UON SORT IT- March 2024 Supplement
ASSESSING CAPACITY IN SURVEILLANCE AND RESPONSE, RESOURCE AVAILABILITY AND READINESS SCORE FOR MALARIA ELIMINATION IN FOUR COUNTIES AND THEIR SUB COUNTIES; KENYA, 2023
Catherine Kilonzo, Ministry of Health, Kenya, Joy Gakenia Murangiri, Ministry of Health, Kenya, James Kiarie, Ministry of Health, Kenya, Jane Githuku, President Malaria Initiative Measure Malaria, Hellen Gatakaa, President Malaria Initiative Measure Malaria, Elvis Oyugi, Ministry of Health, Kenya, Dan Otieno, World Health Organization (WHO), Nairobi, Kenya, Fredrick Ouma Odhiambo, Ministry of Health, Kenya, Regina Kandie, Ministry of Health, Kenya, Ahmeddin Omar, Ministry of Health, Kenya, Alfred Oginga, County Government of Kisumu, Department of Health Services, Kisumu, Kenya, Robert Mwaganu, Ministry of Health, Kenya, Erolls Cheruiyot Sigei, Kenya Medical Training College (KMTC), Nairobi, David Gathara, KEMRI Wellcome Research Programme, Nairobi, Kenya, Edward Mberu Kamau, Special Programme for Research and Training in Tropical Diseases (TDR), World Health Organization, Geneva, Switzerland, Anne-Beatrice Kihara, University of Nairobi Department of Obstetrics and Gynecology, Kenya , International Federation of Gynecology and Obstetrics (FIGO) and Rose Jepchumba Kosgei, University of Nairobi Department of Obstetrics and Gynecology, Kenya.

Corresponding author: Catherine Kilonzo, Ministry of Health, Kenya. Email: cmkilonzo@gmail.com

ASSESSING CAPACITY IN SURVEILLANCE AND RESPONSE, RESOURCE AVAILABILITY AND READINESS SCORE FOR MALARIA ELIMINATION IN FOUR COUNTIES AND THEIR SUB-COUNTIES; KENYA, 2023

C. Kilonzo, J. G. Murangiri, J. Kiarie, J. Githuku, H. Gatakaa, E. Oyugi, D. Otieno, F. O Odhiambo, R. Kandie, A. Omar, A. Oginga, R. Mwaganu, E. C. Sigei, D. Gathara, E. M. Kamau, A. B. Kihara, and R. J. Kosgei

ABSTRACT

Objectives: **The objective of this study was to assess capacity in surveillance and response, resource availability and readiness score for Malaria Elimination in Four Counties and their Sub Counties.**

Design: **This was a retrospective cross-sectional study design that used routinely collected malaria program data using a tool adopted by NMCP (National Malaria Control Program) and modified to fit the country's context, District-Level Readiness for Elimination of Malaria Tool (DREAM-IT), developed by the University of California, San Francisco (UCSF) during a baseline survey in January 2023.**

Setting: **Four counties targeted for malaria elimination in Kenya namely, Kirinyaga, Nyandarua, Laikipia and Nyeri and their 21 sub counties.**

Subject or participant: **County and sub county health management teams in malaria related positions.**

Intervention: **Implementation of malaria elimination strategy in the four target counties in Kenya.**

Main outcome measures: **County and sub-county health management teams' readiness score to implement surveillance, response, and avail resources for malaria elimination.**

Results: **For surveillance and response, the readiness score was at 50 % both at the county and sub-county level and notably worst in one County at 30%. Resource availability was over 85% both at the sub county and county level, however, in one county resources in the county level were very low compared to the sub county.**
Conclusion: **In conclusion, there were variations noted across all the counties as illustrated by the readiness score at the county and sub county level. Need to improve on data management, data quality assurance mechanisms, human resource capacity building and prioritization of malaria activities at county and sub county level.**

INTRODUCTION

The goal of malaria elimination relies heavily on well-established and sustainable health systems including leadership and governance, human resource, surveillance systems, case management and finances that can interrupt local transmission and ensure timely case detection and investigation (1). Assessing the health system identifies core operational gaps, capacity and challenges(2). The current climate change situation within the country may lead to increase in temperatures and change in hydrological cycle. This increase is likely to create a favorable environment for malaria vector breeding, leading to the introduction of malaria transmission in areas it never existed before. Therefore, posing a threat to malaria elimination(3)(4). Globally, malaria was once one of the diseases that caused high morbidity and mortality, however the burden has reduced(5). The number of countries that were malaria endemic in 2000 and that reported fewer than 10 000 malaria cases increased from 26 in 2000 to 47 in 2020. In the same period, the number of countries with fewer than 100 indigenous cases increased from 6 to 26. In the period 2010–2020, total malaria cases in the 21 countries that were part of the "eliminating countries for 2020" (E-2020) initiative reduced by 84% (6).

There has been a significant reduction in malaria case incidence, between 2000-2019 in the WHO African region from 368 to 222 per 1000 population(6). There has been slow progress towards malaria elimination in this region, however four territories including Ethiopia, Zimbabwe, Zanzibar and Senegal have achieved pre-elimination status in selected sub national areas from 2015 to 2020. It is encouraging to note that 20 out of 47 districts with moderate to high burden in Zimbabwe moved from control to malaria pre-elimination during the same period(7). Additionally, South Africa has started implementing subnational elimination in KwaZulu-Natal province and recently conducted an assessment to monitor the progress attained so far on malaria elimination. Studies show that the province is approaching elimination status for malaria with a steady decline in local cases (8).

In Kenya, the national malaria prevalence reduced gradually from 11% in 2010 to 6% in 2020, with prevalence in the low-risk transmission zone remaining at < 1% (9). About 6 counties within the low-risk transmission zone have consistently recorded incidence of < 2.5 confirmed malaria cases per 1000 population from 2013 to 2022 according to routine Ministry of Health(MOH) data (10). In addition, quarterly entomological surveillance, done by Division of National Malaria Program (DNMP) has indicated reduction in annual entomological rate from 4.3 to 1, annual parasite incidence to < 100/1000 and plasmodium falciparum prevalence to < 1%.

The above criteria informed the decision to consider sub-national malaria elimination, in line with the global technical strategy for Malaria (2016-2030), commencing with four out of forty-seven counties namely Laikipia, Nyeri, Nyandarua and Kirinyaga for elimination(11)(12)(13)(14).

A District-Level Readiness for Elimination of Malaria Tool (DREAM-IT) developed by the University of California, San Francisco (UCSF), is a malaria elimination-focused operational assessment tool designed to evaluate the operational readiness of all levels of the health system systematically and comprehensively for malaria elimination. Kenya, through MOH and DNMP, adopted the tool and modified it to fit the country's context. The tool contained 15 thematic areas including general information, office infrastructure, planning and finance, human resource, key document availability and surveillance and response. Surveillance is critical and is the basis of operational activities in settings of any level of transmission(15). Its objective is to support reduction of the burden of malaria, eliminate the disease and prevent its re-establishment. Current systems in Kenya capture malaria surveillance data as aggregate. However, case-based surveillance systems are recommended in malaria elimination settings and Kenya plans to adopt the "1-3-7" case-based approach(16). The approach involves case reporting within 1 day after a confirmed malaria case, case investigation within 3 days; and focus investigation and action within 7 days(16). This would require extensive resources at the sub county and county level.

Establishing structures and sustaining a malaria elimination program is an intensive undertaking that needs optimally functional health systems(1). In Kenya, setting up malaria elimination and scaling it up is made more complex due to the mixed burden of malaria transmission, and the need to balance between malaria control and elimination efforts (4,17). In addition, health services are devolved and variances in county and sub county level management, structures and capacities are expected.

The study aimed to assess capacity of four counties and their sub counties in surveillance and response, resource availability and readiness score for malaria elimination Kenya.

METHODS

Study design

The study design was a retrospective cross-sectional study that used routinely collected program data during a survey in January 2023.

Study site

Laikipia, Nyeri, Kirinyaga and Nyandarua counites are in the central highlands of Kenya. Th four counties have a total of 21 sub counties. Laikipia county has 3 sub-counties namely, Kirinyaga 5, Nyeri 8 and Nyandarua 5 (11–14). The climatic conditions in the central highlands where these counties are located, especially the low temperatures, do not favor the development of mosquitoes. The temperatures in the central highlands of Kenya are too low to allow completion of the sporogonic cycle of the malaria parasite in the vector.

Table 1

Sub-counites in the four Kenyan counties targeted for malaria elimination, 2023

	County	Sub-county
1)	Laikipia	Laikipia East, Laikipia West and Laikipia North
2)	Nyeri	Kieni East, Kieni West, Mathira East, Mathira West, Nyeri Central, Mukurweini, Tetu and Othaya
3)	Kirinyaga	Kirinyaga East, Kirinyaga West, Mwea East, Mwea West and Kirinyaga Central
4)	Nyandarua	Ol'Kalou, Kinangop, Kipipiri, Ndaragwa and Ol'Joro Orok

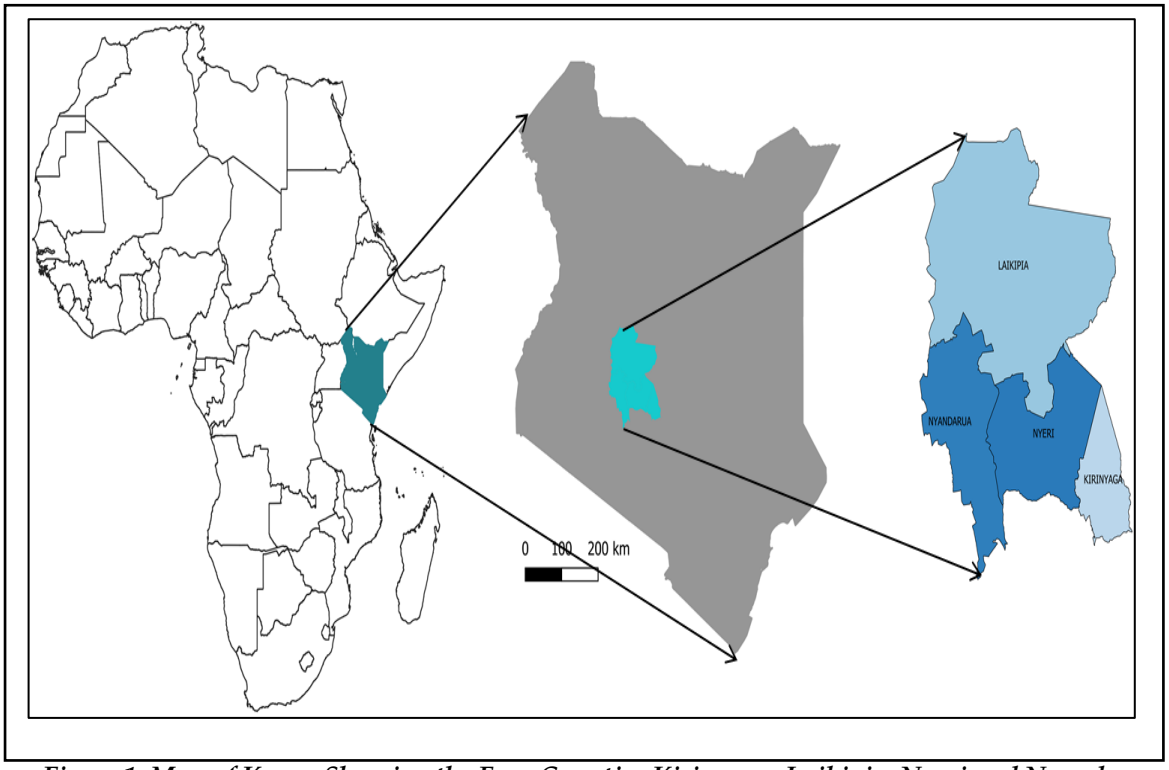

Figure 1: Map of Kenya Showing the Four Counties Kirinyaga, Laikipia, Nyeri and Nyandarua, 2023

The above figure shows the location of Kenya in the African map, and the four counties targeted for malaria elimination in Kenya. The four counties are within the central region of Kenya where malaria prevalence is less than 1%.

Study Population

All the county and sub-county health management teams in the four counties were targeted for the baseline assessment.

Data collection instruments

The data was obtained from health facility assessment that was done as part of routine assessments by DNMP. Data was collected using DREAM-IT tool that contained structured checklists. The checklists were administered among officials from county and sub-county health management teams. These health management teams include core health care workers who coordinate public health and medical services at the county and sub-county. The health management teams include the following carders in the table below.

Table 2

County and sub-county Health Management Team Members in Kenya Counties Targeted for Malaria Elimination 2023

Service Level	Health management team
County level	County Director of Health, County Administrator, County malaria control coordinator, county disease surveillance coordinator, and county pharmacist, county laboratory coordinator
Sub-county level	Sub county medical officer of health, sub county administrator, sub county malaria control coordinator, sub county disease surveillance coordinator, and sub county pharmacist, sub county laboratory coordinator.

Data Analysis and management

Data from the questionnaires as per the checklists were captured electronically using an electronic application in a tablet. The quantitative data was downloaded from the tablets into excel spreadsheet and data management was done in Excel and included: data cleaning, sorting, consistency, accuracy, and completeness.

Quantitative data was summarized using means and proportions and reported per objective using tables and graphs.

A scoring matrix was used based on the number of questions in each checklist. Average score from the sub county assessments was calculated per county. An aggregate score for the county was calculated by summing up the average score of the sub counties. An aggregate score threshold of the counties and sub counties was calculated to give the county and sub county readiness for malaria elimination as shown in the table below.

Ethical considerations

Ethical clearance was obtained from the Maseno University Scientific and Ethics Review Committee (approval number MUSERC/01234/23). Permission to use the assessment data sought from the National Malaria Control Program. Personal identifying information was omitted from the data collection tools to ensure patient confidentiality.

Domains and questions included in the malaria elimination readiness score.
Surveillance and response (number of questions – 16)
County level (number of questions – 6)

- County reviews malaria surveillance data (including reporting rates) quarterly.
- County has rapid response team for outbreak response.
- County has funds to conduct case or foci investigations.
- County has participated in any case investigation in the two years preceding the survey.
- County has participated in any foci investigation.
- County has funds immediately available to support outbreak response activities.

Sub-county level (number of questions – 10)

- Sub-county always uploads weekly malaria reports by Wednesday of every week and monthly reports by 15th day of each month.
- Sub-county with staff within the health management team trained on malaria surveillance or integrated disease surveillance response.
- Reporting guidelines/standard operating procedures available at sub-county
- A functional laptop or computer for reporting to KHIS available at the sub-county
- Sub-county with staff trained in data analysis and management.
- Sub-county with data quality assurance mechanism to verify malaria surveillance data.
- Sub-county reviews malaria surveillance data (including reporting rates) quarterly.
- Sub-county has funds immediately available to support case and/or foci investigations.
- Sub-county has participated in any case investigation.
- Sub-county has participated in any foci investigation.

Resource availability (number of questions – 4)
All levels (number of questions – 4)

- County has costed work plan with malaria activities.
- 80% of county's malaria budget spent.
- County department has key HR required for malaria elimination.
- Key Policy documents.

RESULTS

Quantitative data were collected from health management teams at the county and sub county level in 21 sub counties within 4 counties

Overall, all 21(100%) sub-counties assessed had disease surveillance coordinators, 20(95%) timely submitted routine malaria reports to the Kenya Health Information System (KHIS) and had reporting guidelines or standard operating procedures in place. Notably, 17 (85.7%) of the sub-counties received reports from all health facilities and reported that Sub County Health Management Team (SCHMT) were trained in data analysis and management. Additionally, three quarters of the sub-counties, 15(71.4%) had received training in malaria surveillance or IDSR. However, data review meetings and data quality assurance mechanisms were only in place in 33% and 38% sub-counties respectively.

Among all the counties, only Kirinyaga and Nyandarua Sub-counties specifically conducted malaria case investigations and reported availability of rapid response teams for outbreak response. There were variations in surveillance and response attributes across the counties as shown in **Error! Reference source not found.**

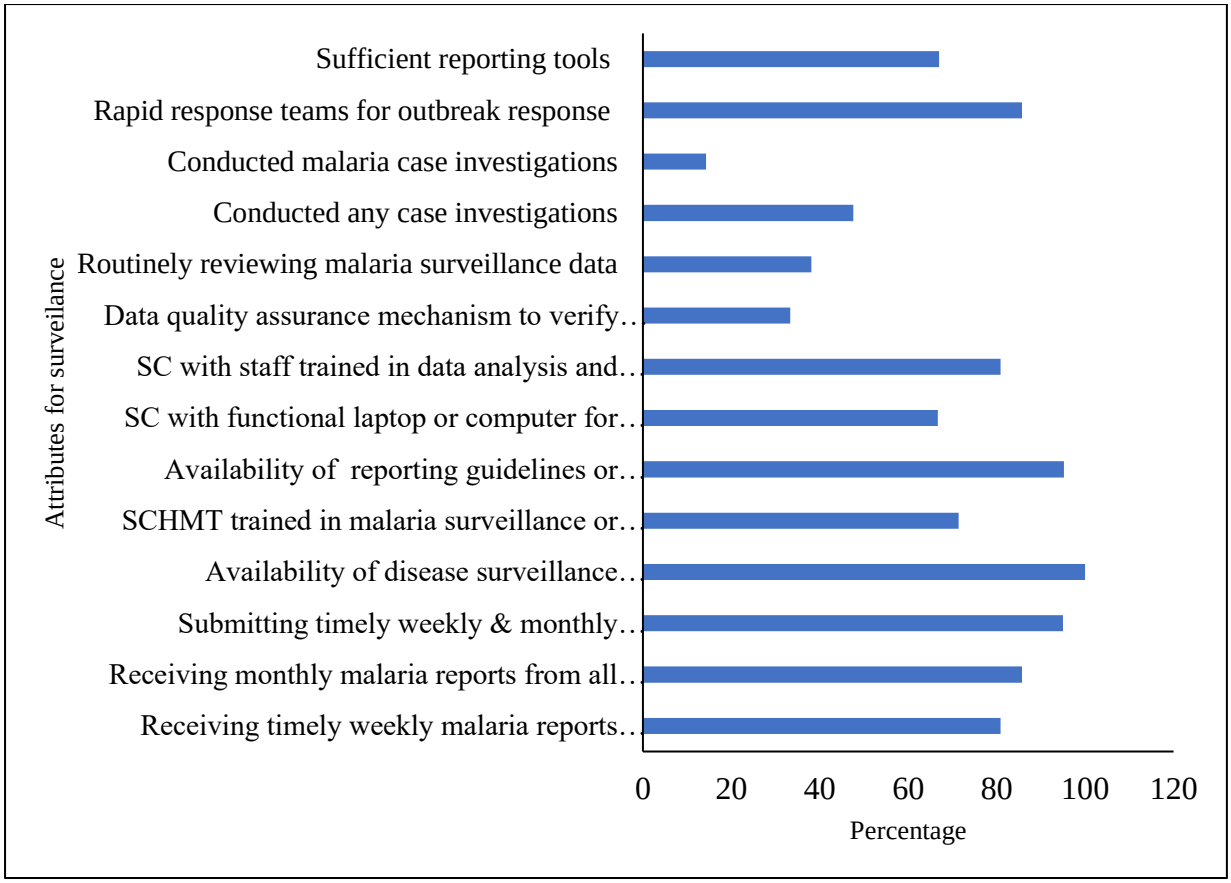

Figure 2: Aggregated Measures of Readiness for Surveillance and Response in sub-counties targeted for Malaria Elimination, Kenya 2023

From the baseline assessment, human resource, training need, policy documents, guidelines and funds availability for implementing malaria elimination were assessed in the four counties. In seventy five percent the counties had an organogram in place. Kirinyaga and Laikipia had the most up to date organograms: Laikipia was dated 2022, Kirinyaga 2021 and Nyandarua 2013. At sub-county level, only 9(42.9%) sub-counties had a current organogram (Nyandarua – 1/5, Laikipia – 3/3, Kirinyaga – 2/5, and Nyeri – 3/8). Four of the nine sub-counties were not able to present their organograms (two each in Nyeri and Laikipia).

In Fifty three percent on the organogram administrative positions relevant to malaria elimination were filled in all the counties. Two counties lacked an entomologist and epidemiologist in the organogram.

At the sub-county level, the most filled positions were sub-county public health officers 21(100%), sub-county health records and information officers 21(100%), sub-county disease surveillance coordinator 20 (95%), sub-county laboratory services coordinator 20(95%), sub-county community health coordinators 19(90%), sub-county pharmacist 17(81%) and sub-county public health nurse 16(76%). Twelve sub-county health management teams (SCHMTs) did not have medical officers of health including six sub-counties where the positions existed but were not filled and six where this position did not exist. However, some sub-counties had sub-county heads of health services performing the role of sub-county medical officers of health.

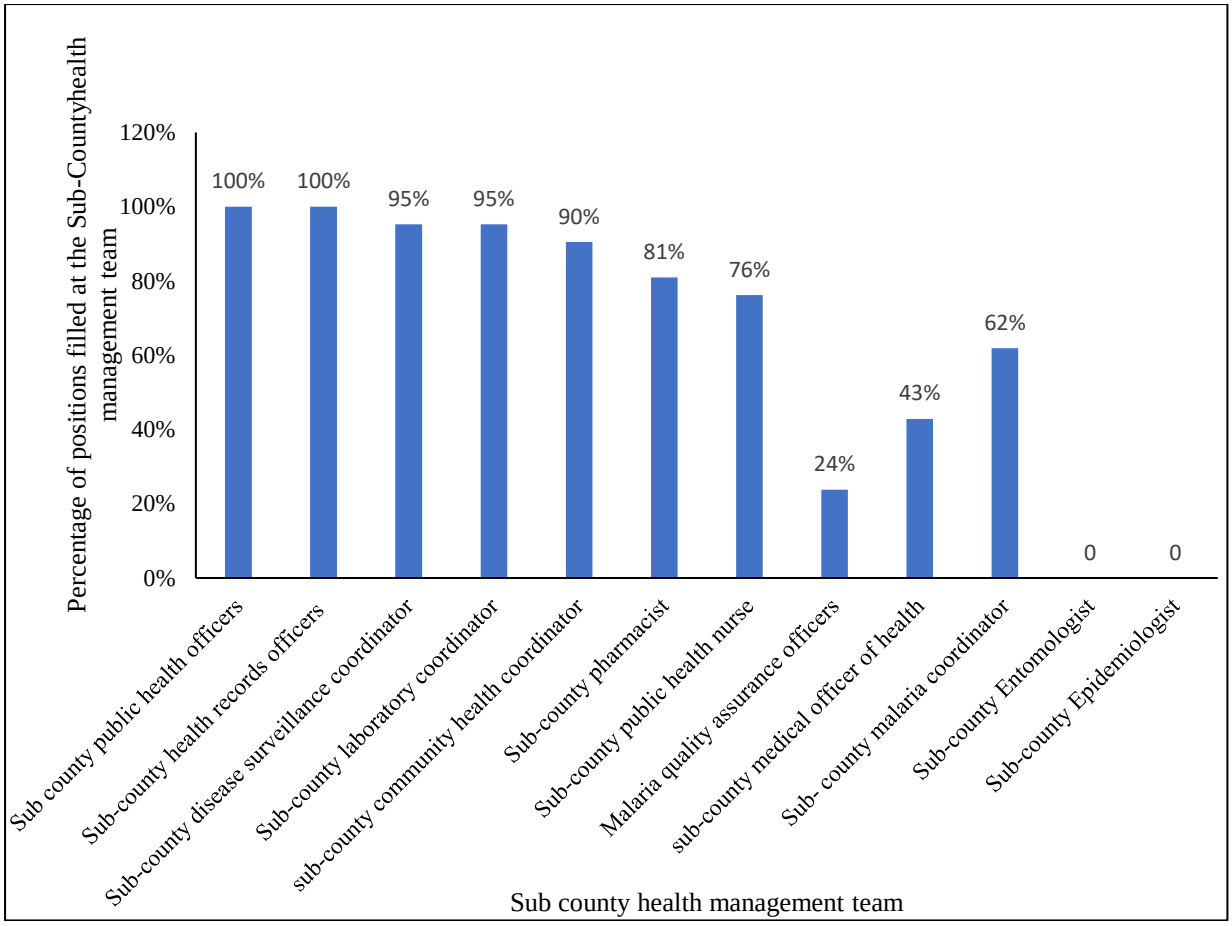

Figure 3: Percentage of sub-county health management team positions filled at the sub county level in the four counties targeted for malaria elimination, Kenya 2023

Overall, in 71.5% of sub-counties (Kirinyaga – 3/5, Laikipia – 1/3, Nyandarua – 4/5, and Nyeri – 7/8) cited inadequate personnel to support malaria elimination activities at sub-county level. Nyeri and Nyandarua Counties indicated the highest human resource support needed with gaps in entomology, case management, social behaviour change, and laboratory diagnosis for malaria as shown in Table 3

Percentage *of Sub-Counties indicating need of human resource support in malaria elimination strategies at sub-county level*.In addition, 15 sub-counties cited inadequate personnel to support case management and laboratory diagnosis for malaria elimination at health facility level.

Table 3

Percentage of Sub-Counties indicating need of human resource support in malaria elimination strategies at sub-county level

	Nyandarua N=5 n (%)	**Laikipia N=3**	**Kirinyaga N=5**	**Nyeri N=8**	**Total N=21 n(%)**
Case management	4(80%)	0	0	6(75%)	10(47.6)
Malaria reporting	4(80%)	0	0	5(62.5%)	8(38.1%)
Data analysis and interpretation	2(40%)	0	1(20%)	5(62.5%)	8(38.1%)

Surveillance and reporting	3(60%)	0	2(40%)	4(50%)	9(42.9%)
Vector control	3(60%)	0	1(20%)	4(50%)	8(38.1%)
Entomology	4(80%)	1(33.3%)	2(40%)	6(75%)	13(61.9%)
Social and behavior communication (SBC)	3(60%)	0	1(20%)	6(75%)	10(47.6%)
Supervision of lower levels	3(60%)	0	0	2(25%)	5(23.8%)
Training	4(80%)	0	0	5(62.5%)	9(42.9%)
Community engagement	3(60%)	0	1(20%)	4(50%)	8(38.1%)
Laboratory diagnosis for malaria	4(80%)	0	0	6(75%)	10(47.6%)
Case management and laboratory diagnosis for malaria	4(80%)	1(33.3%)	3(60%)	1(12.5%)	15(71.4%)

Staff turnover was generally not a challenge 13(62%) sub-counties across the four counties targeted for malaria elimination. Only 3(14%) sub-counties in Nyeri cited staff turnover as a major challenge.

From the assessment, only Kirinyaga County had a costed work plan with malaria activities reviewed quarterly. None of the four counties was getting county-specific fund allocation for malaria activities. There were no malaria-specific work plans for Nyandarua, Laikipia, and Nyeri Counties. At the sub-county level, 10 sub-counties had cost workplans: two in Nyandarua, three in Nyeri and all the five sub-counties in Kirinyaga. None of the three sub-counties in Laikipia had a costed work plan.

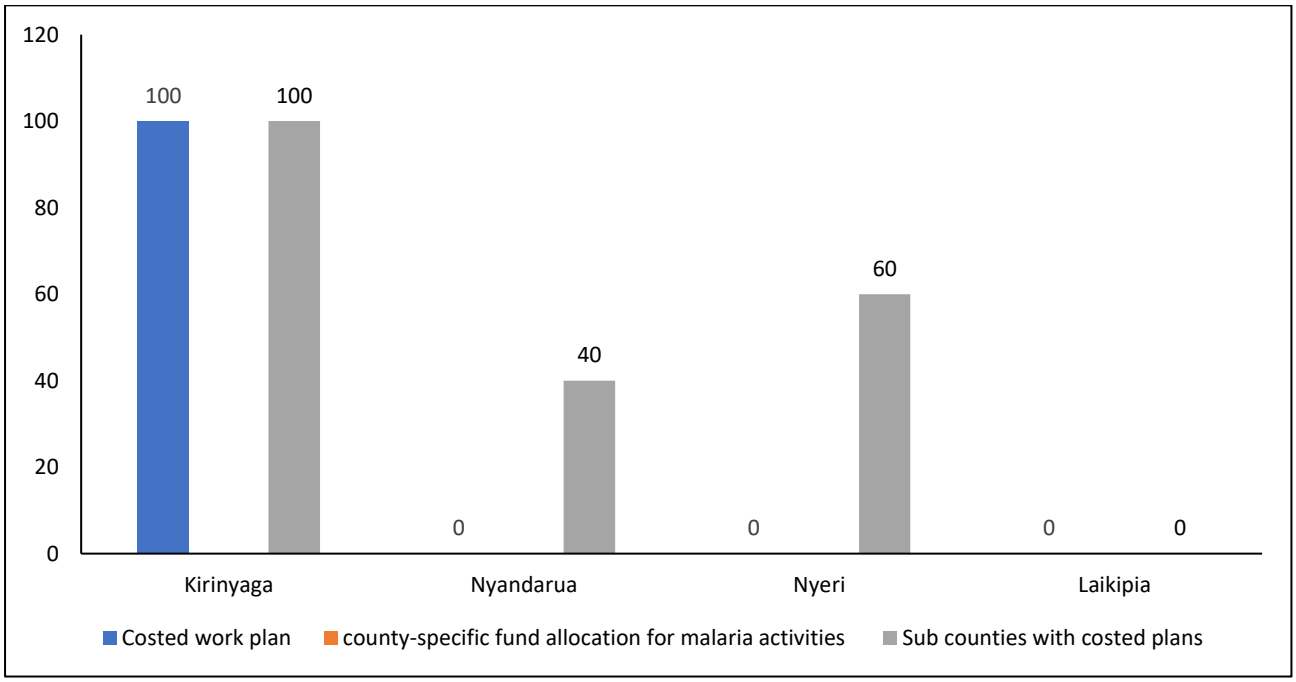

Figure 4: Proportion of counties with costed workplans with malaria activities in Kenyan counties targeted for malaria elimination, 2023

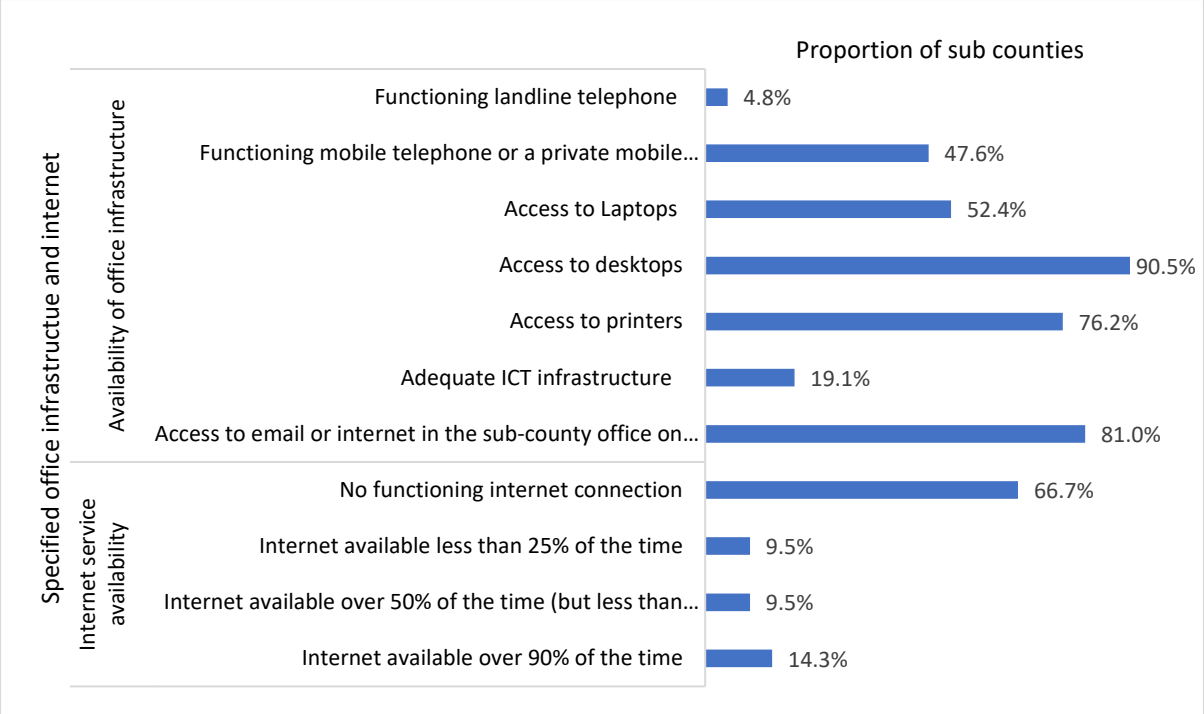

Figure 5: Percentage of sub-counties with specified office infrastructure in Kenyan counties targeted for malaria Elimination 2023

Only one of the 21 (4.8%) sub-counties i.e., Kirinyaga Central, had a functioning landline telephone in their emergency operations center. Fourteen (66.7%) sub-counties reported lack of functioning internet connection during working hours and only three (14.3%) i.e., two in Kirinyaga (Kirinyaga Central and Kirinyaga South) and one in Nyandarua (Olkalou), cited availability of internet connectivity at least 90% of the time.

Key Document Availability

All the four County Health Management Teams (CHMTs) had the Kenya Malaria Strategy (KMS 2019-2023). At sub-county level, the KMS 2019-2023 was available in 11 of the 21 (52%) sub-counties. All other relevant documents were available in less than half the sub-counties assessed (Figure 11).

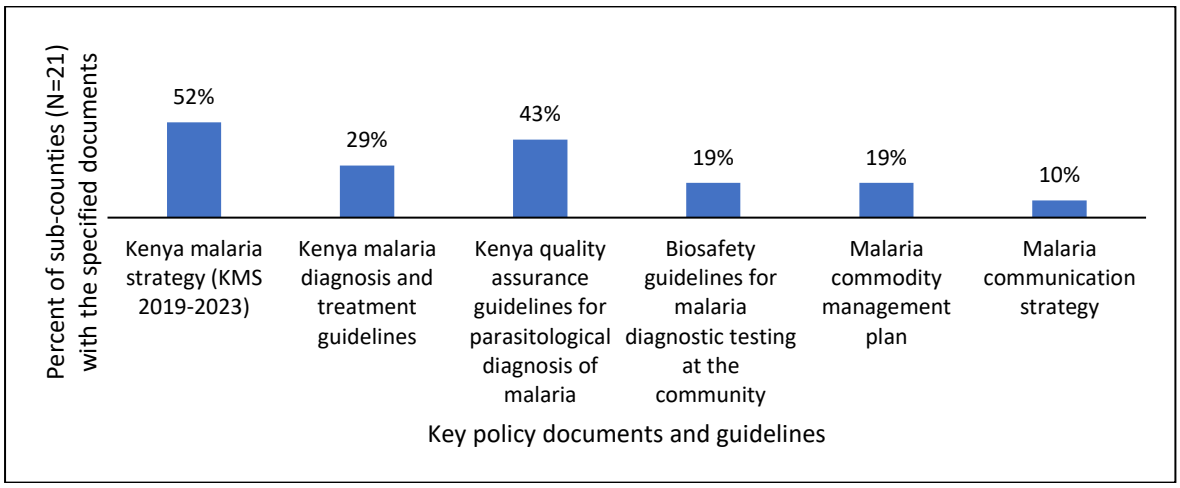

Figure 6: Percent of sub-counties with malaria policy and guideline in Kenyan counties targeted for malaria Elimination, 2023

Overall, Kirinyaga county recorded the highest scores in surveillance and response attributes and Nyandarua county recorded the highest scores in resource availability.

Table 4

Readiness score per thematic area

County		Surveillance	Resource Availability
Kirinyaga	County	52.9%	20.0%
	Sub County Level	56.0%	66.2%
Laikipia	County	41.9%	71.7%
	Sub County Level	36.7%	71.8%
Nyandarua	County	50.9%	84.9%
	Sub County Level	50.0%	89.2%
Nyeri	County	53.5%	74.4%
	Sub County Level	55.0%	62.5%

DISCUSSION

This study aimed at assessing capacity of four counties in surveillance and response, resource availability and readiness score for malaria elimination Kenya, 2023. This was the first readiness assessment survey undertaken in the four counties targeted for malaria elimination. The main findings showed key gaps noted in data management, information and communication technology infrastructure, internet connectivity and data quality assurance mechanisms. There was deficiency in key relevant personnel dedicated to malaria elimination and human resource support requirement markedly noted in entomology, case management, social behavioral change, and laboratory diagnosis. Absence of malaria activities in the annual work plan, implied budgetary planning, and expenditure specific for malaria elimination are not being tracked. Key policy strategies and guidelines were suboptimal in availability.

For surveillance and response, the readiness score was suboptimal at 50 % both at the county and sub-county level and notably worst in one County at 30%. Resource availability was over 85% both at the sub county and county level, however, in one county resources in the county level were very low compared to the sub county.

Surveillance is a core intervention throughout the malaria transmission continuum. In malaria elimination settings, each confirmed malaria case should be identified, treated appropriately, investigated, followed up and reported accordingly. surveillance systems must be carefully planned and well managed to ensure timely transmission, recognition, and prompt response. It will be critical to have an effective malaria surveillance system that can timely detect all malaria infections(15)(16).

Refresher training focusing on key areas related in malaria will be required at both county and sub county levels, with provision of the latest policy documents and guidelines. In addition, there will be need to advocate for allocation of funds for malaria activities and ensure budgetary allocation (17) (18).

Policy implication:

In conclusion, there were variations noted across all the counties as illustrated by the readiness score at the county and sub county level. Need to improve data management, data quality assurance mechanisms, human resource capacity building and prioritization of malaria activities at county and sub county level.

Limitations and strengths of the assessment:

The assessment was conducted up to the health facility level and lacked patient level data.

Malaria surveillance data is currently collected through a passive system in an aggregate format. However, in malaria elimination settings a case base surveillance system will be used.

REFERENCES

1. Sahu M, Tediosi F, Noor AM, Aponte JJ, Fink G. Health systems and global progress towards malaria elimination, 2000-2016. Malar J [Internet]. 2020;19(1):1–12. Available from: https://doi.org/10.1186/s12936-020-03208-6
2. Wangmo LD, Belo OMF, Penjor K, Drukpa T, do Rosario de Fatima Mota M, Viegas O da S, et al. Sustaining progress towards malaria elimination by 2025: Lessons from Bhutan & Timor-Leste. Lancet Reg Heal West Pacific. 2022 May;22:100429.
3. KMS. Kenya Malaria Strategy. 2019.
4. Recht J, Siqueira AM, Monteiro WM, Herrera SM, Herrera S, Lacerda MVG. Malaria in Brazil, Colombia, Peru and Venezuela: current challenges in malaria control and elimination. Malar J. 2017 Jul;16(1):273.
5. Feng J, Zhang L, Huang F, Yin JH, Tu H, Xia ZG, et al. Ready for malaria elimination: Zero indigenous case reported in the People's Republic of China. Malar J [Internet]. 2018;17(1):1–13. Available from: https://doi.org/10.1186/s12936-018-2444-9
6. World malaria report. World Malaria Report 2021. Vol. 13, Angewandte Chemie International Edition, 6(11), 951–952. 2021. 15–38 p.
7. Sande S, Zimba M, Mberikunashe J, Tangwena A, Chimusoro A. Progress towards malaria elimination in Zimbabwe with special reference to the period 2003-2015. Malar J. 2017 Jul;16(1):295.
8. Balawanth R, Ba I, Qwabe B, Gast L, Maharaj R, Raman J, et al. Assessing Kwa-Zulu-Natal's progress towards malaria elimination and its readiness for sub-national verification. Malar J. 2019 Apr;18(1):108.
9. KMIS. Kenya Malaria Indicator Survey 2020 Final Report Nairobi. 2020;(September). Available from: www.nmcp.or.ke.
10. KHIS. KHIS Aggregate [Internet]. KHIS. 2022 [cited 2020 Jun 16]. Available from: https://hiskenya.org/dhis-web-reporting/showDataSetReportForm.action
11. CIDP L. County Integrated Development Plan 2018-2022 of Laikipia County. 2018; Available from: www.ciel.org
12. Government of Kenya. County Government of Kirinyaga. County Integrated Development Plan 2022-2023. 2018;
13. Integrated NC. Republic of Kenya County Government of Nyandarua the Socio-Economic Transformative Agenda for Nyandarua County Nyandarua County Integrated. 2022;2018–22.
14. Martin wamwea. Republic of Kenya Nyeri County Intergrated Development Plan 2013- 2017. Financ Econ Plan. 2017;1(October 2013):5–7.
15. Health Organization W. Malaria Surveillance, Monitoring & Evaluation: a Reference Manual.
16. Feng J, Liu J, Feng X, Zhang L, Xiao H, Xia Z. Towards malaria elimination: Monitoring and evaluation of the "1-3-7" approach at the China-Myanmar border. Am J Trop Med Hyg. 2016;95(4):806–10.
17. Manel Yapabandara AMG, do Rosario de Fatima Mota M, Sarmento R, Bosco JD, Wickremasinghe R. From malaria control to elimination within a decade: lessons learned from Timor Leste, a newly independent country. Malar J. 2020 Mar;19(1):104.
18. Favero R, Rabozakandraina O, Ramamonjisoa S, Rakotovao JP. Malaria Elimination Readiness in Selected Districts of Madagascar: A Mixed-Methods Assessment. Available from: www.mcsprogram.org