Factors Influencing the Quality of Managing Severe Malaria among Children under Five Years at Selected County Hospitals in Kisumu, Kenya

Rose N. Maoga[1], Alex K. Chebor[2], Nyumbile N. Bonface[3]

[1]Department of Nursing Research, Education & Management, School of Nursing, Midwifery and Paramedical Sciences, Masinde Muliro University of Science and Technology, Kakamega, Kenya.
e-mail: bephine2010@gmail.com
[2]Department of Community Health, School of Nursing, Midwifery and Paramedical Sciences, Masinde Muliro University of Science and Technology, Kakamega, Kenya.
e-mail: achebor@mmust.ac.ke
[3]Department of Child Health and Pediatrics, Kakamega County Hospital, Kenya.
e-mail: bnyumbile8@gmail.com

Received September 13, 2024, accepted December 5, 2024, published January 1, 2025.

ABSTRACT

Context: Severe Malaria in children under the age of five is a major public health issue in Kisumu County, a malaria-endemic area in Kenya. Moreover, most severe Malaria cases in Kisumu West Subcounty are managed at Kombewa and Chulaimbo County hospitals. However, the influence of patient-related, caregiver-related, healthcare provider (HCP), and institutional-related factors on the management of severe Malaria in the area is not known.

Aim: The present study aimed to determine the factors influencing the quality of managing severe Malaria among children under five years at selected County hospitals in Kisumu, Kenya, namely Chulaimbo County Hospital and Kombewa County Hospital.

Methods: A mixed-methods prospective cross-sectional study was conducted between April and July 2023. Qualitative data was collected from eight key informants (hospital administrators and ward in charge), while quantitative data was collected from 344 caregivers of children under five years of age who were managed for severe Malaria and 78 healthcare providers (nurses, clinical officers, and doctors) using survey questionnaires. An observational checklist was also used to collect quantitative data. Thematic analysis was used to analyze qualitative data, while descriptive statistics and logistic regression were used to analyze quantitative data. $p<0.05$ was considered significant.

Results: The themes identified included the burden of severe Malaria and the perceptions on the quality of management of severe Malaria, challenges experienced by healthcare workers in the management of severe Malaria, adherence, and needs for improvement in severe malaria management. Only 13/344 (9.0%) of the patients at Chulaimbo County Hospital purchased antimalarials, while only 04/344 (1.2%) of the patients at Kombewa County Hospital purchased antimalarials during the study period. Appropriate malaria testing equipment and antimalarial treatment were observed by 117/344 (34.0%) and 147/344 (42.7%) of the caregivers who visited the hospitals in the study area. Children under five years of age were 40% less likely to receive optimal malaria treatment than females of the same age (OR = 0.6; 95% CI = 0.4-0.9; p=0.017). Children whose caregivers were younger (≤25 years) were 3.5 times more likely to receive optimal malaria treatment than those whose caregivers were older (>25 years) (OR = 3.5; 95% CI = 1.7-7.3; p=0.0005). Children whose caregivers had a primary level of education were more likely to receive optimal malaria treatment than those whose caregivers had higher levels of education (OR = 5.8; 95% CI = 2.6-12.7; p<0.0001). Children who received clinical care from HCPs with Integrated Management of Childhood Illness (IMCI) training were 60% more likely to receive optimal malaria treatment compared to children who received clinical care from HCPs without IMCI training (OR = 0.4; 95% CI = 0.3-0.7; p=0.0005).

Conclusion: These findings suggest that the optimal management of severe Malaria in children under the age of five in the study area is influenced by the gender of the patient, characteristics of the caregivers, on-job training of healthcare providers, and the availability of antimalarial medication. Moreover, these findings suggest that while healthcare providers are knowledgeable and committed to quality malaria management, systemic challenges such as resource limitations, caregiver education gaps, and treatment non-adherence impact their ability to deliver optimal care. Addressing these issues through resource allocation, continuous provider training, and community health education could strengthen severe malaria management in Kisumu County.

Keywords: Children under five, Kisumu County, severe Malaria

Citation: *Maoga, R. N., Chebor K. Alex. & Bonface, N. N. (2025).* Factors influencing the quality of managing severe Malaria among children under five years at selected county hospitals in Kisumu, Kenya. *Evidence-Based Nursing Research*, *7*(1), 41-51. https://doi.org/10.47104/ebnrojs3.v7i1.371

1. Introduction

Malaria is a disease caused by Plasmodium species transmitted by infected female anopheles mosquitoes *(Dufera et al., 2020).* There are six types of plasmodium parasites: Plasmodium falciparum, Plasmodium malaria, Plasmodium ovale curtisi, Plasmodium ovale Wallikeri, Plasmodium vivax, and Plasmodium knowlesi *(Uzun Ozsahin et al., 2022).* Most cases of Malaria are attributed to P. falciparum (75%) and P. vivax (20%) *(Maqsood et al., 2021).*

[1]*Correspondance author: Rose Nyangweso Maoga*

Malaria cases are reported by 87 countries globally, although Africa bears the heaviest burden of infections and deaths. Data from 2019 suggests that there were 229 million malaria cases and 409,000 deaths that year, a staggering 94% of which came from sub-Saharan Africa *(Al-Awadhi et al., 2021).*

The WHO estimates that most malaria cases do not develop into severe Malaria, which only occurs in 1% of all global malaria cases *(Murray et al., 2012).* Severe Malaria was first described at a World Health Organization (WHO) meeting in 1985 and is characterized by generalized weakness, which may lead to prostration, acute kidney injury, circulatory collapse, hemorrhage, pulmonary edema, convulsions, and clinical jaundice *(Garrido-Cardenas et al., 2023; White, 2022).*

Severe malaria-induced mortality may be associated with treatment-related, patient-related, or course of infection-related factors *(Garrido-Cardenas et al., 2023).* Among the many malaria deaths each year, about two-thirds are children under five years of age *(Garrido-Cardenas et al., 2023).* Moreover, children hospitalized with anemia resulting from an episode of severe Malaria have a high mortality rate in the months following admission *(Hendriksen et al., 2012).* Children who survive may experience neurological deficits that lead to seizures, stroke, and mental and behavioral problems *(Esu et al., 2019; Yadava et al., 2019).*

The implementation of free malaria treatment in Kenya has been ongoing since 2006. However, a 12-year study reported that despite the antimalarial campaigns, out-of-policy treatments were ongoing, parasite prevalence remained largely unchanged, and gaps in malaria treatment were rampant. Education levels, wealth index, household size, and distance to hospitals significantly affected treatment-seeking behavior in malaria-endemic areas of the country *(Zhou et al., 2020).*

The primary strategy for managing Malaria involves timely and accurate diagnosis followed by effective treatment *(Otambo et al., 2022).* The WHO recommends that all patients suspected of Malaria should have blood stage infection confirmed by microscopic inspection of blood smears or a malaria-specific Rapid Diagnostic Test (RDT) before antimalarial drug treatment *(Otambo et al., 2022).*

Presumptive diagnosis based on clinical features and history in the absence of laboratory-confirmed blood-stage infection should be adopted only when expert microscopic inspection of blood smears or RDTs is unavailable *(Otambo et al., 2022).* Artemisinin-based Combination Therapy (ACT), e.g., Artemether-Lumefantrine (AL), is recommended for treating non-life-threatening uncomplicated falciparum malaria. In contrast, parenteral Artesunate is recommended for severe Malaria *(Otambo et al., 2022).*

2. Significance of the study

The prevalence of Malaria in Kisumu County is 18%, the highest in Kenya. Moreover, the disease accounts for 30% of hospital admissions among children ≤5 years of age *(Odhiambo et al., 2023).* Considerable effort has gone into promoting active case management in the region through training by the Division of the National Malaria Programme *(Odhiambo et al., 2023).* David and others conducted a cross-sectional study of the determinants of malaria prevalence among children below five years at Chulaimbo County Hospital between July 2019 and January 2020. They reported that 49.6% of the participants tested positive for Malaria, child age was significantly associated with Malaria (p=0.04), females had lower odds of contracting Malaria than males, and children in households whose mothers/fathers had university education had lower odds of contracting the disease *(David et al., 2021).*

Moreover, children who used bed nets were less likely to test positive for Malaria *(David et al., 2021).* Kombewa sub-county has been identified as a hyper-endemic malaria zone *(Kapesa et al., 2018).* The prevalence of asymptomatic parasitemia among school-going children in Kombewa has been reported to be 50% *(Zhou et al., 2011).* Even though Kombewa and Chulaimbo have a clear malaria burden, the role of patient, caregiver, healthcare provider, and institutional-related factors in the optimal management of severe Malaria is not known.

The aim of the present study was to determine the factors influencing the quality of managing severe Malaria among children under five years old at selected County hospitals in Kisumu, Kenya, namely Kisumu County Hospital and Kombewa County Hospital. Through this study, the factors that influence the management of severe Malaria in the study area will be identified and used to provide suitable interventions to improve how severe Malaria is managed among children under five.

3. Aim of the study

The present study aimed to determine the factors influencing the quality of managing severe Malaria among children under five years at selected County hospitals in Kisumu, Kenya, namely Kisumu County Hospital and Kombewa County Hospital.

3.1. Operational definition

Operationally, 'case management' in this study refers to the standardized process of diagnosing, treating, monitoring, and providing follow-up care for children under five years of age diagnosed with severe Malaria. This definition includes initial assessment, laboratory confirmation of Malaria, administration of appropriate antimalarial medications (such as artemisinin-based combination therapy or parenteral Artesunate for severe cases), and supportive care as required to prevent complications and improve health outcomes following WHO and national malaria treatment guidelines.

4. Subjects & Methods

4.1. Research Design

This descriptive cross-sectional survey was conducted between April and August 2023 at Kombewa and Chulaimbo County hospitals in Kisumu County. This period has historically been documented to be responsible for the highest malaria transmission rates in the county *(Othieno et al., 2015).* A mixed methods approach was adopted where qualitative data was collected from key informant interviews of hospital administrators (n=2), medical superintendents

(n=2), and staff from the malaria control units at the two hospitals (n=4). Quantitative data was collected from caregivers of children under five diagnosed with severe Malaria, nurses, clinical officers, and doctors at Kombewa and Chulaimbo County hospitals.

4.2. Study setting

The study was conducted at selected County hospitals in Kisumu, Kenya, namely Kombewa County Hospital and Chulaimbo County Hospital. Kombewa County Hospital is located within the same area, opposite the KEMRI- Walter Reed Project. Total bed capacity of 80 with a pediatric capacity of 20 beds. It was established in the year 1900 as an army barracks. Services provided include medical and maternity surgical areas. Chulaimbo County Hospital is located within the Maseno area along Kisumu-Busia Road. Chulaimbo has a bed capacity of 30.

4.3. Subjects

Sample I: Cases of Paediatric Patients

The study sample includes a purposive sample of children below 5 years admitted with severe Malaria.

Inclusion criteria

They were admitted with severe Malaria as per case definitions of severe Malaria:

- Positive malaria test on RDT or malaria blood film.
- More than 2 convulsions.
- Prostration.
- Impaired consciousness or unarousable coma.
- Severe pallor or low hemoglobin count of less than 5g/dl.
- Hypoglycaemia (Glucose <2.2 mmol/L)

Exclusion criteria

Patients admitted with a non-severe form of Malaria or any other illness.

Sample size children with severe Malaria

According to the Kenya Malaria Indicator Survey (KMIS) *(2021)*, the prevalence of Malaria in the study area was 19%. Kombewa and Chulaimbo hospitals reported 1000 cases and 800 cases of Malaria, respectively, over one year. This number was therefore used to calculate the sample size of children diagnosed with severe Malaria by applying the Cochran formula for sample size determination as below:

$$n = \frac{n_o}{1 + \frac{(n_o - 1)}{N}}$$

n = no/1+no/N
n = 384/1+384/1800
n = 317

Table 1 shows the proportionate stratified sampling applied to select the cases of severe Malaria for review in the study area per facility. 10% of 317 was added for records with incomplete information. The final sample of records to be reviewed was 344

Table (1): Proportionate stratified sampling to select cases of severe Malaria for review per facility

Facility	The proportion of malaria cases based on 1800 cases	Sample size per facility
Kombewa County Hospital	1000 (55.5%)	0.56×344= 195
Chulaimbo County Hospital	800 (44.4%)	0.44 × 349 =154
Total	1800	349 Cases of severe Malaria

Sample II: Health Care Providers

The total staff at the Kombewa County Hospital at the time of this study was 53, comprising 39 nurses, nine clinical officers, and five medical officers. Chulaimbo County Hospital has 28 nurses, 15 clinical officers, and one medical officer. Stratified proportionate sampling was used to identify the number of nurses, clinical officers, and doctors who were to be recruited into the study as below:

Inclusion criteria

The health care providers (nurses, clinical officers, and medical officers) have worked for more than 6 months in the study area in outpatient and pediatric in-patient units at Kombewa and Chulaimbo County hospitals.

Exclusion criteria

Healthcare providers have worked at the two hospitals for less than 6 months.

Sample size calculation

Healthcare providers (doctors, nurses, clinical officers) from Kombewa and Chulaimbo County hospitals were sampled using the Yamane formula

$$n = \frac{N}{1+N(e)^2}$$

Where:
n= The desired sample size,
N=The population under study, which in this case was 97 (nurses, clinical officers, and medical officers) from the two facilities.
e=The desired level of precision was arbitrarily taken to be 0.05. Thus, the desired sample size was:

$$n = \frac{97}{1+97(0.05)^2}$$ = 78 healthcare providers.

Table (2): Stratified proportionate sampling to identify the number of nurses, clinical officers, and doctors to be recruited into the study per facility.

	Overall Sample					Sample per facility	
Cadre	**Kombewa**	**Chulaimbo**	**Total**	**%**	**Sample**	**Kombewa**	**Chulaimbo**
Nurses	39	28	67	69%	0.69×78=54	0.58× 54=31	0.42× 54=23
Clinical Officers	9	15	24	25%	0.25×78=19	0.38× 19=17	0.62× 19=12
Medical Officers	5	1	6	6%	0.06×78=5	0.83× 5=4	0.17× 5=1
Total	**53**	**44**	**97**	**100%**	**78**	**43**	**35**

4.4. Tools of data collection

4.4.1. Semi-structured Key informant interview guide

The researcher developed the guide in English to assess perceptions, challenges, and factors influencing severe malaria management. It included eight open-ended questions relevant to the identification of severe malaria cases, burden and challenges, quality care and compliance, suggested improvements, and needs for malaria management. One tool was used once per informant at each hospital.

4.4.2. WHO Provider Assessment Survey Checklist

This document was adopted from WHO guidelines *(WHO, 2023)* whose main aim was to assess facility preparedness and resource availability (of RDT kits and lab capacity, stock of antimalarials and resources, IEC materials on malaria management) for severe malaria management. The tool had 15 questions in three divided sections. The procedure step by step was followed. The document has closed-ended questions that require a Yes/No response. The tool is a record used for resource verification.

4.4.3. Survey Questionnaire

The researcher developed this tool based on WHO guidelines *(WHO, 2023)* to measure demographics, perceptions, and practices among healthcare providers and caregivers. It comprised sociodemographic characteristics, knowledge, practices in malaria management, and institutional factors affecting severe malaria management. It is a five-point Likert scale questionnaire with multiple-choice questions. It scored from 1-5 (the higher the score indicated a better practice).

4.4.4. Observational Checklist

The researcher developed this tool based on WHO guidelines *(WHO, 2023)* for systematic observation to measure medication availability and diagnostic tool presence during patient care. It included observation of medications, diagnostic equipment, and testing practices in the form of yes and no responses for the ten items assessed.

4.5. Procedures

Ethical approval was obtained from the institutional ethics review committee of Masinde Muliro University of Science and Technology (MMUST IREC-027/2022). A research permit was obtained from the National Commission of Science, Technology, and Innovation (NACOSTI Ref No: 311812). Permission to collect data was obtained from the hospital administrators at Kombewa and Chulaimbo County hospitals, respectively. Informed consent was obtained from all study participants before the interview or data collection.

The research instruments, including the survey questionnaires and the key informant interview guide, were pretested at Ahero County Hospital, which has a similar catchment area and malaria profile to the study sites. Feedback from this pretesting allowed the researchers to refine questions, ensuring clarity, relevance, and alignment with study objectives. The validation confirmed that questions were suitable for capturing relevant information on patients, caregivers, healthcare providers, and institutional factors affecting severe malaria management.

Reliability of data collection tools: To ensure consistency, the reliability of quantitative instruments, specifically the survey questionnaires, was assessed. Internal consistency reliability was calculated using Cronbach's alpha for survey items, achieving a reliability coefficient of 0.73, which indicates acceptable reliability for the scales used.

The data collection for this study was conducted over five months, from April to August 2023. The process was designed to capture both qualitative and quantitative data, which would make it possible to understand the factors that influence severe malaria management in selected county hospitals in Kisumu, namely Kombewa County Hospital and Chulaimbo County Hospital. Quantitative data were collected from a total of 344 children under five years of age diagnosed with severe Malaria, along with their caregivers, as well as 78 healthcare providers (nurses, clinical officers, and doctors). Qualitative data were gathered through key informant interviews with eight individuals, including hospital administrators and ward in-charges.

Recruitment of research assistants: Trained research assistants were engaged to support data collection. They were recruited based on their familiarity with healthcare environments, particularly in malaria-endemic areas. All assistants underwent a two-day training workshop covering data collection protocols, patient interaction, interview techniques, and ethical considerations, including informed consent procedures.

Quality control measures: To ensure high data quality, research assistants adhered to a standardized data collection protocol under the supervision of the lead researcher. Data entry and management were performed systematically, with regular cross-checks to prevent errors. Any discrepancies were addressed promptly by re-evaluating the original responses or, if needed, consulting the participants again.

4.6. Data analysis

Qualitative information from key informant interviews was reviewed, and emerging themes were identified. These themes were then coded into categories based on the respondents' responses. Relational content analysis was used to explore how malaria management practices influence compliance with the case management of severe Malaria.

Quantitative data from the children, caregivers, HCPs, and institutions were analyzed via descriptive statistics (mean, frequency, and proportions) and inferential analysis (logistic regression). The significance level was 95% (p-value <0.05). All data was analysed on Statistical Package for the Social Sciences (SPSS) version 27.

5. Results

Key informant interviews

The themes that emerged from the key informant interviews included the identification and burden of severe malaria cases in the hospitals, the perceptions on the quality of management of severe Malaria, challenges experienced by healthcare workers in the management of severe Malaria, and adherence and needs for improvement in the management of severe Malaria as below:

Theme 1: Identifying cases of severe Malaria.

One key informant remarked that healthcare workers could easily identify a child presenting with severe Malaria. "Most children with severe malaria present with convulsions, pallor, and prostration." "We can easily tell from such symptoms that child has severe malaria."

On the question of the malaria burden, one of the informants indicated: “Malaria cases differ from month to month, but we see many cases of severe malaria from April to July each year."

Theme 2: Perceptions on quality of management of severe Malaria.

Key informant interviews generally demonstrated that healthcare providers understood the need for quality management of severe Malaria. "We strive to ensure that patients, especially children, receive timely care when they present themselves at the hospital, and at times, we initiate treatment when we suspect severe malaria."

From the interview it was clear that healthcare workers were conversant with guidelines on management of severe Malaria. "From the outset, we have to perform a rapid diagnostic test to confirm that the patient has malaria and administer the right initial treatment and subsequent doses." Healthcare providers indicated, "The treatment guidelines are very helpful in ensuring that patient receives quality treatment, and it is our joy when patients recover and are discharged within the shortest time possible."

One healthcare provider (clinical officer) indicated that speed and timing are key in ensuring survival: "We should not waste time when the patient presents with cardinal signs of severe Malaria. We should do a rapid malaria test and initiate treatment even as we await other laboratory tests."

Theme 3: Challenges experienced by healthcare providers in the management of severe Malaria.

The interview demonstrated many positive experiences of healthcare workers in managing severe Malaria. However, certain challenges may impact the quality of care for patients with severe Malaria. The interview exemplified this theme: "We see many parents coming to the hospital very late, many days after their child has been sick." "Parents buy time by giving children self-medication at home, and by that time, the child is very sick."

On poor compliance with treatment: ″Most mothers do not finish the malaria dose after discharge, and this makes us see many children being readmitted with malaria."

The high number of admissions with severe anemia puts a strain on healthcare services as blood might not be readily available: "At times, we experience many admissions of children with severe anemia. We have to carefully choose who is transfused and who is managed with hematinic, although we would prefer to have all children receive blood transfusion as they need."

On laboratory testing, healthcare providers expressed concern that, at times, there are no reagents to perform certain tests such as full-hemogram and clinical chemistry for patient monitoring. Two hospital administrators and two medical superintendents expressed concern*:* "We rely on rapid diagnostic tests and malaria blood film, which do not require expensive reagents." At times, there are no reagents to perform full-hemogram and serum chemistry tests when we need to monitor patient progress and response to treatment or to identify what other conditions patients might be suffering from."

Theme 4: Adherence and needs for improvement in managing severe Malaria.

Further discussions revealed that to improve adherence to treatment guidelines for severe Malaria would improve when there is adequate training of front-line health care providers, sensitizing the community on recognizing danger signs of Malaria, and improving supplies for hospital use. The medical officer in charge commented: “When we train healthcare workers on case identification and treatment procedures, we increase the chances of greater compliance with malaria treatment guidelines."

Participants indicated that health education at discharge would help reduce poor compliance to medication post-discharge and reduce cases of readmissions from Malaria. As observed by a medical officer and nursing officer-in-charge: "We have to strive and educate parents/caregivers on the need to complete prescribed doses and not to stop treatment when they see a child begins to feel better; doing so will help reduce readmission from treatment failure."

Interviewees indicated that the hospital had not experienced a shortage of malaria drugs and rapid diagnostic tests in the recent past. If such is sustained, patients can be assured of quality care in managing severe Malaria. The respondents indicated: “Overall, we do not experience a shortage of antimalarial and rapid diagnostic tests. At least we can correctly identify those sick from Malaria and administer the required medication.″

Table 3 shows the sociodemographic characteristics of the children recruited into the study during the study period. A total of 344 children were recruited into the study. Most children were more than 12 months in age (286/344, 83.1%), male (174/344, 50.6%), and from Kombewa County Hospital (218/344, 63.4%).

Table 4 shows the demographic characteristics of the caregivers of the children recruited into the study. Most participants were between 25 and 34 years of age (50.6%), had received a tertiary education (220/344, 63.9%), and were married (260/344, 75.6%).

Table 5 shows the sociodemographic characteristics of the healthcare providers recruited into the study. Most participants were from Kombewa (55%), were nurses (67%), held a diploma (83%), had <1 year of experience (45%), were trained on Integrated Management of Child Illness (IMCI) (59%), and had attended a CME on malaria/in-service training (96%).

Table 6 describes the availability of medications for managing severe Malaria at Kombewa and Chulaimbo County hospitals. Only (9.0%) of the patients at Chulaimbo County Hospital purchased antimalarials, while only 04/344 (1.2%) of the patients at Kombewa County Hospital

purchased antimalarials during the study period. Appropriate malaria testing equipment and antimalarial treatment were observed by 117/344 (34.0%) and 147/344 (42.7%) of the caregivers who visited the hospitals in the study area.

Table 7 describes the tests done, medications given, microscopic blood test diagnosis, and appropriate medication in the study area. Microscopy was observed to have been done in 271/344 (78.8%) files of the children with severe Malaria, while rapid diagnostic test was observed to have been done in 62/344 (18.0%) of the files of the children with severe Malaria. Oral ACT was observed to have been administered in 126/344 (36.6%) of the files with severe Malaria, and artemether injection was observed to have been administered in 218/344 (63.4%) of the files of children with severe Malaria. Moreover, both microscopic blood test diagnosis and appropriate medication were observed to have been provided to 182/344 (52.9%) of the files of children with severe Malaria.

Table 8 describes the association between various sociodemographic characteristics of children and caregivers on the optimal management of severe Malaria in the study area. Female children were 60% more likely to receive optimal management of Malaria than male children (p=0.017). Children of caregivers <25 years of age were 3.5 times more likely to have optimal management of Malaria than caregivers who were ≥25 (OR=3.5, 95% CI: 1.7-7.3, p=0.0005). Children from caregivers with a primary level of education were 5.8 times more likely to receive optimal management of Malaria compared to children from caregivers with a secondary level of education and above (95% CI: 2.6-12.7, p<0.0001).

Table 9 summarizes the association between the sociodemographic characteristics of healthcare providers and the optimal management of severe Malaria in the study area. Children who received clinical care from healthcare providers who were IMCI trained were 40% more likely to get optimal malaria management than children who received clinical care from healthcare providers who did not receive IMCI training (95% CI: 0.3-0.7, p=0.0005). Children receiving clinical care from healthcare providers who received in-service training or IMCI were 60% more likely to receive optimal malaria management than those who received care from healthcare providers who did not receive in-service training or IMCI (95% CI: 0.4-0.9, p=0.017).

Table 10 summarizes the association between institutional factors and the optimal management of Malaria in the study area. Children who were clinically managed using parenteral artemisinin were 90% less likely to receive optimal malaria management than children who were clinically managed using other antimalarials.

Table 11 reveals that female children were 1.75 times more likely to receive optimal malaria management than male children (p=0.021). Children whose caregivers were <25 years old were 37% more likely to receive optimal malaria management than children from caregivers who were ≥25 years old (p=0.018). Children who received artemisinin were 59% more likely to receive optimal malaria management than other antimalarials (p=0.0012).

Table (3): Frequency and percentage distribution of sociodemographic characteristics of the studied children with severe Malaria (n=344).

Demographic factors	No.	%
Age of the child (months)		
<12	58	16.9
≥12	286	83.1
Gender		
Male	174	50.6
Female	170	49.4
Facility		
Kombewa	218	63.4
Chulaimbo	126	36.6

Table (4): Frequency and percentage distribution of sociodemographic characteristics of the caregivers of studied children with severe Malaria (n=344).

Demographic factor	No.	%
Age (years)		
15-24	44	12.8
25-34	174	50.6
35-44	106	30.8
>45	20	5.8
Level of education		
Primary	50	14.5
Secondary	74	21.5
Tertiary	220	63.9
Marital status		
Single	77	22.4
Married	260	75.6
separated	3	0.9
Divorced	1	0.3
Widow	3	0.9%

Table (5): Frequency and percentage distribution of sociodemographic characteristics of the healthcare providers recruited into this study (n=78).

Demographic factor	No.	%
Facility		
Kombewa	43	55
Chulaimbo	35	45
Cadre		
Nurses	52	67
Clinical officers	20	26
Medical officers	2	3
Specialist paediatrician	4	5
Level of education		
Diploma	65	83
Undergraduate	5	6
Postgraduate	2	3
Years of experience		
<1year	35	45
2-4 years	27	35
5-7 years	7	9
8-10 years	2	3
>10 years	7	9
IMCI trained		
Yes	46	59
No	32	41
Attended CME on Malaria or in-service training		
Yes	75	96
No	3	4

Table (6): Frequency and percentage distribution of medication availability for managing severe Malaria in the study hospitals (n=344).

Variables	Facility			
	Kombewa		Chulaimbo	
	No.	%	No.	%
Patients purchased medicine for Malaria.				
Yes	4	1.2	13	9.0
No	122	35.5	205	59.6
Stocking of facilities				
Observed/verified malaria testing equipment	0	0.0	62	18.0
Observed/verified appropriate antimalarial (ACT) in stock	9	2.6	9	2.6
Appropriate malaria testing equipment and antimalarial treatment	117	34.0	147	42.7

Table (7): Summary of how Malaria is managed by Kombewa and Chulaimbo County hospitals (n=344).

Variable	Facility				Total (n. %)	
	Kombewa (n, %)		Chulaimbo (n, %)			
	No.	%	No.	%	No.	%
Test done						
Microscopy	89	32.8	182	67.2	271	78.8
Rapid Diagnostic Test (RDT)	36	58.1	26	41.9	62	18.0
Tests not done	1	9.1	10	90.9	11	3.2
Medications given						
Oral ACT	2	1.6	124	98.4	126	36.6
Artemether injection	124	51.9	94	43.1	218	63.4
Microscopic blood test diagnosis and appropriate medication						
Yes	88	48.3	94	51.7	182	52.9
No	38	23.5	124	76.5	162	47.1

Table (8): Association between various sociodemographic characteristics of children and caregivers on the optimal management of severe Malaria in the study area (n=344).

Variables	Total	Recommended test and medication for Malaria (%)		Odds ratio (OR)	P value
		Yes	No		
Demographic features of the children					
Gender					
Male	174	46.6	53.4	0.6(0.4-0.9)	0.017
Female	170	59.4	40.6		
Age group (months)					
<1	58	53.4	46.6	1.0(0.6-1.8)	0.928
≥1	286	52.8	47.2		
Demographic features of the caregivers					
Age group (years)					
<25	44	77.3	22.7	3.5(1.7-7.3)	0.0005
≥25	300	49.3	50.7		
Level of education					
Primary	50	84.0	16.0	5.8(2.6-12.7)	<0.0001
Secondary and above	294	47.6	52.4		
Marital status					
Married	260	51.5	48.5	0.8(0.5-1.3)	0.371
Single/separated/divorced/widow	84	57.1	42.9		

Table (9): Summary of the association between the sociodemographic characteristics of healthcare providers and the optimal management of severe Malaria in the study area (n=78).

Demographics of the healthcare providers	Total (n=78)	Recommended test and medication for severe Malaria (%)		Odds ratio	p-value
		Yes	No		
Cadre					
Nurse	52	67.0	33.0	0.9 (0.6-1.4)	0.654
Doctor/clinical officer	22	54.6	45.4		
Previous training on IMCI					
Yes	46	45.5	54.5	0.4 (0.3-0.7)	0.0005
No	32	64.7	35.3		
In-service training on IMCI					
Yes	75	47.5	52.5	0.6 (0.4-0.9)	0.017
No	03	60.6	39.4		

Table (10): Summary of the association between institutional factors and optimal management of Malaria in the study area (n=78).

Variable	Total (n=78)	Recommended test and medication for severe Malaria (%)		Odds ratio	p-value
		Yes	No		
Stock in the facilities					
Appropriate testing equipment and antimalarial treatment	264	54.6	45.4	1.3 (0.8-2.9)	0.269
Observed/verified appropriate malaria testing equipment and antimalarial treatment in stock	80	47.5	52.5		
Available antimalarials					
Parenteral artemisinin	292	46.2	53.8	0.1 (0.04-0.24)	<0.0001
Other	52	90.4	8.6		

Table (11): Multiple logistic regression results on patient, caregiver, and provider correlate with microscopic blood tests and recommended medication for severe Malaria.

Characteristics	AOR	95% CI	p-value
Characteristics of the children			
Female (ref: Male)	1.75	1.09 – 2.81	0.021
Characteristics of the caregiver			
<25 years (ref: ≥25 years)	0.37	0.16 – 0.84	0.018
Primary level education (ref: Secondary and above)	0.42	0.17 – 1.01	0.053
Characteristics of the health facility			
Artemisinin (ref: Other antimalarial)	0.59	0.43 – 0.81	0.0012

6. Discussion

Severe Malaria remains a critical health challenge in sub-Saharan Africa, particularly among children under five, who bear the highest risk of malaria-related morbidity and mortality. Effective case management of severe Malaria is essential for reducing the high rates of hospitalization, severe complications, and mortality associated with the disease. Despite the availability of free malaria treatment and active campaigns to reduce malaria prevalence in Malaria endemic areas such as Kisumu County, gaps in case management persist, often influenced by various patient, caregiver, healthcare provider, and institutional factors.

These factors can impact timely diagnosis, adherence to treatment protocols, and overall quality of care provided to pediatric patients. It may be important to understand the influence of these factors on severe malaria case management to facilitate the development of interventions. The present study aimed to determine the factors influencing the quality of managing severe Malaria among children under five years at selected County hospitals in Kisumu, Kenya, namely Chulaimbo County Hospital and Kombewa County Hospital.

The present study evaluates the impact of patient-related, caregiver-related, healthcare provider-related, and institutional factors on managing severe Malaria in children under five at Chulaimbo County and Kombewa County Hospitals. The analysis identified significant associations between demographic factors and the likelihood of receiving optimal malaria treatment. Specifically, female children were more likely to receive appropriate management than male children, with female patients being 60% more likely to receive optimal care. Additionally, children of caregivers younger than 25 and with primary education levels were significantly more likely to receive optimal care than those of older and more highly educated caregivers. Children receiving care from healthcare providers trained in Integrated Management of Childhood Illness (IMCI) or those working in facilities with reliable diagnostic and antimalarial resources were also more likely to receive optimal treatment.

Gender disparities in malaria management were particularly notable, with female children receiving more prompt and effective care than male children. This finding is evidenced by the higher proportion of males (50.6%) receiving quality care than girls (49.4%). This finding is indicative of a lower resistance to Malaria in male children compared to their counterparts.

This finding aligns with findings from *Tanner and Vlassoff (1998)*, who suggested that gender-sensitive approaches are necessary in malaria-endemic settings to ensure equitable care. Similarly, *Tolhurst and Nyonator (2006)* highlighted that socio-cultural biases can affect treatment-seeking behaviors, contributing to discrepancies in care between male and female patients in regions like sub-Saharan Africa. Caregiver demographics also played a key role. Children of younger caregivers (<25 years) received higher quality care, possibly indicating that younger caregivers may be more proactive in seeking timely healthcare. This finding is supported by *Mpimbaza et al. (2018),* who reported that younger caregivers in Uganda were less likely to delay care for children with Malaria, often seeking prompt medical assistance than older caregivers.

Interestingly, children of caregivers with primary education levels had better outcomes than those with caregivers who had secondary or tertiary education. This finding contrasts with *David et al. (2021),* who found that children of more educated caregivers were less likely to contract Malaria, possibly due to greater health awareness and preventive behaviors. In the current context, however, it is plausible that less educated caregivers may rely more on formal healthcare, while more educated caregivers might attempt initial home remedies or self-diagnosis, potentially delaying optimal treatment.

Healthcare provider training also emerged as a pivotal factor in case management quality. Children treated by IMCI-trained providers were 60% more likely to receive optimal care, underscoring the importance of specialized training in improving patient outcomes. *Rozelle et al. (2021)* reported similar findings in Liberia, where community health workers trained in malaria management showed improved diagnostic accuracy and treatment outcomes in pediatric patients. These results suggest that ongoing training and capacity building for healthcare providers are essential for effective malaria management, especially in resource-limited settings.

Institutional factors, such as the availability of antimalarial medications and diagnostic tools, were also associated with better treatment outcomes. WHO guidelines recommend timely diagnosis and treatment as critical components of malaria management *(WHO, 2023). Odhiambo et al. (2023), Otambo et al. (2022), and Riley et al. (2016)* highlight the need for well-resourced healthcare facilities in endemic areas. For example, the availability of medications such as parenteral Artesunate was a significant determinant of optimal care, reflecting the WHO's emphasis on appropriate treatment protocols.

The qualitative findings of this study provide the perspectives of the healthcare provider and caregiver in managing severe Malaria among children under five. Key informant interviews reveal several themes: The identification and burden of severe Malaria, perceptions of management quality, challenges encountered in care provision, and the need for improved adherence to treatment guidelines. Healthcare providers highlighted that severe malaria cases in children are relatively easy to identify due to recognizable symptoms such as convulsions, pallor, and prostration.

This finding aligns with the WHO guidelines on clinically identifying severe Malaria *(Garrido-Cardenas et al., 2023; White, 2022).* Providers noted a seasonal increase in cases, particularly from April to July, underscoring the malaria endemicity in the Kisumu area. Such patterns are supported by *Jenkins*

et al. (2015), who observed seasonal spikes in malaria transmission in similar Kenyan regions.

The interviews reflected a strong commitment among healthcare providers to deliver quality care despite systemic limitations. Providers expressed confidence in following treatment protocols, often initiating rapid diagnostic tests (RDTs) and administering antimalarial medications as per WHO recommendations. They emphasized that adherence to these guidelines plays a crucial role in patient recovery and survival, which aligns with studies by *Otambo et al. (2022) and Riley et al. (2016),* underscoring the significance of standardized case management.

Providers also identified several critical challenges impacting their ability to manage severe Malaria effectively. Late presentation of patients due to delayed care-seeking was frequently noted. Caregivers often attempt self-medication at home, which can lead to deteriorated health by the time children reach the hospital. Similar findings were observed by *Mpimbaza et al. (2018),* who found that self-treatment among caregivers is common, particularly in rural settings, and is often a response to logistical and economic barriers to healthcare access.

Furthermore, compliance with post-discharge treatment regimens emerged as a persistent issue, with many caregivers reportedly failing to complete prescribed malaria doses for their children. This finding can lead to readmissions and increased morbidity, consistent with findings by *Odhiambo et al. (2023),* who identified treatment non-adherence as a key barrier to malaria control *(Odhiambo et al., 2023).*

Another major challenge was resource constraints, specifically the intermittent availability of diagnostic reagents and blood transfusion supplies. Providers reported that they occasionally lack essential lab reagents, such as those needed for full hemogram tests, critical for monitoring severe malaria patients. This shortage limits the capacity to comprehensively assess and manage complications, mirroring findings from *Kapesa et al. (2018),* who documented similar resource limitations in Kenya's malaria-endemic areas.

Healthcare providers identified a pressing need for enhanced training and community education to improve adherence to malaria treatment protocols. They emphasized the value of continuous medical education and IMCI training in promoting compliance with WHO treatment guidelines. This finding is consistent with *Rozelle et al. (2021),* who reported that community health training in Liberia improved adherence to malaria treatment protocols and patient outcomes. Providers also recommended community-based health education for caregivers, particularly on recognizing severe malaria symptoms and completing prescribed treatment regimens post-discharge. Health education initiatives like these could reduce treatment non-compliance and late care-seeking rates.

7. Conclusion

These findings suggest that the optimal management of severe Malaria in children under the age of five in the study area is influenced by the gender of the patient, demographic characteristics of the caregivers, on-the-job training of healthcare providers, and the availability of antimalarial medication. Moreover, these findings suggest that while healthcare providers are knowledgeable and committed to quality malaria management, systemic challenges such as resource limitations, caregiver education gaps, and treatment non-adherence impact their ability to deliver optimal care.

8. Recommendations

Addressing resource allocation, continuous provider training, and community health education could strengthen severely. Further research studies to determine patient satisfaction levels as well as staff training needs assessment.

9. References

Al-Awadhi, M., Ahmad, S., & Iqbal, J. (2021). Current status and the epidemiology of Malaria in the Middle East Region and Beyond. *Microorganisms, 9*(2), 338. https://doi.org/10.3390/MICROORGANISMS9020338

David, M., Onguru, D., & Lawrence, B. (2021). Determinants of Malaria prevalence among children below five years in Northwest Kisumu Ward, Kisumu County, Kenya: A cross-sectional study. *Middle East Journal of Applied Science & Technology*, *4*(4), 01–18. https://doi.org/10.2139/ssrn.3983007

Dufera, M., Dabsu, R., & Tiruneh, G. (2020). Assessment of Malaria as a public health problem in and around Arjo Didhessa sugar cane plantation area, Western Ethiopia. *BMC Public Health 20*, 1–10. https://doi.org/10.1186/S12889-020-08784-5

Esu, E. B., Effa, E. E., Opie, O.N., & Meremikwu, M. M. (2019). Artemether for severe Malaria. *The Cochrane Database of Systematic Review, 6*(6), CD010678. https://doi.org/10.1002/14651858.CD010678.pub3

Garrido-Cardenas, J. A., González-Cerón, L., García-Maroto, F., Cebrián-Carmona, J., Manzano-Agugliaro, F., & Mesa-Valle, C. M. (2023). Analysis of fifty years of severe Malaria Worldwide Research. *Pathogens, 12*(3), 373 https://doi.org/10.3390/pathogens12030373

Hendriksen, I. C., Mwanga-Amumpaire, J., von Seidlein, L., Mtove, G., White, L. J., Olaosebikan, R., Lee, S. J., Tshefu, A. K., Woodrow, C., Amos, B., Karema, C., Saiwaew, S., Maitland, K., Gomes, E., Pan-Ngum, W., Gesase, S., Silamut, K., Reyburn, H., Joseph, S., Chotivanich, K., … & Dondorp, A. M. (2012). Diagnosing severe falciparum malaria in parasitaemic African children: a prospective evaluation of plasma PfHRP2 measurement. *PLoS Medicine, 9*(8), e1001297. https://doi.org/10.1371/journal.pmed.1001297

Jenkins, R., Omollo, R., Ongecha, M., Sifuna, P., Othieno, C., Ongeri, L., Kingora, J., & Ogutu, B. (2015). Prevalence of malaria parasites in adults and its determinants in Malaria endemic area of Kisumu County, Kenya. *Malaria Journal, 14,* 263, https://doi.org/10.1186/s12936-015-0781-5

Kapesa, A., Kweka, E. J., Atieli, H., Afrane, Y. A., Kamugisha, E., Lee, M. C., Zhou, G., Githeko, A. K., & Yan, G. (2018). The current malaria morbidity and mortality in different transmission settings in Western Kenya. *PLoS One 13*, e0202031. https://doi.org/10.1371/JOURNAL.PONE.0202031

Kenya Malaria Indicator Survey, (2021). 2020 Malaria Indicator Survey summary report. Ministry of Health Division of National Malaria Programme Nairobi Republic of Kenya Ministry of Health.

Maqsood, A., Farid, M. S., Khan, M. H., & Grzegorzek, M. (2021). Deep malaria parasite detection in thin blood smear microscopic images. *Applied Science, 11*(15), 2284. https://doi.org/10.3390/app11052284

Mpimbaza, A., Katahoire, A., Rosenthal, P. J., Karamagi, C., & Ndeezi, G. (2018). Caregiver responses and association with delayed care-seeking in children with uncomplicated and severe Malaria. *Malaria Journal, 17,* 476. https://doi.org/10.1186/S12936-018-2630-9

Murray, C. J., Rosenfeld, L. C., Lim, S. S., Andrews, K. G., Foreman, K. J., Haring, D., Fullman, N., Naghavi, M., Lozano, R., & Lopez, A. D. (2012). Global malaria mortality between 1980 and 2010: A systematic analysis. *Lancet (London, England), 379*(9814), 413–431. https://doi.org/10.1016/S0140-6736(12)60034-8

Odhiambo, F. O., O'Meara, W. P., Abade, A., Owiny, M., Odhiambo, F., & Oyugi, E. O. (2023). Adherence to national Malaria treatment guidelines in private drug outlets: A cross-sectional survey in the malaria-endemic Kisumu County, Kenya. *Malaria Journal, 22*, 307(2023). https://doi.org/10.1186/s12936-023-04744-7

Otambo, W. O., Olumeh, J. O., Ochwedo, K. O., Magomere, E. O., Debrah, I., Ouma, C., Onyango, P., Atieli, H., Mukabana, W. R., Wang, C., Lee, M. C., Githeko, A. K., Zhou, G., Githure, J., Kazura, J., Yan, G. (2022). Healthcare provider practices in diagnosing and treating of Malaria in rural communities in Kisumu County, Kenya. *Malaria Journal, 21*(1), 129. https://doi.org/10.1186/S12936-022-04156-Z

Riley, C., Dellicour, S., Ouma, P., Kioko, U., Omar, A., Kariuki, S., Ng'ang'a Z., Desai, M., Buff, A. M., Gutman, J. R. (2016). Knowledge and adherence to the national guidelines for malaria diagnosis in pregnancy among healthcare providers and drug outlet dispensers in rural, western Kenya. *The American Journal of Tropical Medicine and Hygiene, 98*(5), 1367-1373.

Rozelle, J. W., Korvah, J., Wiah, O., Kraemer, J., Hirschhorn, L. R., Price, M. R., Subah, M., McCormick, L., Varpilah, B., & Panjabi, R. (2021). Improvements in malaria testing and treatment after a national community health worker program in rural Liberia. *Journal of Global Health Reports, 5,* e2021073. https://doi.org/10.29392/001C.25979

Tanner, M., & Vlassoff, C. (1998). Treatment-seeking behavior for Malaria: A typology based on endemicity and gender. *Social Science & Medicine*, *46*(4-5), 523–532. https://doi.org/10.1016/S0277-9536(97)00195-0

Tolhurst, R., & Nyonator, F. K. (2006). Looking within the household: Gender roles and responses to Malaria in Ghana. *Transactions of the Royal Society of Tropical Medicine and Hygiene*, *100*(4), 321–326. https://doi.org/10.1016/j.trstmh.2005.05.004

Uzun Ozsahin, D., Mustapha, M. T., Bartholomew Duwa, B., & Ozsahin, I. (2022). Evaluating the performance of deep learning frameworks for malaria parasite detection using microscopic images of peripheral blood smears. *Diagnostics, 12*(11), 2702. https://doi.org/10.3390/DIAGNOSTICS12112702

White, N. J. (2022). Severe Malaria. *Malaria Journal, 21*(1), 284. https://doi.org/10.1186/S12936-022-04301-8

WHO (2023). WHO Guidelines for Malaria - October 16, 2023. Available at: https://iris.who.int/bitstream/handle/10665/373339/WHO-UCN-GMP-2023.01-Rev.1-eng.pdf

Yadava, S. K., Laleker, A., & Fazili, T. (2019). Post-malaria neurological syndrome: A rare neurological complication of Malaria. *Infection, 47*(2), 183–193. https://doi.org/10.1007/s15010-019-01267-9

Zhou, G., Afrane, Y. A., Vardo-Zalik, A. M., Atieli, H., Zhong, D., Wamae, P., Himeidan, Y. E., Minakawa, N., Githeko, A. K., & Yan, G. (2011). Changing patterns of malaria epidemiology between 2002 and 2010 in Western Kenya: The fall and rise of Malaria. *PLoS One 6*, e20318. https://doi.org/10.1371/journal.pone.0020318

Zhou, G., Hemming-Schroeder, E., Gesuge, M., Afrane, Y. A., Lee, M. C., Atieli, H. E., Githeko, A. K., & Yan, G. (2020). Gaps between knowledge and Malaria treatment practices after intensive anti-malaria campaigns in Western Kenya: 2004–2016. *The American journal of tropical medicine and hygiene, 102*(6), 1358–1365. https://doi.org/10.4269/ajtmh.19-0907