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EFFECTS OF FACILITY-BASED MALARIA SURVEILLANCE MONITORING AND EVALUATION MENTORSHIP MODEL ON DATA QUALITY IN KAKAMEGA COUNTY, KENYA
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ABSTRACT

***Objectives*: This paper aims to describe the impact of the facility-based malaria surveillance monitoring and evaluation (SME) mentorship model on data quality in Kakamega County, Kenya.**

***Intervention*: Facility-based mentorship for malaria surveillance, Monitoring and Evaluation**

***Methods*: This is a retrospective study that analysed routine data collected during routine malaria data quality assessments (mRDQAs) in Kakamega County before and after implementing the facility-based SME mentorship program. The study assessed data quality indicators, including completeness, timeliness, accuracy, and consistency, through mRDQAs conducted by trained SME mentors.**

***Results:* A total of 35 SME mentors were trained, and 1,403 healthcare workers were mentored in 225 (100%) targeted health facilities. The study found significant improvements in data completeness, timeliness, and accuracy following the mentorship program. Timely reporting increased from 96% to 99%, completeness**

of reports from 96% to 100%. Data accuracy improved for several key malaria indicators. Cross-checks revealed discrepancies between baseline and round two assessments, with reduced accuracy in Cross-checks between Laboratory and Pharmacy registers and a significant increase in Artemisinin Combined Therapy (ACT) stock management log and pharmacy register, suggesting potential over-reporting.

Conclusion: **The study underscores the positive effects of facility-based mentorship on malaria data quality through improvements in completeness, timeliness, accuracy, and other data quality aspects. It acknowledges areas requiring attention, including data consistency and system attributes. It recommends strengthening data quality through checks, audits, custom tools, and continuous capacity-building activities for new and experienced healthcare workers.**

INTRODUCTION

Malaria remains a significant public health concern both globally and in Kenya. There were an estimated 241 million malaria cases and 627,000 malaria deaths worldwide in 2020, representing an additional 14 million cases in 2020 compared to 2019 (1). Malaria accounts for an estimated 13% to 15% of outpatient consultations in Kenya. Approximately 70% of the population is at risk for malaria, including 13 million in endemic areas and another 19 million in highland epidemic-prone and seasonal transmission areas (2).

Malaria control strategies are deployed according to risk stratification based on routinely collected malaria case data (3). Kenya's Malaria Strategy 2019–2023 aims at reducing malaria incidence and deaths by 75% of 2016 levels by 2023. This goal is supported by objective five, which aims to strengthen malaria surveillance and use the information to improve decision-making for program performance (4).

The Global Technical Strategy for malaria 2016–2030 reiterates the importance of adequate investments in supervising and employing routine health information data to assist program planning, enforcement, and assessment (5). In most African countries, health facility-based surveillance data on malaria is reported through routine health information systems. Unfortunately, there are challenges in health facility data: completeness, accuracy and timeliness limit the utility of routinely collected health facility data for programmatic monitoring and evaluation. As a result, modelling is used to estimate malaria burden in many countries (6).

Malaria Surveillance, Monitoring, Evaluation and Operational Research (SMEOR) in Kakamega County has received enormous support from the national, county government and international development partners through Global Fund Malaria and U.S Presidents Malaria Initiatives (USAID PMI) projects. There is a need for a robust SMEOR system to measure progress toward the achievement of the malaria strategy goal through various strategies and interventions. Enhancing healthcare workers' knowledge and skills is one way of enhancing SMEOR and improving the availability of quality data for decision-making. This paper describes the effects of a facility-based mentorship model for capacity building of health care workers on SMEOR. The main focus is on completeness, timeliness, accuracy, consistency of data, and the availability of SMEOR systems that support data Malaria data quality.

METHOD

Study Setting

Kakamega County is located in the Western part of Kenya. The county has 12 sub-counties, 60 wards, 187 villages and 400 community administrative areas, and a projected population of 2,094,804 people. To cater for the healthcare needs of its residents, Kakamega County has a network of 362 health facilities offering malaria case management and preventive services, making these healthcare services more accessible to its population. Annex.1 (7).

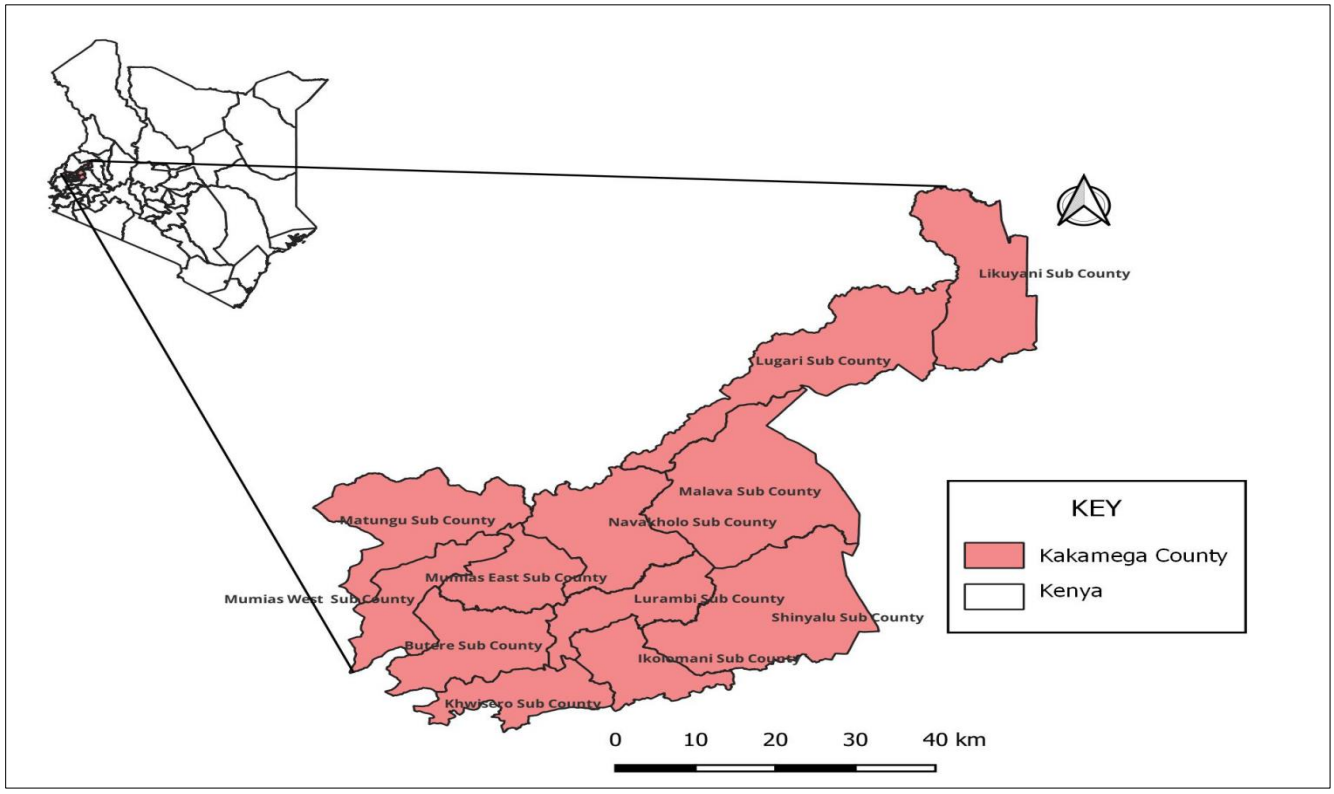


Figure 1: Map of Kakamega county

Source: Kenya Health Information System(KHIS).

Study design

This was a retrospective review of routine data collected during mRDQAs in Kakamega County before and following the facility-based SME mentorship program.

Study population

Health facilities in Kakamega county, Kenya.

Study variables

The study variables include the number of facilities submitting timely reports, data completeness in outpatient registers and monthly summary forms, reported malaria cases with no missing data in outpatient under five registers (MoH 240), Annex 2, and data accuracy, consistency, and reliability between data sources with the same or similar information.

Sources of data

Baseline and follow-up mRDQA. The mRDQA tool developed by MEASURE Evaluation was used to collect data (8). The mRDQA tool has since been adopted by the national malaria

control program. The tool supports targeted rapid data-quality assessment focused on malaria and allows a review of the accuracy of data from the previous three months for up to five malaria indicators. However, documentation of malaria data at the facility level is done for two broad age groups: under five and over five. The assessment focused on data for the under-fives due to high outpatient malaria consultations in this age group.

The assessment was organized and conducted by trained sub-county mentors for malaria SMEOR in their respective sub-county. The mentors were trained on using the mRDQA tool during a two-day workshop that included health facility visits to get hands-on experience and familiarize themselves with the process before the data collection exercise. The baseline assessment was done from 15 to Feb 18, 2022, and round two assessments were done from 18 to Oct 21, 2022, after eight months of facility-based mentorship.

Analysis and statistics

Completeness was assessed in three levels: completeness of the monthly report, data element completeness and source document completeness. Completeness of the monthly information was determined using the most recent completed and submitted monthly report (MoH 705A), Annex 3. The indicator was calculated by determining the number of cells expected to be completed and the number of completed or filled in.

Malaria data element completeness was assessed using the outpatient register (MOH 204A). Annex 2. Timeliness of submission of the monthly reports was considered by verifying if the reports for the last three months preceding the assessment were submitted by the deadline for reporting. Data accuracy using the Verification Factor (VF) is the validated (recounted) value in source registers divided by the value reported in summary forms or Kenya Health Information System (KHIS) multiplied by 100. VF values between 90 and 110 were considered within the target quality threshold. VF<90 or >110 represented over- and under-reporting, respectively.

$$VF = \frac{validated\ (recounted)\ value\ in\ source\ register}{value\ reported\ in\ summary\ form\ or\ KHIS} \times 100$$

For data cross-checking, data sources were compared to determine the level of consistency and reliability between data sources with similar information. Cross-checks are techniques to corroborate results found in one data source with data from a different source. A Comparison of data elements between a client service delivery register and another register for a service delivery support unit, such as the pharmacy or laboratory. The rationale is to ensure that information in the support unit registers is being updated correctly in the primary service delivery register for the program area or indicator and that the information is the same in the two data sources. Select the priority data elements to compare, such as those on diagnosis and treatment (e.g., test dates and results, regimens prescribed, and filled dates). Demographic characteristics (age and gender) and unique identifiers can also be compared. For the assessment:

Cross check A: Randomly selected ten patients who had been treated for Malaria in the period at the facility in outpatient register check for corresponding entries in the laboratory register

Cross check B: Randomly selected ten patients who had been treated for Malaria in the period at the facility in outpatient register check for corresponding entries in the pharmacy register

Cross check C: For stock management reported as beginning balances for the reporting period,

what was received, balances at the end of the reporting period from the stock management cards. Number of doses dispensed to patients in the Daily activity register for that period.

$$Verification\ Ratio = \frac{Doses\ issued\ in\ pharmacy\ Daily\ activity\ register}{(Initial\ stock + what\ was\ received) - Available\ stock} \times 100$$

Five indicators were used to assess data accuracy. Annex 4

Changes in data quality aspects were considered pre and post-mentorship program

Ethics consideration

The Maseno University Scientific and Ethics Review Committee approved the study ref no MUSERC/01234/23.

RESULTS

A total of 35 mentors were trained on the Malaria surveillance. These included health records and information officers, Pharmacy Personnel, Clinicians, Nurses and malaria program officers. All 225 (100%) targeted facilities for SMEOR mentorship were visited and 1,403 healthcare workers mentored. Figure 2

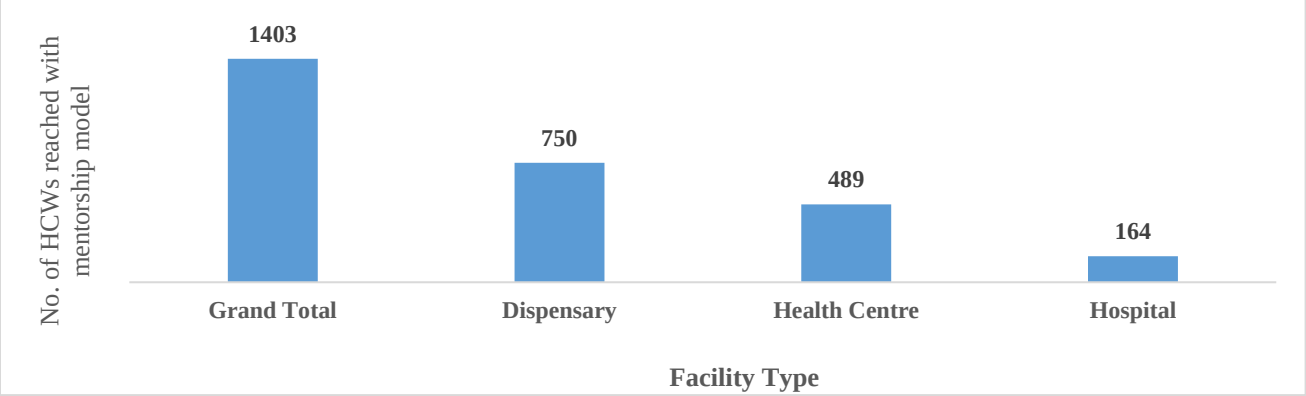


Figure 2: Number of Healthcare workers mentored on malaria surveillance, monitoring, and evaluation in Kakamega County from February to October 2022

In the initial assessment, 37 facilities were included, while in the first follow-up round, 36 facilities were sampled for mRDQA. Among the assessed facilities, the majority (53%) were dispensaries. However, hospitals were not included in the second round of assessment due to the unavailability of outpatient registers (MoH 204 A) in hospitals. All hospitals in the county have transitioned to using outpatient Electronic Medical Record (EMR) systems, and not all the data sets found in the standardized registers were accessible. Figure 3

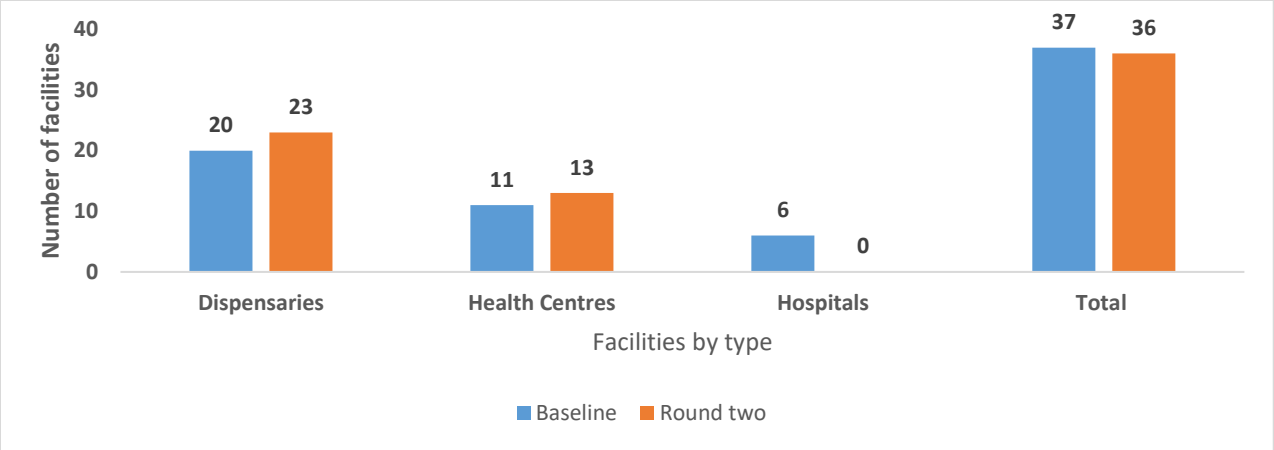


Figure 3: Facilities sampled for data quality assessment by type, Kakamega county, February 2022 and October 2022

There were more Ministry of Health (MoH) facilities visited twice, four and five times. None of the FBO facilities were seen more than six or seven times. Figure 4

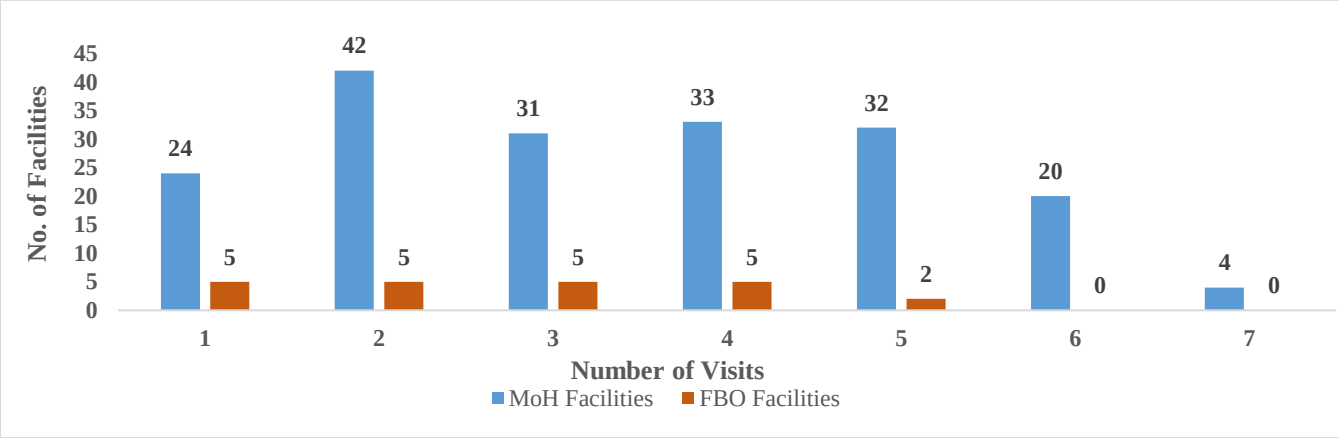


Figure 4: Frequency of facility visits for surveillance monitoring and evaluation mentorship to health facilities in Kakamega County from February 2022 to October 2022

The baseline and second-round assessment timelines were within the threshold, 96% and 99%, respectively. In the second round, the facilities demonstrated better timeliness and completeness of reports compared to the baseline assessment. However, they recorded a lower score, 70%, in contrast to the baseline's 76%, regarding the percentage of malaria cases with number missing data in MoH 204A.

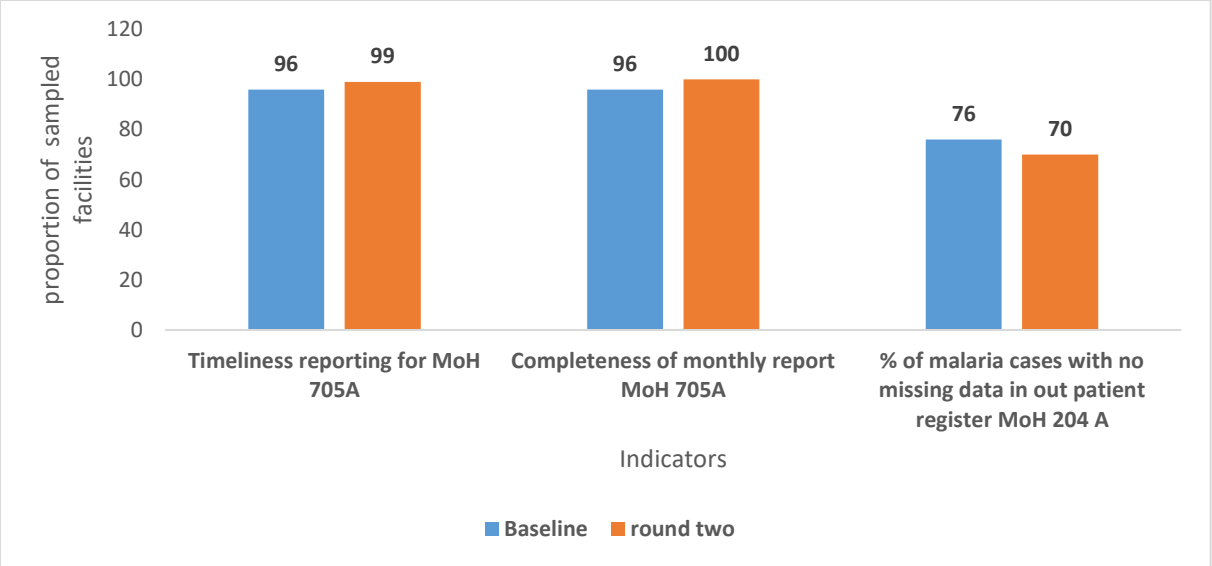
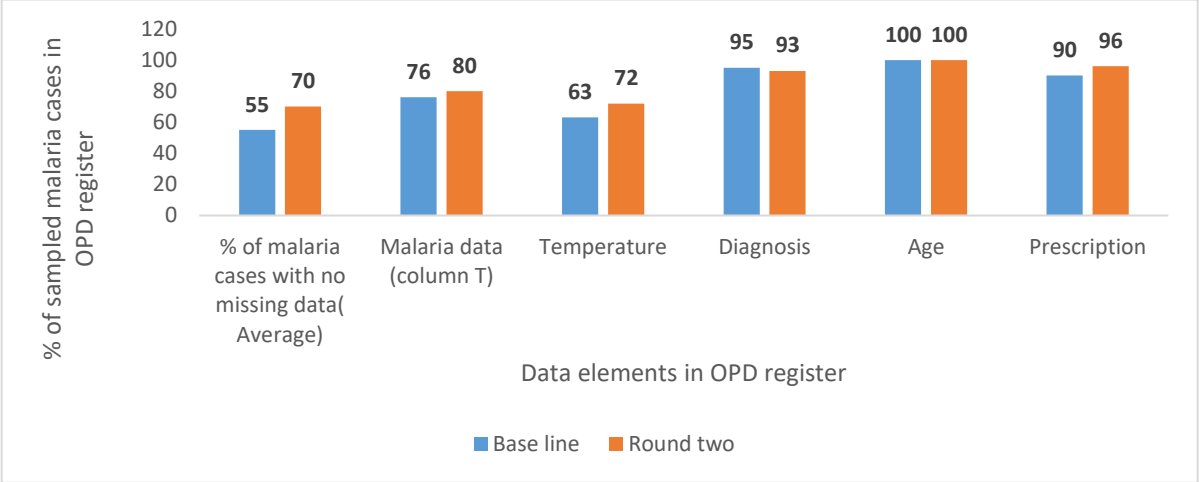


Figure 5: Timelines and completeness of Ministry of Health Register and monthly summary forms

The percentage of malaria cases with no missing data was higher for the patient's age at baseline and round two assessments. In both assessments, the age column was filled at 100%. Facilities achieved higher scores in terms of completing various columns (such as Column T, Temperature, Prescription, and cases with no missing data) except for the diagnosis column, which showed a slight decrease in round two compared to the baseline assessment, as illustrated in the. Figure 3



**OPD- Outpatient*

Figure 6:Percentage of malaria cases with no missing data

Source registers and summary forms were available in over 90% of the health facilities assessed except for the laboratory register (MoH 240) (74%) at baseline and 58% at round two. There was a reduction in the proportion of facilities with laboratory registers (MoH 240) from 74% to 58% and laboratory summary forms (MoH 706) from 91% to 71%.

Table 1

Availability of standardized Ministry of Health Registers

Source register/ summary form	Baseline assessment	Round two assessment
Outpatient register (MoH 204A)	97	100
Monthly report (MoH 705A)	100	100
Laboratory register (MoH 240)	74	58
Laboratory summary form (MoH 706)	91	71
Daily activity register	97	97
Malaria commodity form	89	100

**MoH – Ministry of Health*

Data Accuracy

Data accuracy showed significant improvement from the baseline to round two assessments, with higher accuracy in suspected malaria, cases tested for malaria, confirmed malaria and cases tested with rapid diagnostic tests or microscopy. However, there was a slight decline in the accuracy of recording pregnant women receiving third dose of Intermittent preventive therapy for malaria (IPTp3), dropping from 99% in the baseline to 95% in round two.

Table 2

Verification factors for malaria data accuracy

Data element	*Verification Factor at Baseline	*Verification factor for Round two
Suspected malaria	73	95
Tested for malaria	78	96
Confirmed malaria	65	96
Number of cases tested using rapid diagnostic test or microscopy	85	98
Number of pregnant women given IPTp3	99	95

**VF values between 90 and 110 were considered within the target quality threshold. VF<90 or >110 represented over- and under-reporting respectively*

Data cross-checks

The data cross-checks revealed differences between the baseline assessment and round two. In Cross-check A (OPD: Lab register), accuracy declined from 89% in the baseline to 82% in round two. Similarly, in Cross-check B (OPD: Pharmacy register), accuracy decreased from 87% to 84%. However, in Cross-check C (ACT stock management log: pharmacy register), accuracy increased from 99%, within the recommended target, to 175%, indicating over-reporting.

Table 3

Data cross-check across registers in Outpatient, Laboratory, and pharmacy departments

Indicator	Baseline	Round two
Cross-check A (90%) (OPD: Laboratory register)	89	82
Cross-check B (90%) (OPD: Pharmacy register)	87	84
Cross-check C ((>=90%, <=110%) (ACT stock management log: pharmacy register)	99	175

**OPD-Outpatient Department, ACT – Artemesinin Combined Therapy.*

Systems assessment

Several noteworthy changes in system attributes were observed between the baseline and round two assessments. Designated staff's ability to review the quality of compiled data improved from 73% in the baseline to 83% in round two. The presence of written instructions on data collection and reporting saw a significant increase, rising from 65% in the baseline to a robust 92% in round two.

Moreover, there was a notable rise in the availability of reserve stock of blank registers or reporting forms, increasing from 62% in the baseline to 81% in round two. Similarly, the absence of stock outs of registers or reporting forms since the last visit showed improvement, from 43% in the baseline to 58% in round two. Standardized registers increased significantly from 81% in the baseline to 92% in round two, and facilities found patient diagnosis and treatment history more quickly, rising from 86% in the baseline to 92% in round two.

However, maintaining accurate demographic information for the facilities catchment area experienced a slight decrease from 95% in the baseline to 83% in round two. The up-to-date display of malaria cases diagnosed and treated increased substantially from 62% in the baseline to 89% in round two. In contrast, displaying a chart of disease incidence by month decreased from 51% in the baseline to 39% in round two. These findings reflect improvements and areas requiring further attention in the facilities' data management and reporting systems between the two assessments.

Table 4

Surveillance, monitoring and evaluation systems assessment

Surveillance, Monitoring, and Evaluation System attributes	Baseline assessment	Round two	
Designated staff to enter data	86%	89%	
Designated staff to compile reports	92%	100%	
Designated staff to review the quality of compiled data	73%	83%	
Written instructions on data collection and reporting	65%	92%	
Reserve stock of blank registers or reporting forms	62%	81%	
No stock out of registers or reporting forms (since the last visit)	43%	58%	
Standardized register in use	81%	92%	
The patient's diagnosis and treatment history are easily found	86%	92%	
Data archives are correctly maintained according to established legal guidelines	81%	83%	

Maintain accurate demographic information for the catchment area	95%	83%	
Established targets to monitor progress	84%	86%	
Up-to-date display of the number of malaria cases diagnosed and treated	62%	89%	
Chart of disease incidence by month displayed	51%	39%	

DISCUSSION

The study aimed to assess the effects of the facility-based SME mentorship model on data documentation and reporting practices in facilities in Kakamega County. The main focus was on completeness, timeliness, accuracy, consistency, and reliability of malaria data. In addition, SMEOR systems supporting Malaria data quality were assessed.

There was an improvement in timely reporting and completeness for outpatient summary registers and the percentage of malaria cases with no missing data on average in the outpatient register. Source registers and summary forms were available in majority of the health facilities assessed. There was a reduction in the proportion of facilities with laboratory registers and laboratory summary forms. Data accuracy improved following the mentorship visits, with most malaria indicators scoring within the target data quality threshold of VF 90% to 110%.

For data cross-checks, only 83% of randomly selected patients from the outpatient register had a corresponding entry with matching information in the laboratory and pharmacy registers. There was an agreement of data in stock management cards at the stores and pharmacy's Daily activity register in most facilities at baseline assessment. The significant gaps included arithmetic errors, with most pharmacy registers also lacking daily page summaries.

Several noteworthy changes in SMEOR system attributes were observed between the baseline and round two assessments. Designated staff's ability to review the quality of compiled data improved. The presence of written instructions on data collection and reporting saw a significant improvement because the county received revised tools from the USAID PMI Measure Malaria project. This also contributed to the rise in the availability of reserve stock of blank registers or reporting forms and the absence of stock outs of registers or reporting forms. The use of standardized registers increased significantly during round two of the assessment. There was a slight decrease in the proportion of facilities maintaining accurate demographic information for the catchment area by displaying a chart of disease incidence by month.

There was an improvement in timely reporting and completeness for outpatient summary registers and the percentage of malaria cases with no missing data on average in outpatient registers. Timeline scores were higher than other studies where timely reporting was below the targets (5). For malaria cases with missing data, reasons for this gap included using outdated registers and partially filled-out summary forms that affected documentation of suspected malaria cases. PMI malaria project printed and distributed revised standardized tools across facilities in the county. This, in addition to the facility-based mentorship, could have contributed to the improvement in the indicator.

Source registers and summary forms were available in over 90% of the health facilities assessed. There was a reduction in the

proportion of facilities with laboratory registers and summary tools. This could affect the quality of data collected at facility service delivery points. There was an improvement in data accuracy after the mentorship. As Okyere *et al*. note, accurate is considered high-quality data suitable for decision-making (5).

For data checks, 89% of randomly selected patients from the outpatient register (MOH 204A) had a corresponding entry with matching information in the laboratory and 87% in pharmacy registers. The patients that could not be matched were due to inconsistent use of patient numbers across records; transcription errors; unavailability or suboptimal use of the laboratory and pharmacy register; and gaps in some of the days of the month, e.g., weekends and during specific periods in December due to absence or lack of personnel. The patient flow contributed to incomplete recording in the outpatient register MOH 204A in some high-volume health facilities. There was an agreement of data in stock management cards at the stores and pharmacy Daily activity register in 99 % of facilities at baseline assessment. The significant gaps included arithmetic errors, with most pharmacy registers also lacking daily page summaries.

These findings on SMEOR systems assessment reflect improvements and areas requiring further attention. While other SMEOR systems attributes performed well in both assessments, displaying a chart of disease incidence by month decreased from 51% in the baseline to 39% in round two. This could be attributed to healthcare worker's skills and knowledge in essential data analytics, as noted in the study in Ghana, where human resource factors such as supervisors often have minimal data quality checking skills, may not understand the importance of collecting data, and may not provide feedback after supervision. In addition, health workers in the field have inadequate skills for routine data collection and may not have received relevant training (9).

Conclusions

In conclusion, the two rounds of data quality assessments revealed positive progress and areas requiring further attention. The findings highlighted the dynamic nature of data quality and management within healthcare facilities. While progress was noted in several areas, continuous facility-based mentorship efforts should be adopted to improve data quality to address specific challenges and ensure the consistent improvement of data quality and reporting systems.

Policy implication

There is a need to strengthen malaria data quality at the facility level by establishing periodic data quality checks and introducing regular data audits to identify and correct inaccuracies in reporting and have custom-made tools to help check on the quality. Maintain Regular Capacity Building through facility-based mentorship, Continuous Medical Education (CMEs) and on-the-job training. Establish a routine capacity-building schedule to keep healthcare workers updated on best practices in data management and reporting, emphasizing targeting the newly recruited staff and ensuring continuity of data quality efforts.

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Annex 1: Distribution of health facilities in Kakamega County by ownership and level of care

Sub-county	FBO			MOH				NGO		Private			Total
	Level 2	Level 3	Level 4	Level 2	Level 3	Level 4	Level 5	Level 2	Level 3	Level 2	Level 3	Level 4	
Butere	2	0	0	4	11	2	0	0	0	8	4	1	32
Ikolomani	0	3	0	11	2	2	0	1	0	7	1	0	27
Khwisero	0	3	1	2	12	1	0	0	0	8	4	0	31
Likuyani	0	0	0	11	2	2	0	0	0	10	2	0	27
Lugari	1	1	0	15	1	3	0	0	0	11	0	0	32
Lurambi	1	1	0	17	3	0	1	1	0	22	4	0	50
Malava	2	0	0	21	4	1	0	0	0	7	2	0	37
Matungu	1	0	0	6	5	1	0	0	1	9	4	0	27
Mumias East	0	0	1	7	4	1	0	0	0	8	0	0	21
Mumias West	2	0	1	7	3	1	0	0	0	11	1	0	26
Navakholo	2	0	0	9	3	1	0	0	0	1	0	0	16
Shinyalu	0	1	1	14	5	0	0	0	1	11	3	0	36
Grand Total	11	9	4	124	55	15	1	2	2	113	25	1	362

Annex 2: Copy of Outpatient register MoH 204 A

Date (DD/MM/YYYY)	OPD No. (New)	OPD No. (Revisit)	Referred From 1=CU, 2=From other facility, 3=N/A	Full Names (THREE names)	Age	Sex	County/Sub-county	Village / Estate / Landmark	Parent / Caregiver's Telephone No.	Weight (kg)	Height (Length (cm)	MUAC 1.Green 2.Yellow 3.Red	Temp (oC)	Respiratory Rate	Oxygen Saturation Reading (SPO2)	Pulse Rate	DANGER SIGNS 1.Unable to drink or breastfeed 2.Vomits everything 3.Had convulsions in this illness 4.Is lethargic or unconscious 5. Is convulsing now	Duration of Current Illness (in hours/days)	Malaria 1.Presenting with symptoms NOT Tested 2. RDT Tested (-ve) 3. Microscopy Tested (-ve) 4. RDT Tested (+ve) 5. Microscopy Tested (+ve)	IMNCI Classification/ Diagnosis	TRACER DRUGS PRESCRIBED 1.ORS & Zinc 2.Zinc Only 3.ORS Only 4.AmoxDT 5.Vitamin A 6.Oxygen 7. Albendazole	Other ALL Treatments Prescribed	Immunization Status Up to Date (Y/N)	TB Screening 1 presumed TB 2. No signs 3. On TB treatment 4.Not done	Nutrition and dietetics Interventions 1=Nutrition couselling 2=Nutrition therapeutic supplements 3 = Dietetics	Referred to (1=CU, 2= to other HF, 3=N/A)	REMARKS
A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	AA	AB

Annex 3: Outpatient Summary Register for under-fives (MoH 705A)

Facility Name:_____ **Ward:**_____ **Sub-county:**_____ **County:** _____ **MFL NO**_____ **Month:** _____ **Year:**___

DISEASES (New Cases Only)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	Totals
Diarrhoea with no dehydration																																
Diarrhoea with some dehydration																																
Diarrhoea with severe dehydration																																
Cholera																																
Dysentery (Bloody diarrhoea)																																
Gastroenteritis																																
Pneumonia																																
Severe pneumonia																																
Upper Respiratory Tract Infections																																
Lower Respiratory Tract Infections																																
Asthma																																
Presumed Tuberculosis																																
Suspected Malaria																																
Tested for Malaria																																
Confirmed malaria																																
Ear infection																																

Annex 4: Malaria Indicators used to assess for data accuracy

Data quality dimension	**Data elements**	**Name of Data tool**
Completeness of malaria monthly report	Suspected malaria, tested for malaria, confirmed malaria	MOH 705A
Timeliness of submission of monthly report	Suspected malaria, tested for malaria, confirmed malaria	MOH 705A
Data element completeness	Malaria data – Column T	MOH 204A
	Temperature (^{0}C) – column N	MOH 204A
	Diagnosis – Column U	MOH 204A
	Age – column F	MOH 204A
	Treatment/prescription – Column W	MOH 204A
Source document completeness	Outpatient register	MOH 204A
	Outpatient summary form	MOH 705A
	Laboratory register	MOH 240
	Laboratory summary form	MOH 706
	Daily activity register	MOH 645
	Monthly summary report of malaria commodities	MOH 743
Data Accuracy	Suspected malaria	MOH 204A, MOH 705A, KHIS
	Tested for malaria	
	Confirmed malaria	
	Number of outpatient clients tested/total exam (under five years old) BS and RDT	MOH 240 or 645, MOH 706 or 743, KHIS
	Number of clients given IPTp (3rd dose)	MOH 405, MOH 711, KHIS
Cross-checks	OPD & and laboratory register	MOH 204A, MOH 240 or MOH 645
	OPD & daily activity register (pharmacy dispensation)	MOH 204A, MOH 645
	ACT stock management and pharmacy dispensation log	MOH 645, bin card
Consistency checks	Number of suspected cases of malaria	MOH 705A