling short of the KMS threshold of 100% treatment of all malaria-positive cases, can help shape further sustaining these gains. Overtreatment of patients could also have implications on drug resistance guidelines and policies. Capacity building of health workers on malaria

treatment guidelines, especially on AL dosing, can positively address the identified gaps.

CONCLUSION

Gaps in data for the treatment for only patients that tested positive for malaria and tablets dispensed based on patient weight were evident, alluding to non-adherence to malaria treatment guidelines. Data review and capacity building of the health workers should be conducted to bridge this gap.

REFERENCES

1. More MN. Extreme Heat & Climate Change Increase Risk of Malaria, other Health Threats - Malaria No More [Internet]. [cited 2023 Mar 2]. Available from: <https://www.malarianomore.org/news/extreme-heat-climate-change-increase-risk-of-malaria-other-health-threats/#:~:text=Rising temperatures%2C changing rainfall patterns,2080%2C due to global warming.>
2. Le PVV, Kumar P, Ruiz MO, Mbogo C, Muturi EJ. Predicting the direct and indirect impacts of climate change on malaria in coastal Kenya. PLoS One [Internet]. 2019 Feb 1 [cited 2023 Mar 2];14(2). Available from: <https://pubmed.ncbi.nlm.nih.gov/30726279/>
3. WHO. World Malaria Report. 2022.
4. Ministry of Health-NMCP. Kenya Malaria Strategy 2019-2023 [Internet]. Vol. 4, KMS 2019-2023. 2019. Available from: <http://marefateadyan.nashriyat.ir/node/150>
5. MOH D. Guidelines for the diagnosis, treatment and prevention of malaria in Kenya. 2020.
6. Agency KN. Malaria outbreak in Kericho under control – Kenya News Agency [Internet]. [cited 2023 Mar 2]. Available from: <https://www.kenyanews.go.ke/malaria-outbreak-in-kericho-under-control/>
7. Malaria Control Program M of H. Monitoring outpatient malaria case management under the 2010 diagnostic and treatment policy in Kenya. 2021.

8. KHIS. Reports | DHIS2 [Internet]. [cited 2023 Mar 1]. Available from: <https://hiskenya.org/dhis-web-reports/index.html#/data-set-report>
9. WHO. SUMMARY OF PRODUCT CHARACTERISTICS [Internet]. Vol. 1, Journal of Materials Processing Technology. 2018. Available from: <https://extranet.who.int/pqweb/sites/default/files/MA111part4.pdf>
10. Amboko B, Stepniewska K, Macharia PM, Machini B, Bejon P, Snow RW, et al. Trends in health workers' compliance with outpatient malaria case-management guidelines across malaria epidemiological zones in Kenya, 2010–2016. *Malar J* [Internet]. 2020;19(1):1–14. Available from: <https://doi.org/10.1186/s12936-020-03479-z>
11. MoH Kenya. Kenya Health Policy 2014–2030. 2014.
12. Stover KR, Travis King S, Robinson J. Artemether-lumefantrina: Una Opción para la Malaria. *Ann Pharmacother*. 2012;46(4):567–77.
13. Amboko BI, Ayieko P, Ogero M, Julius T, Irimu G, English M. Malaria investigation and treatment of children admitted to county hospitals in western Kenya. *Malar J*. 2016 Oct;15(1):506.
14. Ministry of Health-NMCP. MONITORING OUTPATIENT MALARIA CASE MANAGEMENT UNDER THE 2010 DIAGNOSTIC AND TREATMENT POLICY IN KENYA Progress January 2010 – July 2020 National Malaria Program Ministry of Health. 2020.
15. Watsierah CA, Onyango RO, Ombaka JH, Abong BO, Ouma C. Provider knowledge of treatment policy and dosing regimen with artemether-lumefantrine and quinine in malaria-endemic areas of western Kenya. *Malar J* [Internet]. 2012;11(1):1. Available from: *Malaria Journal*
16. Okello G, Molyneux S, Zakayo S, Gerrets R, Jones C. Producing routine malaria data: An exploration of the micro-practices and processes shaping routine malaria data quality in frontline health facilities in Kenya. *Malar J* [Internet]. 2019;18(1):1–13. Available from: <https://doi.org/10.1186/s12936-019-3061-y>
17. Id SL, Janson A, Persson L-Å, Wickremasinghe D, Ka C. Improving quality and use of routine health information system data in low- and middle- income countries: A scoping review. 2020;1–16.