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TRACKING THE PERFORMANCE OF MALARIA SURVEILLANCE INDICATORS USING ROUTINE KENYA HEALTH INFORMATION SYSTEM DATA ACROSS THE EPIDEMIOLOGICAL ZONES IN KENYA, 2021-2022

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**ABSTRACT**

**Objectives:** Assessment of malaria surveillance performance indicators to determine completeness of malaria reports, testing rates, incidence rates, blood examination rates, positivity rate and treatment rates across epidemiological zones in Kenya.

**Design:** Cross-sectional retrospective review.

**Setting:** All government health facilities in Kenya

**Subjects:** Suspected malaria cases tested and treated as reported on Kenya Health Information System (KHIS), 2021 to 2022.

**Main outcomes:** Reporting rate, testing rate, malaria incidence, blood examination rate, treatment, and positivity rate.

**Results:** The malaria reporting rates for MOH 705 was 100% in year 2021 and 98% in year 2022, MOH 706 was 88% in year 2021 and 90% in year 2022, MOH 743 was 89% in year 2021 and 94% in year 2022. The testing rate was 79% in year 2021 and 87% in year 2022. Malaria incidence rate was 75 and 83 cases per 1000 population in year in year 2021 and 2022 respectively. Blood examination rate was 18 and 19 tests per 100 population in year 2021 and 2022 respectively. The treatment rate was 102% in year 2021 and 97% in year 2022. The test positivity rate was 29% across the years. The Lake endemic zone had the highest burden contributing to 77% and 82% in year 2021 and 2022 respectively.

**Conclusion: To reduce malaria burden, improvement should target level two health facilities that serve a large population of patients. Capacity building and mentorship of health workers on adherence to malaria case management could enhance the patient quality of care.**

## INTRODUCTION

Despite the continued investment in malaria prevention, diagnostic and treatment over the years, malaria morbidity and mortality remained stable. In 2020, malaria cases were estimated at 245 million and in 2021, 247 million with the World Health Organization (WHO) African Region accounting for about 95% of the cases (1). Despite the decline of the malaria burden in Kenya, three-quarters of the population from various epidemiological zones is still at risk. Nationally in 2020, the prevalence of malaria in children was 6%, and by zone; highland epidemic prone (0.7%) lake endemic (18.9%), coast endemic (4.5%), seasonal transmission (1.8%) and low risk areas (0.4%) (2).

The third Pillar of the Global Technical Strategy (GTS) for malaria 2016–2030 is transformation of malaria surveillance into a core intervention in all malaria-endemic countries (3). In line with GTS, surveillance is currently one of the core interventions for malaria control in Kenya guided by the Kenya Malaria Strategy 2019-2023 (KMS) of strengthening malaria surveillance and use of the information to improve decision making for program performance (4). Monitoring trends of malaria incidence cases, and vector densities is crucial in informing subsequent targeted implementation, and application of malaria interventions. However, malaria surveillance is still weak in countries with the highest malaria burden, making it difficult to accurately assess disease trends and plan interventions.

In settings in which transmission remains high, malaria surveillance is integrated into routine health information systems for trend and stratification analysis. Surveillance systems need to be assessed to identify key surveillance gaps, data completeness, data accuracy and timeliness (5). The malaria surveillance system relies on the existing national Kenya Health Information System (KHIS) platform in which all health facilities are expected to report (6). These data collected routinely and reported on weekly/monthly basis are used to inform immediate actions at community or facility levels for decision making at Sub-County, County and National levels.

Despite existing efforts in malaria surveillance, there is still limited use of quality data/synthesized information for planning, implementation, policy development and decision making. There are knowledge gaps on the use of KHIS to monitor malaria strategic goal and identify deficiencies in compliance with case management guidelines (4, 7).

This study assessed the performance of the malaria surveillance indicators across the epidemiological zones in Kenya, 2021-2022. Specifically, to determine the: completeness of the of the key malaria summary reports by level of care, proportion of suspected malaria cases tested, malaria incidence rates, annual blood examination rates, malaria positivity rates and percentage of confirmed malaria cases treated with artemisinin-based combination therapy (ACTs).

## MATERIALS AND METHODS

*Study design:* This was a cross-sectional retrospective review of KHIS reported data to assess malaria surveillance performance indicators in Kenya from 2021 to 2022.

*Study population:* All suspected malaria cases, tested and treated as reported in the KHIS for the year 2021 to 2022 in Kenya.

*Study setting:* Kenya is situated in the eastern part of the Africa and lies astride the equator. It borders Ethiopia to the north, Somalia to the northeast, Tanzania to the south, Uganda to the west, and South Sudan to the northwest. The country is administratively divided into 47 counties and 302 sub-counties. Transmission of malaria and infection risk across geographic regions in Kenya is determined largely by altitude, rainfall patterns, and temperature. There are four main malaria epidemiological transmission zones. The endemic zones are high malaria risk areas with stable malaria transmission, around Lake Victoria in western Kenya and in the coastal regions with stable malaria. The seasonal malaria transmission areas experience intense malaria transmission during the rainfall seasons in the arid and semi-arid areas of Kenya. The malaria epidemic prone areas in the western highlands of Kenya are seasonal, with considerable year-to-year variation of malaria transmission and lastly, the low-risk malaria areas of central highlands of Kenya including Nairobi where temperatures are usually too low to allow completion of the sporogonic cycle of the malaria parasite in the vector (4). This study disaggregated the analysis by epidemiological zones. The Kenyan health system is structured into six levels of the hierarchy as follows: level one- Community facilities, level two- Dispensaries, level three-Health centres, level four-Sub-County (primary referral) facilities, level five-County (secondary referral)

facilities), and level six-National (tertiary referral) facilities (6).

*Statistical data analysis:* The malaria surveillance system relies on the existing KHIS platforms of reporting service data, commodity management data and surveillance data. Malaria data is collected in both weekly integrated disease surveillance reporting (IDSR) platform and the monthly KHIS platform. All health facilities within the counties are expected to report on both platforms. All patients seeking treatment in health facilities in Kenya have their data on case management captured in registers, daily summaries of cases categorized into structured columns of variables is documented for several diseases (including malaria). The data is submitted to the reporting platforms on a weekly and monthly basis using the paper-based summaries at the facility level. The summaries are then submitted to the Subcounty for data entry onto the KHIS. Data captured in this platform was downloaded and analyzed for use. All the reported data for MOH 705, MOH 706 and MOH743 for the period 2021 and 2022 was downloaded from KHIS then descriptive statistics were performed and data presented using tables and graphs.

*Study variables:* The study variables included percentage of reporting facilities submitting complete reports, proportion of suspected malaria cases tested, incidence of outpatient malaria cases/1000 population, proportion of confirmed malaria /100 population, percentage of confirmed malaria cases treated with ACTs, malaria test positivity rate.

*Ethical approval:* Formal ethical approval was granted by Maseno University Scientific and Ethics Review Committee, study ref no MUSERC/01234/23.

## RESULTS

The findings show the national and epidemiological level performance of malaria surveillance indicators in Kenya. The lake endemic zone had the highest burden contributing to 77% and 82% in 2021 and 2022 respectively of the all the cases.

*Completeness of MOH summary reporting tools*

The Malaria program uses data from outpatient summary tools (MOH 705 A and B), laboratory summary form (MOH 706) for

health facilities offering laboratory services and MOH 743 in health facilities without laboratory services, mainly dispensaries and small health centers. Figure 1 shows the reporting rates based on the actual and expected facility reports. The malaria summary reporting rates for MOH 705 was 100% in year 2021 and 98% in year 2022, MOH 706 was 88% in year 2021 and 90% in year 2022, MOH 743 was 89% in year 2021 and 94% in year 2022. All facilities are expected to report.

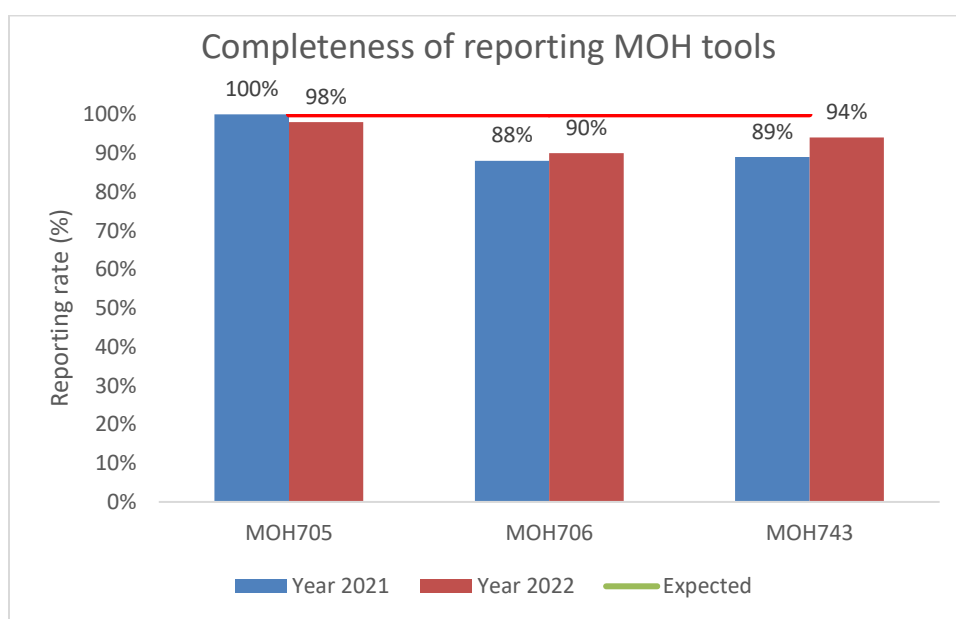


Figure 1: Completeness of reporting MOH tools in Kenya, 2021-2022

Table 1 provides a summary of performance estimates per year. The proportion of suspected malaria cases tested for all population was 79% in year 2021 and 87% in year 2022. Malaria incidence rate was 75 cases per 1000 population in year 2021 and 83 cases per 1000 population in year 2022, annual blood

examination rate was 18 tests per 100 population in year 2021 and 19 tests per 100 population in year 2022. There were more patients treated with ACT than confirmed cases (102%) in year 2021 and a few patients were not treated with ACTs (97%) in year 2022 and test positivity rate was 29 across the years.

**Table 1**

*Malaria performance indicators per year 2021-2022 in Kenya*

Malaria surveillance indicators	Estimates	Estimates
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	Year 2021	Year 2022
Proportion of suspected malaria cases tested <sup>a</sup>	79%	87%
Malaria incidence rate <sup>b</sup>	75 cases/1000 population	83 cases/1000 population
Annual blood examination rate <sup>c</sup>	18 tests per 100 population	19 tests per 100 population
Proportion of confirmed malaria cases treated with ACTs <sup>d</sup>	102%	97%
Malaria test positivity rate <sup>e</sup>	29%	29%

*a=Number of cases tested for malaria/Number of suspected malaria cases; b=Number of confirmed malaria cases/Total population; c=Number of confirmed malaria cases/Total population; d=Number of malaria cases treated with ACTs/Number of confirmed malaria cases; e=Number tested positive for malaria parasites/Total tested.*

Table 2 shows the reporting rates based on the actual and expected reports by level of care. Based on the summary tool MOH 705A and B, the reporting rates for the lower levels of care at level 2-5, were slightly varied (range: 95%-101% in 2021 and 95%-99% in 2022) while those

of level 6 were more or less than expected. The MOH 743 showed the reporting rates were slightly varied at level 2-5 (range: 86%-89% in year 2021 and 94%-103% in 2022) and level 6 reported less than expected across the years.

**Table 2**  
*Summary reporting rates for MOH Tools by level of care in Kenya, 2021-2022*

MOH Tools	Level	Year 2021			Year 2022		
		Actual	Expected	%	Actual	Expected	%
MOH 705 A	Level 2	88,188	88,852	99%	90,123	91,140	99%
	Level 3	18,796	18,735	100%	19,546	19,992	98%
	Level 4	7,505	7,450	101%	7,593	7,932	96%
	Level 5	329	330	100%	351	360	98%
	Level 6	54	46	117%	45	60	75%
MOH 705 B	Level 2	88,852	89,064	100%	91,152	92,676	98%
	Level 3	18,735	19,056	98%	19,561	20,052	98%
	Level 4	7,450	7,668	97%	7,557	7,920	95%
	Level 5	330	348	95%	352	360	98%
	Level 6	46	60	77%	42	60	70%
MOH 743	Level 2	51,702	57,972	89%	56,063	59,352	94%
	Level 3	12,073	13,056	92%	12,548	13,260	95%
	Level 4	3,776	4,404	86%	4,143	4,404	94%
	Level 5	237	276	86%	283	276	103%
	Level 6	24	36	67%	27	36	75%

*Malaria testing rate*

The proportion of suspected malaria cases tested increased from 89% in year 2021 to 94%

in year 2022 for under 5 years and 75% in year 2021 to 85% in year 2022 for over 5 years (Figure 2). The norm is expected to be at 100%.

There may be a gap both at the collection point and at the aggregating point.

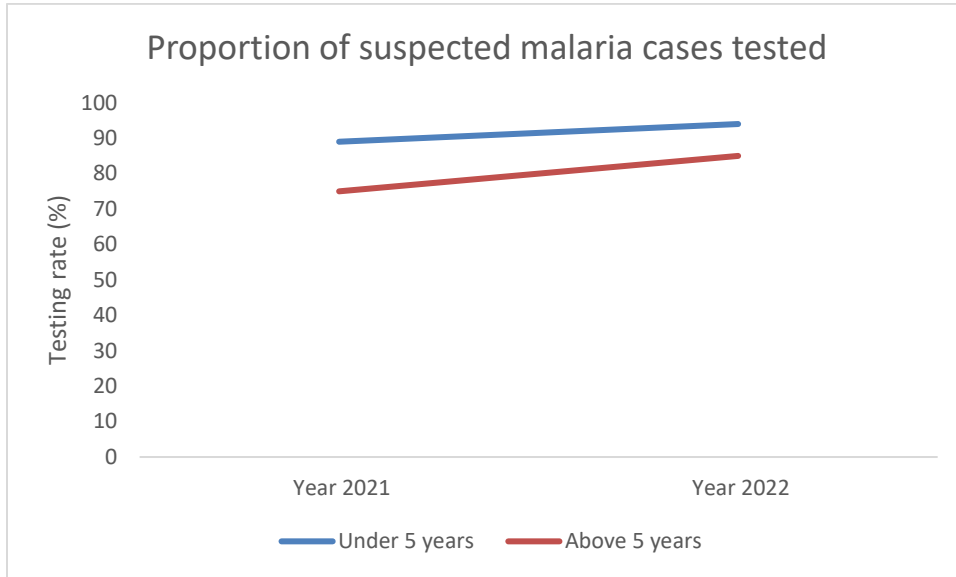


Figure 2: Proportion of suspected malaria cases tested in Kenya, 2021-2022

*Malaria incidence rate*

The number of confirmed cases of malaria per month per 1000 population in the lake endemic zone increased from 372 to 412 during the year

2021/2022. In the same period, the incidence across other epidemiological zones reduced as shown (Figure 3).

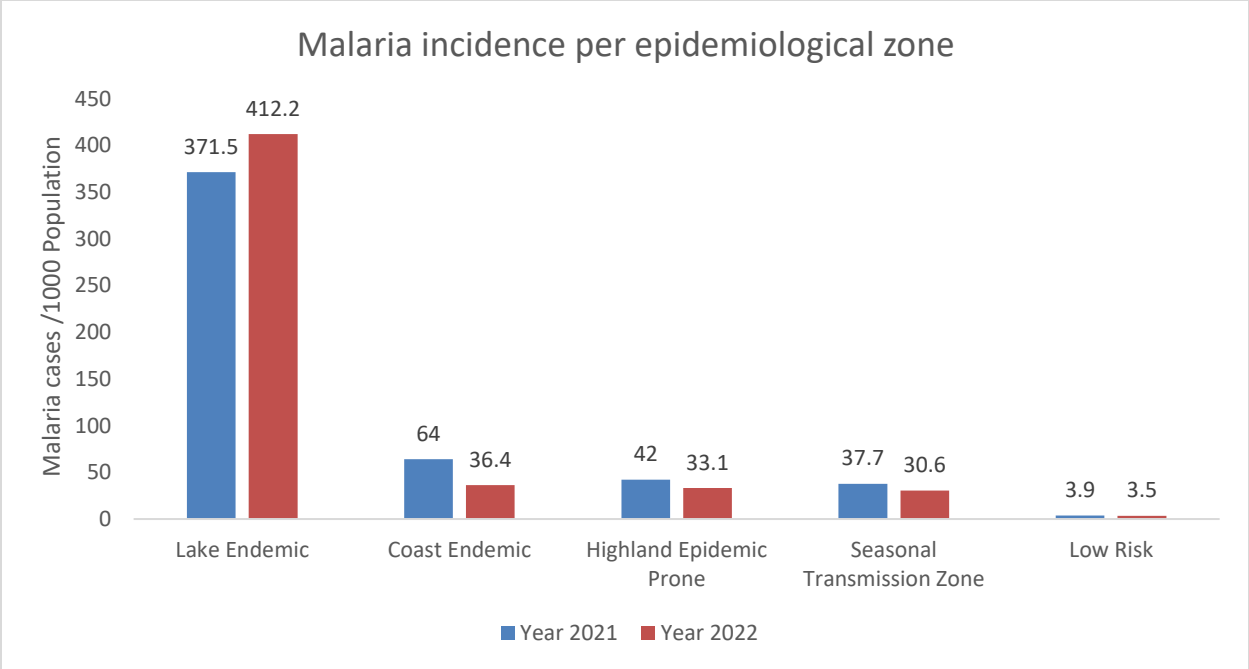


Figure 3: Confirmed malaria cases per 1,000 population by epidemiological zones in Kenya, 2021-2022

*Malaria blood examination rate*

Annual Blood Examination Rate (ABER) reflects the proficiency and competence of case detection (Figure 4). More

cases were tested in the lake endemic zone slightly more than 80 cases/100 population and less in the low-risk areas.

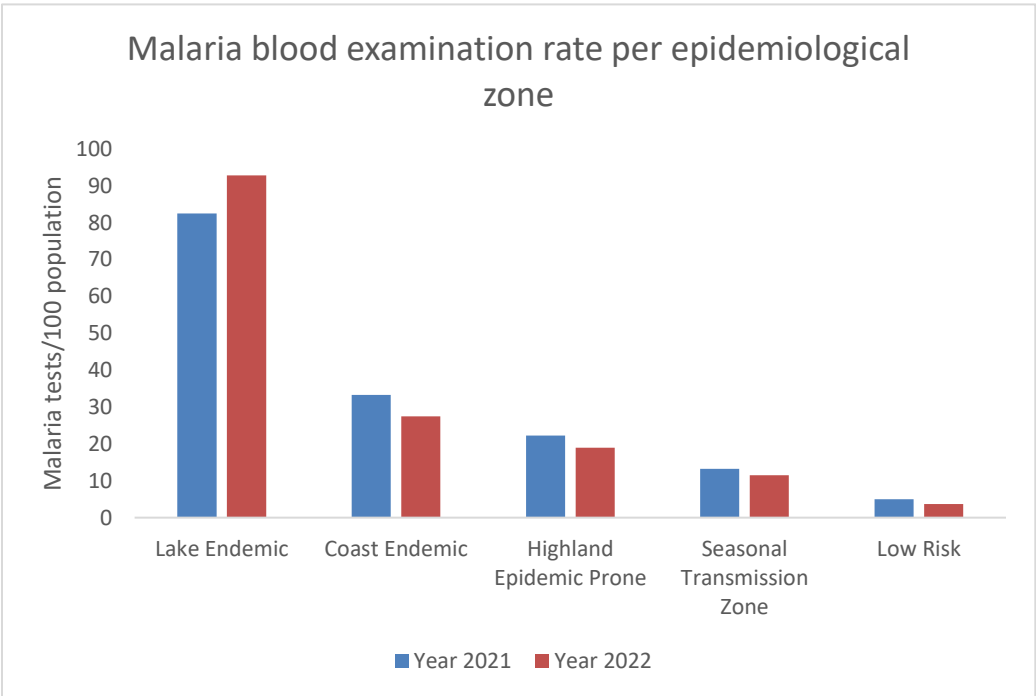


Figure 4: Malaria blood examination rate - per 100 population by epidemiological zones in Kenya, 2021-2022

*Confirmed malaria cases treated with first line antimalarial (ACTs)*

Nearly all the confirmed malaria patients seen in the lake endemic zone were treated with ACT in the year 2021 and a few cases that were confirmed did not get the treated with ACT. Across other epidemiological zones, there

were more cases treated with ACT than those confirmed in both years. The lake endemic zone had the highest burden contributing to 77% and 82% in 2021 and 2022 respectively of the all the cases while the low-risk areas have the lowest burden (Figure 5).

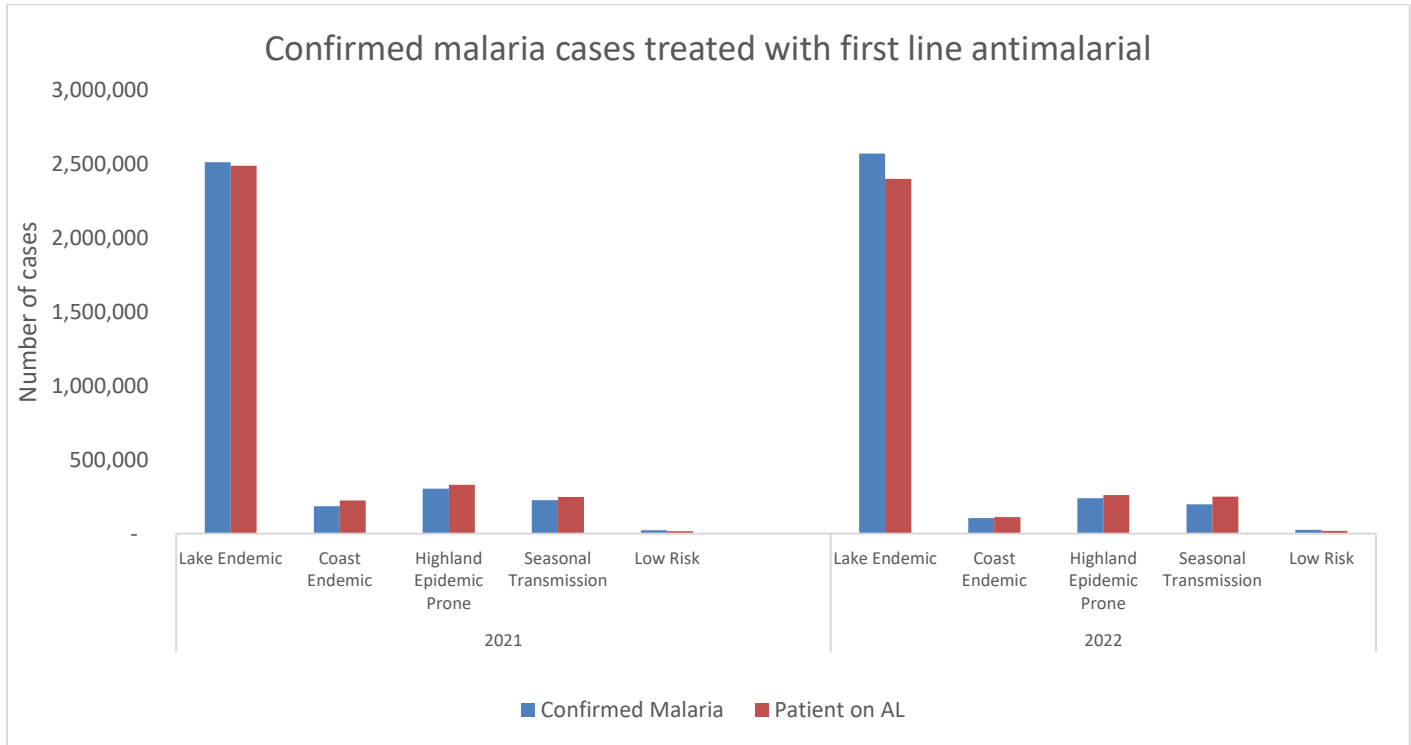


Figure 5: Confirmed malaria cases treated with first line antimalarial ACTs by epidemiological zones in Kenya, 2021-2022

*Malaria test positivity rate*

Figure 6 shows the percentage of the malaria cases that tested positive against the total number of cases tested for malaria parasites based on both microscopy and Rapid

Diagnostic Tests (RDTs) per epidemiological zone. The positivity rate was varied in across the epidemiological zones and was highest in the Lake Endemic zone (40% in 2021 and 38% in 2022).



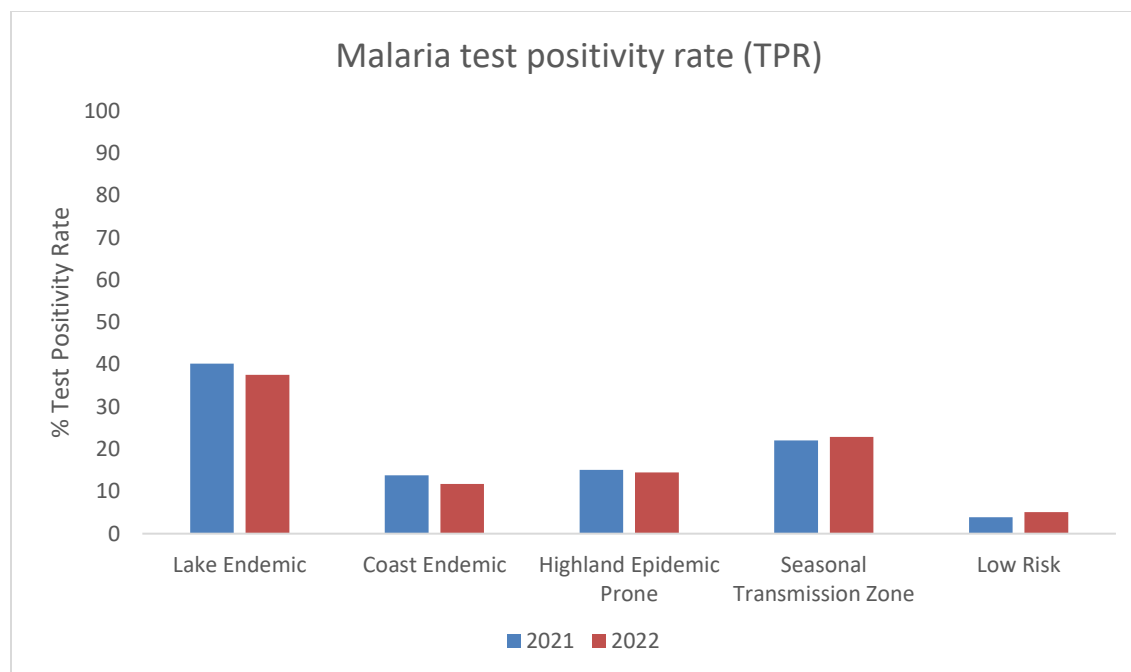


Figure 6: Malaria test positivity rate by epidemiological zones in Kenya, 2021-2022

## DISCUSSION

Monitoring of malaria surveillance indicators showed the overall program performance on achieving the strategic goal on reducing the malaria incidence and deaths, adherence to treatment guidelines within and between malaria epidemiological zones (4, 7-8). Level 2 health facilities serve a large population of patients in the rural setting where the burden of malaria is high compared to other levels and their reporting rates were optimal across the epidemiological zones. To reduce malaria burden improvements should be pitched at level 2 health facilities (9).

The proportion of suspected malaria cases tested indicator monitors adherence to test and treat policy. The national malaria treatment guidelines advocate for diagnosis based on parasitological confirmation with either microscopy or malaria rapid diagnostic tests for all persons regardless of age in all epidemiological zones before treatment (10-

11). However suboptimal, the proportion of tested malaria suspected cases increased over the two years and was higher in children under 5 years than over 5 years. Similar studies have attributed the increase of suspected malaria cases to availability and use of RDTs (12). Proper tracking of suspected malaria cases across all health facilities in all the epidemiological zones is useful in ascertaining the quality of care and determining the utilization of malaria commodities in health facilities (7).

Malaria incidence provides the most direct measure of malaria burden and allows one to quantify cases over time relative to the size of the population at risk (13). The program strategic goal is to reduce malaria incidence from 113 to 28 confirmed malaria cases/1000 population by 2023 (4). Instead, the malaria incidence levels increased from 75 to 83 confirmed malaria cases/1000 population with greater contribution from the lake endemic region that has higher vector abundance than

the other epidemiological zones (14). The increase though marginal can be attributed to normal seasonal variations. Few malaria cases were reported in the low-risk areas. Implementation of malaria elimination probable in the low-risk areas will require implementation of a case-based malaria surveillance system to classify malaria cases (local vs. imported) which is currently not available in the current surveillance system. It is probable that cases reported in this zone are imported from other counties with high malaria burden.

The ABER provides a measure of the adequacy of a case surveillance system. The ABER of 1% was maintained in Kenya in the year 2021/2022 and varied across the epidemiological zones. Previous studies have reported higher ABER in areas where malaria screening is targeted on population groups at risk of malaria (15). In Kenya, the highest malaria burden is in the lake endemic zone (2). In the year 2022, there was an increase in malaria diagnosis at the lake endemic zone because of increased community case management intervention and this may result in higher ABER.

One of the strategic objectives is to manage 100% of suspected malaria cases according to the Kenya malaria treatment guidelines. The first line anti-malarial for uncomplicated malaria (artemether lumefantrine), should only be administered to outpatients who are tested positive for malaria parasites using a parasitological test by either RDT or microscopy. Apart from the Lake Endemic zone that treated slightly less patients who tested positive. This would indicate a possibility of health facilities experiencing stockouts or rather missing to treat some positive cases who can quickly transition to severe malaria.

The consumption of ACTs across other zones was slightly more than the positive cases an

indicative of presumptive treatment or treating negative cases with ACTs (16). Health facilities with ACTs in stock consistently treated adequately a higher proportion of malaria confirmed case (13). There is need to ensure the pipeline is secured with sufficient commodities to avert stock-outs or expiries and consequently manage malaria cases. The health workers are required to adhere to case management diagnosis and treatment guidelines.

The test positivity rate (TPR), defined as the number of laboratory-confirmed malaria tests per 100 suspected cases examined, is one of several indicators used for estimating temporal trends in malaria incidence (17). Similar studies have reported using TPR to define level of endemicity, identify burden areas and evaluate the impact of control interventions (13). This study utilized routine data from the government health facilities as reported through the KHIS system.

## CONCLUSION

In conclusion, to reduce malaria burden, improvement should target level two health facilities that serve a large population of patients. Despite the reporting rates being suboptimal, the MOH tools can still be used for decision making to improve health facility service delivery. Malaria incidence rate increased in Lake endemic zone and reduced in other epidemiological zones. This study recommends tracking malaria incidence to inform program performance, preparedness, and optimal resource utilization. The programmatic policy recommends all suspected malaria cases be tested and if confirmed positive treated according to the treatment guidelines. Positively, this study found more cases were tested in the Lake endemic zone and those confirmed with

malaria were treated with ACT in the year 2021. Negatively, across other epidemiological zones, there were more cases treated with ACT than those confirmed in both years. Adherence to the case management guidelines is key to enhance the quality of care given to suspected malaria patients. Capacity building and mentorship of frontline health workers on malaria case management should be of utmost importance.

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