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MONITORING HEALTH WORKERS' ADHERENCE TO MALARIA CASE MANAGEMENT GUIDELINES FOR PATIENTS WITH SEVERE MALARIA AT PUBLIC HEALTH FACILITIES IN KENYA, 2023

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ABSTRACT

Objectives: **Among the suspected severe malaria patients admitted in the public health facilities in Kenya, to identify those that are correctly diagnosed, assess the health workers' adherence to malaria case management guidelines, health facility and health worker readiness to implement the policy.**
Design: **Cross-sectional, cluster sample survey.**
Setting: **All 47 counties in Kenya, 2023**
Subject: **49 Government and 42 faith-based hospitals were assessed, 318 inpatient health workers from paediatric and medical wards were interviewed and 2073 files for patients admitted with suspected malaria were examined.**
*Main outcomes***: testing suspected malaria patient, recommended treatment based on severity criteria and test results.**
*Results***: Among all patients 42.6% had documented at least one feature of malaria severity and 36.8% were diagnosed as severe. Adherence to severe malaria treatment guidelines was 54.6%, 96.7% of all hospitals provided malaria microscopy, 82.4% stocked artesunate and 41.8% had at least one ward with displayed artesunate poster, 36.5% of health workers were trained on artesunate, 45.3% accessed malaria case-management guidelines and 28.3% had been supervised.**
*Conclusion***: Despite high level health worker adherence to test and treat policy for severe malaria, there was a significant irrational use of artesunate for non-severe patients with microscopy confirmed positive test. There is a need to focus on**

programmatic interventions directed to rationalize the use of artesunate. Health workers' supervision, case-management training, dissemination of guidelines and job aids should be programmatic priority.

INTRODUCTION

Globally, there were an estimated 247 million malaria cases reported with World Health Organization (WHO) African Region accounting for 95% of the cases in 2021 (1). In Kenya, malaria remains a major public health concern with three-quarters of the population being at risk of the disease despite the decline in malaria prevalence (2). Irrespective of malaria classification as either uncomplicated or severe, provision of prompt and effective treatment remains the cornerstone of malaria case management. Early, correct diagnosis and intervention can prevent the progression of uncomplicated malaria. Severe malaria is a medical emergency and should be managed in a facility with inpatient services (3).

The WHO recommends the use of artesunate drug for treatment of severe malaria (4). In Kenya, this has since been translated into a policy and included in the strategy to ensure 100% of suspected malaria cases are managed according to the case management guidelines (2). Adherence to severe malaria case management guidelines is crucial to reduce mortality rates and enhance patient outcomes. Initially to support the treatment policy, procurement, and distribution of diagnostic and artesunate commodities alongside trainings for health workers on inpatient malaria case management were implemented and job aids developed and disseminated nationwide.

Relaxation of interventions supporting treatment policy pose challenges to adherence to severe malaria case management guidelines. Previous studies have shown health workers' adherence to the malaria test and treatment policies are sub-optimal (5, 6-7). This assessment provides current evidence on suspected patients correctly diagnosed for severe malaria, adherence to malaria case management guidelines, health facility and health workers' readiness to implement the policy among the suspected severe malaria patients admitted in the public health facilities in Kenya.

MATERIALS AND METHODS

General study design and population: This was a cross-sectional, cluster sample health facility assessment in Kenya, 2023 comprising of 91 health facilities measuring severe malaria for all population. Four health workers (2 clinicians and 2 nurses) on duty in the paediatric and medical wards at facilities with inpatient capacities were interviewed. To assess for inpatient malaria case management, retrospective reviews of admission files were undertaken. The primary analysis of readiness and malaria case management indicators were undertaken at hospital, health worker and patient level.

Sample size determination: To detect 15%-point difference around conservative estimates of 50% performance with the level of confidence of 5%, power of 80%, design effect of 1.8, the sample of 680 suspected malaria admissions per ward (paediatric and adults) or 1,360 patient files in total was estimated. To obtain estimated sample size from 47 County hospitals 15 patient files with suspected malaria admissions was extracted from each ward (680/47) or 30 files in total per hospital. For the restricted analysis on various patients' subsets such as those with confirmed severe malaria, an estimate of 200 cases per ward was sufficient to detect 15-20% changes around the

same conservative performance levels and the same power assumptions.

Sampling Procedure for severe malaria: The Government of Kenya (GoK) county referral hospitals and the Faith Based Organizations (FBOs) equivalent to referral hospitals health facilities was selected purposively. As sampling for proportionality is not the main concern in health facility selection, purposive sampling was allowed for quick access to the targeted population. Two health workers were selected randomly and interviewed from paediatric and medical wards.

Data collection procedures: Data at hospitals was collected using three methods: 1) retrospective review of patient files from hospital medical records office; 2) interviews with paediatric and medical ward health workers and 3) hospital assessments.

Data management and statistical analysis: Data was collected using electronic Open Data Kit (ODK) app. Data management and cleaning was undertaken on completion of the fieldwork. The analysis was performed in STATA, version 14 (StataCorp, USA). The analysis of indicators was undertaken at health facility, health worker and patient levels. Descriptive statistics formed the basis of analysis through frequencies, medians, and inter-quartile ranges for non-normally distributed data. Indicators of severe malaria case management were summarized as percentages stratified by facility ownership, endemicity and ward.

Study variables: The quality of malaria case-management for patients admitted with suspected malaria was measured using composite case-management indicator which included performance of all of the following tasks: 1) testing of suspected malaria patients, and 2) prescribing of recommended treatment based on the severity criteria and malaria test results defined as a) injectable artesunate for severe test positive patients (confirmed severe malaria), b) AL for non-severe test positive patients, c) no antimalarial treatment for severe test negative patients (or treatment with artesunate with repeated malaria test followed by treatment discontinuation for negative results), and d) no antimalarial treatment for non-severe test negative patients.

Ethical approval: This study was approved by Kenyatta National Hospital/University of Nairobi-Ethics Committee (KNH/UON/ERC/P233/04/2018). Written informed consent was obtained from all health workers interviewed in the study.

RESULTS

Characteristics of inpatient study populations
Assessing malaria case management for the inpatient, 49 Government of Kenya (GoK) and 42 faith-based hospitals (FBO) were assessed, 318 inpatient health workers from paediatric and medical wards were interviewed. In total, 2073 patients' files admitted with suspected malaria were examined: 1064 from paediatric and 1009 from medical ward. The median age of paediatric and medical ward patients was 3 and 30 years respectively. The average length of admission was 4 days.

Figure 1 show that male patients represented 55% of admissions and similar proportion of paediatric and medical ward patients (30.0% vs 31%) were admitted in high malaria risk areas.
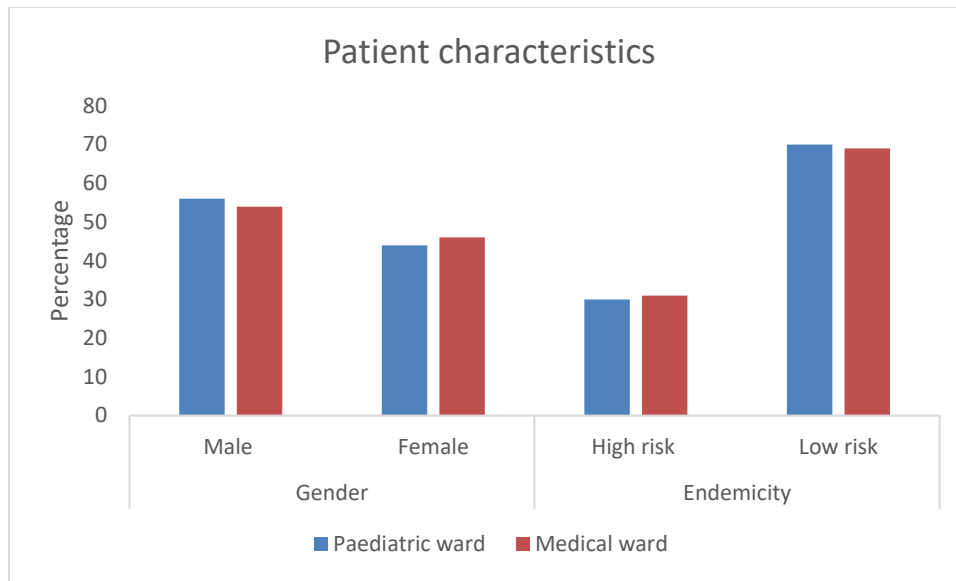
Figure 1: Basic characteristics of patients' admissions

Figure 2 shows the main characteristics of interviewed health workers stratified by hospital ownership. Females represented 59% of all participating health workers and were more represented within FBO than GoK, and medical wards than paediatric ward. Of 318 interviewed health workers' 62% were nurses while 38% were clinicians. The median health workers age was 27 years and median of 4 years of experience in managing inpatients.
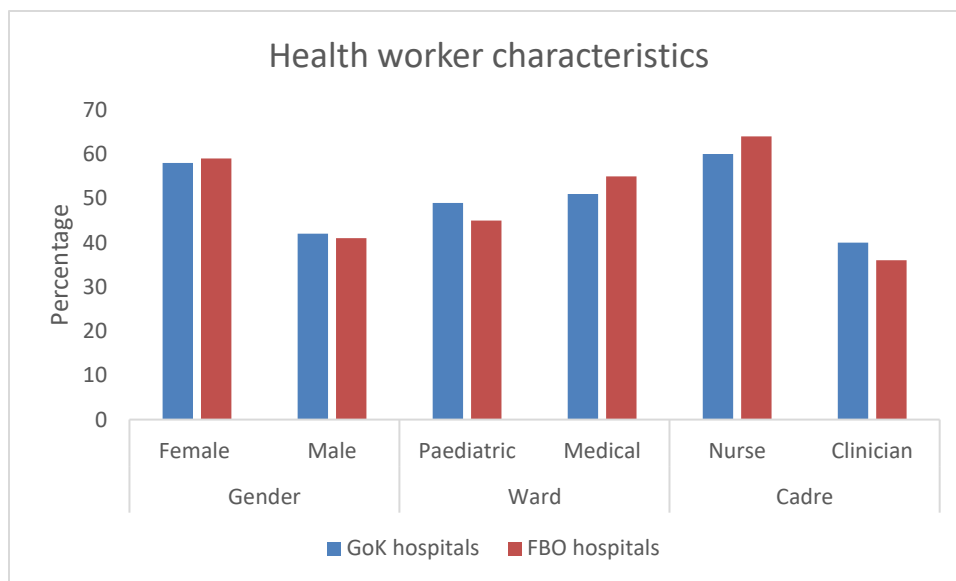
Figure 2: Health workers' characteristics

Assessing for severe malaria diagnosis
Severe malaria diagnosis was assessed based on the documented clinical and laboratory features, health workers' malaria diagnosis and vital signs taken on admission. Table 1 shows documented features of severe malaria stratified by hospital ownership and admission ward. Among all patients, 42.6% had documented at least one feature of malaria severity on admission, more commonly children (46.7%) than adults (38.4%). Table 2 shows the health workers most made

unclassified diagnoses of "malaria" (43.0%), but they also diagnosed 36.8% of patients as severe, complicated, or cerebral malaria.

Table 1

Documented clinical and laboratory features of severe malaria

	GoK Hospitals		FBO Hospitals		All hospitals		
	Paediatric ward (N=554)	Medical ward (N=479)	Paediatric ward (N=510)	Medical ward (N=530)	Paediatric ward (N=1064)	Medical ward (N=1009)	All patients (N=2073)
	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)
Altered	106	139	41 (8.0)	62	147	201 (19.9)	348
Prostration[b]	133	52 (10.9)	67 (13.1)	22 (4.2)	200	74 (7.3)	274
Convulsions (2 or	79 (14.3)	25 (5.2)	18 (3.5)	11 (2.1)	97 (9.1)	36 (3.6)	133 (6.4)
Severe anaemia[c]	27 (4.9)	10 (2.1)	8 (1.6)	2 (0.4)	35 (3.3)	12 (1.2)	47 (2.3)
Jaundice	63 (11.4)	70 (14.6)	25 (4.9)	24 (4.5)	88 (8.3)	94 (9.3)	182 (8.8)
Respiratory	57 (10.3)	25 (5.2)	26 (5.1)	23 (4.3)	83 (7.8)	48 (4.8)	131 (6.3)
Shock[e]	32 (5.8)	15 (3.1)	2 (0.4)	10 (1.9)	34 (3.2)	25 (2.5)	59 (2.9)
Abnormal bleeding	14 (2.5)	11 (2.3)	3 (0.6)	7 (1.3)	17 (1.6)	18 (1.8)	35 (1.7)
Haemoglobinuria[f]	24 (4.3)	17 (3.6)	7 (1.4)	11 (2.1)	31 (2.9)	28 (2.8)	59 (2.9)
Oliguria/anuria	8 (1.4)	8 (1.7)	2 (0.4)	3 (0.6)	10 (0.9)	11 (1.1)	21 (1.0)
Hypoglycaemia[g]	3 (0.5)	2 (0.4)	1 (0.2)	0	4 (0.4)	2 (0.2)	6 (0.3)
Pulmonary oedema	13 (2.4)	18 (3.8)	3 (0.6)	2 (0.4)	16 (1.5)	20 (2.0)	36 (1.7)
Any clinical/lab	335	256	162	131	497	387 (38.4)	884

GoK-Government of Kenya; FBO-Faith Based Organization.

[a] *"Drowsiness, lethargy, confusion, unconsciousness, coma", "Alert, Voice, Pain, Unresponsive (AVPU)<A" or "Glasgow Coma Scale (GCS) <15";* [b] *"Unable to drink/breastfeed/sit/stand/walk" or "prostrated";* [c] *" Hemoglobin (Hb) <5g/dl" or " Hematocrit (HCT)<15%";* [d] *"Acidotic/deep breathing", "chest in-drawing" or "respiratory distress";* [e] *"Capillary refill >=3sec", "systolic BP<80mmHg in adults or <50mmHg in children" or "shock";* [f] *"Dark urine" or "blood in urine";* [g] *"Blood sugar <2.2mmol/l"*

Table 2

Health workers' malaria admission diagnoses

	GoK hospitals		FBO hospitals		All hospitals		
	Paediatric ward (N=554)	Medical ward (N=479)	Paediatric ward (N=510)	Medical ward (N=530)	Paediatric ward (N=1064)	Medical ward (N=1009)	All patients (N=2073)
	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)
"Malaria" (unclassified)	189	178	253	272	442	450	892
Any severe malaria	285	264	112	102	397	366	763
Severe malaria	273	232	89 (16.8)	106	379	321	700
Cerebral malaria	12 (2.2)	31 (6.5)	1 (0.2)	3 (0.6)	13 (1.2)	34 (3.4)	47 (2.3)
Complicated malaria	11 (2.0)	11 (2.3)	8 (1.6)	12 (2.3)	19 (1.8)	23 (2.3)	42 (2.0)
Uncomplicated/non-	17 (3.1)	4 (0.8)	13 (2.6)	6 (1.1)	30 (2.8)	10 (1.0)	40 (1.9)

GoK-Government of Kenya; FBO-Faith Based Organization.

Performance of basic measurements and vital signs assessed on admission revealed that nearly all patients had age determined, weight was more commonly taken for children (74.3%) than for adults (30.4%). Among all patients, the most common vital sign measured on admission was temperature (77.2%) and the least common was respiratory rate (39.2%) (Table 3).

Table 3

Performance of basic measurements and vital signs on admission

	GoK hospitals		FBO hospitals		All hospitals		
	Paediatric ward (N=554)	Medical ward (N=479)	Paediatric ward (N=510)	Medical ward (N=530)	Paediatric ward (N=1064)	Medical ward (N=1009)	All patients (N=2073
	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)
Age	551	471	509	522	1060	993	2053
Weight	418	101	373	206	791	307	1098
Temperature	461	254	468	418	929	672	1601
Respiratory	270	128	215	200	485	328	813
Blood pressure	41 (7.4)	381	55 (10.8)	475	96 (9.0)	856	952
Pulse rate	345	365	264	451	609	816	1425
Oxygen	357	207	185	161	542	368	910

GoK-Government of Kenya; FBO-Faith Based Organization.

Adherence to inpatient malaria case-management guidelines

Adherence to inpatient malaria case-management guidelines was 54.6%. Stratified analysis of individual components by the use, results of malaria tests and severity criteria revealed details of malaria case-management practices. Majority of the malaria suspected patients with suspected severe malaria were tested for malaria on admission (82.7%). Of those tested 43.9% had a positive test result, those with severe malaria criteria, nearly all (94.0%) were treated with recommended injectable artesunate while, those without severe malaria criteria (neither clinically documented nor diagnosed as severe malaria by clinicians), only 4.1% were treated with artemether-lumefantrine. Most of these patients were treated with injectable artesunate (87.7%). Patients who tested negative with severe malaria criteria, 53.5% were not given antimalarial and 42.0% were treated with injectable artesunate. While those who tested negative patients without severe malaria criteria (neither clinically documented nor diagnosed as severe malaria by clinicians), 77.2% were not treated for malaria and 17.4% had artesunate prescribed. Patients who were not tested for malaria, and therefore not managed in accordance with guidelines, 55.6% were not treated for malaria and 38.6% were prescribed for artesunate (Figure 2). Refer to Appendix Table 1 for more details.
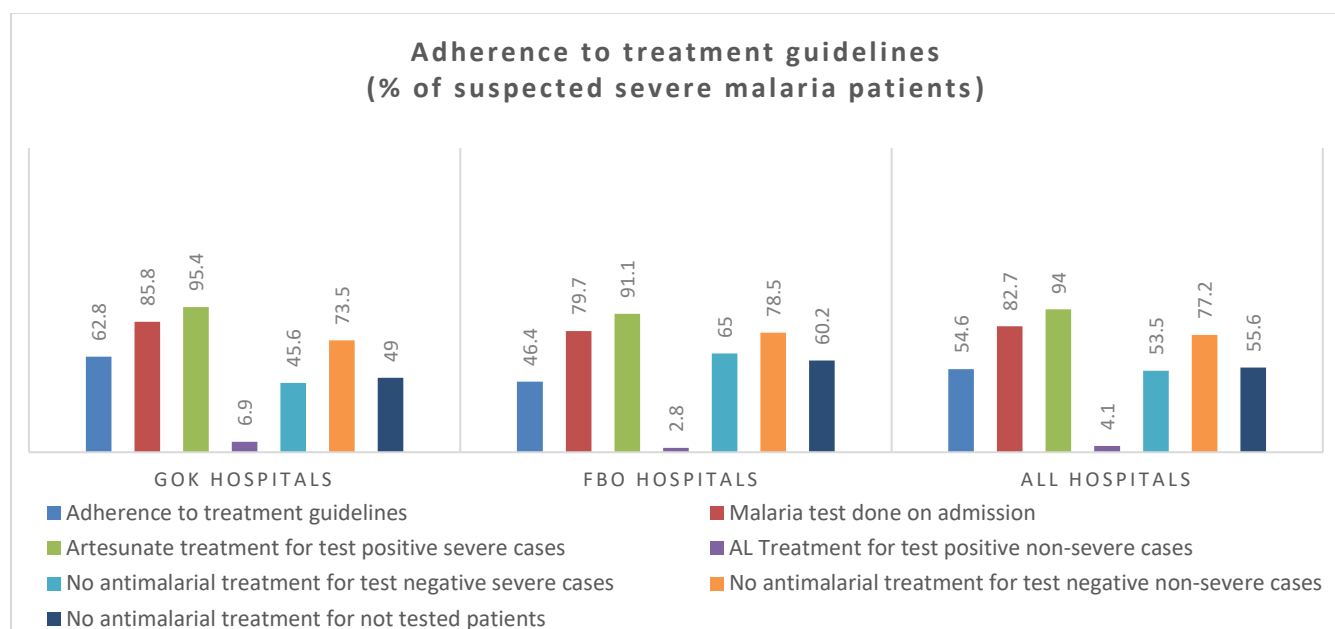
Figure 3: Adherence to severe malaria treatment guidelines

Health facility readiness to implement inpatient malaria case management

Table 4 show the health facility readiness based on availability of malaria diagnostics, antimalarial medicines, and administration job aids. Malaria microscopy was provided in 96.7% of all hospitals, 30.8% stocked malaria Rapid Diagnostic Tests (RDTs), 82.4% of hospitals stocked injectable. Artesunate stock-outs 3 months prior to the assessment were similarly reported at GoK and FBO hospitals (18.4% vs 21.4%) with overall stock-out levels of 19.8%. Injectable quinine was in stock at 22.0% of hospitals, artemether injections at 20.9% while 84.6% of hospitals had at least one injectable antimalarial. Fourteen hospitals had no antimalarial injections on assessment days. Artemether-lumefantrine, the first line treatment for uncomplicated malaria and follow on treatment for severe malaria, was available at 93.4% of hospitals, 41.8% of hospitals had at least one ward with displayed artesunate administration, and artesunate dosing wheels at 18.7%.

Table 4
Availability of malaria diagnostics services, antimalarials and job aids

	GoK hospitals N = 49	FBO hospitals N = 42	All hospitals N = 91
	n (%)	n (%)	n (%)
Malaria diagnostic services			
Malaria microscopy	49(100%)	39 (92.9)	88 (96.7)
Malaria RDTs in stock	7 (14.3)	21 (50.0)	28 (30.8)
Injectable antimalarials			
Artesunate in stock	38 (77.6)	37 (88.1)	75 (82.4)
Quinine in stock	6 (12.2)	14 (33.3)	20 (22.0)
Artemether in stock	5 (10.2)	14 (33.3)	19 (20.9)
Any injectable antimalarial in stock	39 (79.6)	38 (90.5)	77 (84.6)
Artesunate stock-out in past 3 months	9 (18.4)	9 (21.4)	18 (19.8)

Oral antimalarials			
Artemether-lumefantrine in stock	47 (95.9)	38 (90.5)	85 (93.4)
Quinine in stock	2 (4.1)	0	2 (2.2)
Sulphadoxine-pyrimethamine in stock	5 (10.2)	14 (33.3)	19 (20.9)
DHA-PPQ in stock	4 (8.2)	11 (26.2)	15 (16.5)
Hydroxychloroquin	0	1 (2.4)	1 (1.1)
Administration job aids			
Artesunate poster displayed	16 (32.7)	22 (52.4)	38 (41.8)
Artesunate wheel	7 (14.3)	10 (23.8)	17 (18.7)

GoK-Government of Kenya; FBO-Faith Based Organization; RDTs-Rapid Diagnostic Tests; DHA-PPQ- Dihydroartemisinin–piperaquine

Health worker readiness to implement inpatient malaria management

Table 5 show the inpatient health workers' coverage with in-service training, case-management guidelines of relevance, and supportive supervision focusing on severe malaria management and artesunate use. Of 318 interviewed health workers, 36.5% were trained on artesunate use, more commonly through the 3-day DNMP malaria case-management training (22.6%) and Continuing Medical Education (CME) sessions that focused on artesunate use (21.1%). Similarly, the coverage of artesunate trained health workers was 36.9% and 35.9% among the Gok and FBO respectively. Only 5% of the health workers have been trained on malaria surveillance. With respect to the guidelines, 72.3% of health workers had basic Paediatric Protocols while 45.3% had access to national malaria case-management guidelines. Regarding the support supervision, 28.3% of health workers received supervisory visit 3 months preceding the assessment and only 11% reported a supervisory visit that included topics on malaria case management and artesunate use.

Table 5

Health workers' coverage with in-service training, guidelines, and supervision

	GoK hospitals N = 176	FBO hospitals N = 142	All hospitals N = 318
	n (%)	n (%)	n (%)
Training exposure			
3-day malaria case management training			
Ever trained	46 (26.1)	26 (18.3)	72 (22.6)
Trained on artesunate use	43 (24.4)	29 (20.4)	72 (22.6)
1-day artesunate training	33 (18.8)	34 (23.8)	67 (21.1)
Any training on artesunate use	65 (36.9)	51 (35.9)	116 (36.5)
Malaria surveillance training	11 (6.3)	5 (3.5)	16 (5.0)
Guidelines exposure			
Malaria case-management guideline	76 (43.2)	68 (47.9)	144 (45.3)
Basic paediatric protocols	134 (76.1)	96 (67.6)	230 (72.3)
Supportive supervision			
Any supervisory visit in past 3 months	41 (23.3)	49 (34.5)	90 (28.3)
Supervision including malaria case management	15 (8.5)	21 (14.8)	36 (11.3)

Supervision including artesunate use	14 (8.0)	20 (14.1)	34 (10.7)

GoK-Government of Kenya; FBO-Faith Based Organization.

DISCUSSION

This study identified patients correctly diagnosed with severe malaria, assessed adherence to case management guidelines, health facility and health worker readiness to implement the treatment policy. These findings pointed strengths and challenges to improve the quality of malaria case-management. About half of the patients had documented at least one feature of malaria severity and a third were diagnosed as severe. Half of the severe malaria patients received appropriate treatment as per treatment guidelines. Nearly all hospital provided malaria microscopy and in every ten facilities eight stocked artesunate. Health worker readiness indicators were sub optimal.

The severe malaria features among admitted patients were described in line with national malaria guidelines as presence of any of the following clinical and laboratory criteria (3,8). To protect correctness of health workers treatment practices from documentation biases, the severity criteria were complemented with health workers diagnosis or suspicion of severe malaria made on admission (9-10). Case management of severe malaria requires prompt recognition of clinical manifestations of severe malaria, initiation of appropriate treatment, monitoring of disease progression, and management of co-morbidities (3, 8).

Performance of basic measurements and vital signs monitor the severity of the patient condition, and aid in prescribing injectable artesunate (8). The performance of temperature, respiratory rate and oxygen saturation were more commonly measured for children than adults while conversely blood pressure and pulse rate were more commonly measured in adults.

High level of policy performance and health worker adherence to test and treat guidelines for malaria was observed in inpatient malaria case-management. Most of the suspected malaria patients are tested and nearly all of patients with confirmed severe malaria are treated with artesunate. More negatively, there is a significant overuse of antimalarials for patients with negative test and in particular overuse of injectable artesunate for non-severe test positive patients. Similar studies done elsewhere have shown challenges around health worker capacity to test and personal attitudes towards testing that lead to presumptive treatment (11-13).

Adherence to severe malaria management is dependent on health facility readiness in terms of diagnostics, antimalarial and administrative job aids (14-15). Availability of parasitological malaria diagnosis based on microscopy continues to be universal in Kenya. Microscopy is the 'Gold standard' in diagnosis of severe malaria in hospitals (16). Based on confirmed test result the recommended treatment is injectable artesunate (8). This assessment found improved availability of artesunate in both sectors and noted an increase of artesunate stock-outs in both sectors. On a positive side the availability of any injectable antimalarial facilitate improved care and treatment in case of the artesunate stock outs and artemether lumefantrine was high in the facilities. The severe malaria treatment guidelines recommend patients be discharged on ACT to clear parasites (3,8).

The administration job aids provide step by step guide on preparation and administration of injectable artesunate (17). This report observed a reverse trend in the availability of artesunate job-aids that may need the program to print and disseminate those materials to all health facilities.

The health worker readiness in terms of severe malaria training and guideline exposure is a prerequisite in successfully managing the patients. Studies have shown that health workers adhere to the treatment guidelines based on the knowledge (18). This assessment found health worker in-service training sub optimal and majority of them had not been supervised and mentored on malaria case management.

CONCLUSION

Majority of suspected malaria patients were tested and nearly all of patients with confirmed severe malaria were treated with artesunate. The availability of parasitological malaria diagnosis based on microscopy continues to be universal in Kenya. More negatively, there is a significant overuse of injectable artesunate for non-severe patients who tested positive. To rationalize use of antimalarials broader aspects of the quality of inpatient malaria case-management need to be addressed. In addition, reassess the supply chain management to establish reasons for artesunate stockouts and its overuse/misuse.

Facility-based malaria supportive supervision and targeted in-service case-management training accompanied with dissemination of guidelines and job aids for health workers should be programmatic priority for malaria program.

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APPENDIX TABLES

Appendix Table 1: Inpatient malaria test and treat case-management practices, by malaria risk area

	GoK hospitals		FBO hospitals		All hospitals	
	High risk	Low risk	High risk	Low risk	High risk	Low risk
	N=345	N=688	N=290	N=750	N=635	N=1438
	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)
Composite performance	236 (68.4)	413 (60.0)	142 (49.0)	341 (45.5)	378 (59.5)	754 (52.4)
Malaria test done on admission	321 (93.0)	565 (82.1)	275 (94.8)	554 (73.9)	596 (93.9)	1119 (77.8)
Malaria test repeated	80 (23.2)	32 (4.7)	41 (14.1)	31 (4.1)	121 (19.1)	63 (4.4)
Treatment for test positive severe cases	N=206	N=312	N=101	N=134	N=307	N=446
Artesunate parenteral	196 (95.2)	298 (95.5)	92 (91.1)	122 (91.0)	288 (93.8)	420 (94.2)
Quinine parenteral	0	0	4 (4.0)	2 (1.5)	4 (1.2)	2 (0.5)
Artesunate and quinine parenteral	3 (1.5)	4 (1.3)	5 (5.0)	1 (0.8)	8 (2.6)	5 (1.1)
Artemether-lumefantrine	5 (2.4)	7 (2.2)	0	4 (3.0)	5 (1.6)	11 (2.5)
Other antimalarial treatments	0	0	0	1 (0.8)	0	1 (0.2)
No antimalarial treatment	2 (1.0)	3 (1.0)	0	4 (3.0)	2 (0.7)	7 (1.6)
Treatment for test positive non-severe	N=34	N=82	N=92	N=157	N=126	N=239
Artemether-lumefantrine	2 (5.9)	6 (7.3)	3 (3.3)	4 (2.6)	5 (4.0)	10 (4.2)
Artesunate parenteral	31 (91.2)	73 (89.0)	81 (88.0)	135 (86.0)	112 (88.9)	208 (87.0)
Quinine parenteral	0	0	6 (6.5)	7 (4.5)	6 (4.8))	7 (2.9)
Artesunate and quinine parenteral	0	0	2 (2.2)	1 (0.6)	2 (1.6)	1 (0.4)
Other antimalarial treatments	0	0	0	2 (1.3)	0	2 (0.8)
No antimalarial treatment	1 (2.9)	3 (3.7)	0	8 (5.1)	1 (0.8)	11 (4.6)
Treatment for test negative severe cases	N=70	N=99	N=29	N=88	N=99	N=187
No antimalarial treatment	24 (34.3)	53 (53.5)	13 (44.8)	63 (71.6)	37 (37.4)	116 (62.0)
Artesunate parenteral	42 (60.0)	43 (43.4)	14 (48.3)	21 (23.9)	56 (56.6)	64 (34.2)
Quinine parenteral	0	0	1 (3.5)	1 (1.1)	1 (1.0)	1 (0.5)
Artesunate and quinine parenteral	1 (1.4)	0	0	0	1 (1.0)	0
Artemether-lumefantrine	3 (4.3)	2 (2.0)	1 (3.5)	2 (2.3)	4 (4.0)	4 (2.1)
Other antimalarial treatments	0	1 (1.0)	0	1 (1.1)	0	2 (1.1)
Treatment for test negative non-severe	N=11	N=72	N=53	N=175	N=64	N=247
No antimalarial treatment	9 (81.8)	52 (72.2)	29 (54.7)	150 (85.7)	38 (59.4)	202 (81.8)
Artesunate parenteral	2 (18.2)	17 (23.6)	18 (34.0)	17 (9.7)	20 (31.3)	34 (13.8)
Quinine parenteral	0	0	2 (3.8)	1 (0.6)	2 (3.1)	1 (0.4)
Artesunate and quinine parenteral	0	1 (1.4)	0	0	0	1 (0.4)
Artemether-lumefantrine	0	2 (2.8)	4 (7.6)	3 (1.7)	4 (6.3)	5 (2.0)
Other antimalarial treatments	0	0	0	4 (2.3)	0	4 (1.6)