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Epidemiological, Clinical, and Therapeutic Aspects of Malaria among Febrile Children Aged 0 - 59 Months in Kisangani

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Abstract

Background: Malaria remains a leading cause of morbidity and mortality among children under five years in sub-Saharan Africa. This study aimed to describe the epidemiological, clinical, and therapeutic aspects of malaria among febrile children aged 0 - 59 months attending health facilities in Kisangani. **Methods:** A multicenter cross-sectional descriptive study with prospective data collection was conducted from June 15 to December 30, 2025. Febrile children aged 0 - 59 months were consecutively recruited. Malaria diagnosis was based on RDT and/or microscopy. Discordant results were considered positive if either test was positive. Species identification relied on microscopy. Data were analyzed using R version 4.3.1. **Results:** Among 417 children included, the hospital malaria prevalence among febrile children was 39% (95% CI: 34 - 43). *Plasmodium falciparum* accounted for 89% of infections. Uncomplicated malaria represented 82% of cases, while 18% were severe malaria. ACT was used in 90.1% (119/132) of uncomplicated cases, and injectable artesunate in 89.6% (26/29) of severe cases. **Conclusion:** Malaria remains highly prevalent among febrile children in Kisangani. Strengthening early diagnosis, appropriate treatment, and preventive strategies is essential.

Keywords

Malaria, Children, Epidemiology, Kisangani, DRC

1. Introduction

Malaria remains one of the most important infectious diseases worldwide, partic-

ularly in tropical regions. It is caused by Plasmodium species transmitted by Anopheles mosquitoes [1].

According to the World Malaria Report 2025, approximately 282 million cases and 610,000 deaths occurred globally in 2024, with Africa accounting for most of the burden [2]. Children under five years remain the most vulnerable group [3].

In the Democratic Republic of the Congo, malaria represents a major public health problem, ranking second worldwide in disease burden [4]. Despite control strategies, the disease remains highly prevalent in regions such as Kisangani.

2. Materials and Methods

2.1. Study Design and Setting

Multicenter cross-sectional descriptive study conducted from June 15 to December 30, 2025 in six health facilities in Kisangani.

2.2. Study Population

Children aged 0 - 59 months presenting with fever (≥37.5˚C) or history of fever within 48 hours.

2.3. Inclusion Criteria

- Age 0 - 59 months.
- Fever or recent fever.

2.4. Exclusion Criteria

- Repeat consultation.
- Refusal of parental consent.
- Incomplete data.

2.5. Sampling

Consecutive recruitment proportional to facility attendance. Participants were consecutively recruited from selected health facilities in Kisangani during the study period. The number of children included per facility was proportional to patient volume.

2.6. Data Collection

Standardized questionnaire including:

- Sociodemographic data.
- Clinical signs.
- Treatment history.

2.7. Biological Diagnosis

- RDT (SD Bioline Malaria Ag Pf).
- Thick and thin smear (Giemsa 10%).

2.8. Definition of malaria

Positive if RDT and/or microscopy positive.

Species identification: microscopy (thin smear).

2.9. Statistical Analysis

Descriptive analysis using R software. Results expressed as frequencies and 95% CI.

2.10. Ethical Considerations

This study was conducted in accordance with the ethical principles outlined in the Declaration of Helsinki for research involving human subjects.

Ethical approval was obtained from the Ethics Committee of the University of Kisangani (Reference No.: UNIKIS/CE/KGB/004/07/2025) prior to the initiation of the study.

Given that the study population involved children aged 0 - 59 months, special attention was paid to the protection of this vulnerable group. Written informed consent was obtained from parents or legal guardians before inclusion. The study objectives, procedures, potential benefits, and minimal risks were clearly explained in a language understandable to the caregivers. Participation was entirely voluntary, and caregivers were informed of their right to withdraw their child from the study at any time without any consequences on the quality of care provided.

To ensure confidentiality, all collected data were anonymized using unique identification codes instead of personal identifiers. Data were securely stored and accessible only to authorized members of the research team. No identifiable information was included in the analysis or publication.

Regarding clinical management, all children diagnosed with malaria received treatment according to national and World Health Organization guidelines. Participation in the study did not delay or interfere with standard care. Children with severe malaria or other medical conditions were promptly managed according to clinical protocols in the respective health facilities.

Given the observational nature of the study, no additional invasive procedures were performed beyond routine clinical care. Blood samples used for malaria diagnosis were part of standard medical practice.

3. Results

3.1. Flow diagram

During the study period, a total of 921 children were screened for eligibility. Of these, 417 met the inclusion criteria. A total of 504 children were excluded, including 220 repeat consultations, 104 refusals of parental consent, and 180 cases with incomplete data. Finally, 417 children were included in the analysis (**Figure 1**).

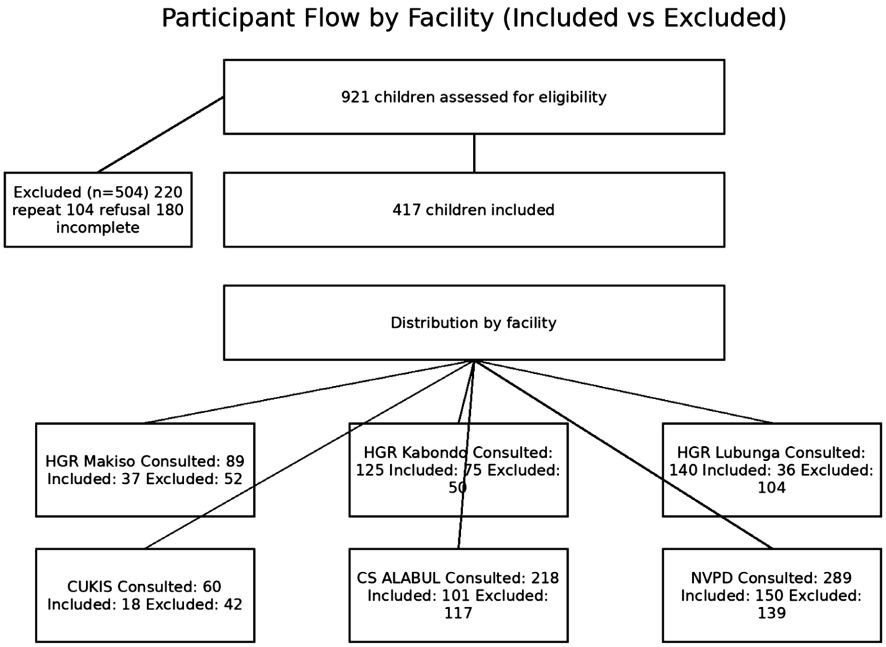

Figure 1. Paticipant flow by facility (Included vs Excluded).

3.2. Sociodemographic Characteristics

- Total: 417 children.
- Female: 52%.
- Male: 48%.
- Median age: 16 months (IQR: 9 - 36).
- Acute malnutrition: 28.3%.

The results presented in Table 1 show that malaria was confirmed in 39% of febrile children. Microscopy identified a higher proportion of positive cases (35%) compared to RDT (22%), suggesting a possible limitation in the sensitivity of rapid diagnostic tests in this setting. This difference highlights the importance of combining diagnostic methods to improve case detection.

Table 1. Malaria diagnosis, species distribution, prevention, and treatment.

Variables	n	%	95% CI
RDT			
Positive	93	22	18 - 26
Negative	324	78	73 - 81
Microscopy			
Positive	145	35	30 - 39
Negative	272	65	60 - 69
Confirmed malaria			
Yes	161	39	34 - 43
No	256	61	56 - 66

As shown in Table 2, *Plasmodium falciparum* was the predominant species, accounting for 89% of infections. The relatively low proportions of *P. malariae* (8%) and *P. ovale* (3%) are consistent with known epidemiological patterns in sub-Saharan Africa.

Table 2. Species distribution (microscopy-positive cases).

Species	n	%
Plasmodium falciparum	129	89
P. malariae	11	8
P. ovale	5	3

Table 3 shows that the use of insecticide-treated nets (ITNs) was reported in 54% of cases, either alone or in combination with other measures. However, these categories are based on caregiver-reported practices and may overlap, particularly regarding insecticide use. Therefore, these findings should be interpreted as reflecting general preventive behaviors rather than strictly mutually exclusive vector control strategies.

Table 3. Prevention methods.

Method	n	%
ITN (MILD)	225	54.0
Insecticide only	121	29
ITN + insecticide	70	16.8
None	1	0.2

As presented in Table 4, more than half of the children (53%) received some form of treatment before consultation, including antimalarials and antibiotics. This high proportion reflects widespread self-medication practices, which may delay appropriate diagnosis and management.

Median delay before treatment: 5 days (IQR: 2 - 5).

Table 4. Home treatment before consultation.

Treatment	n	%
Antimalarial ± others	108	26
Antibiotics only	111	27
Others	198	47

Table 5 shows that the majority of uncomplicated malaria cases were treated with ACT (90.1%), while injectable artesunate was administered in 89.6% of severe malaria cases, reflecting good adherence to recommended treatment guidelines.

Table 5. Treatment after diagnosis.

Treatment	n	%
Uncomplicated malaria	**n = 132**	
ACT	119	90.1
Oral quinine	13	9.9
Severe malaria	**n = 29**	
Injectable artesunate	26	89.6
Injectable quinine	3	10.4

Of the 417 children included in the study, 161 were diagnosed with malaria (positive RDT and thick and thin blood smear), including 132 with uncomplicated malaria and 29 with severe malaria. Among the 132 children with uncomplicated malaria, 119 were treated with ACTs and 13 received oral quinine. Among the 29 children with severe malaria, 26 (89.6%) received injectable artesunate, while 3 (10.4%) were treated with quinine.

4. Discussion

Malaria remains a major cause of morbidity among children under five years of age in sub-Saharan Africa, particularly in highly endemic settings such as Kisangani. The present study provides updated epidemioclinical and therapeutic data among febrile children attending health facilities, contributing to a better understanding of malaria burden in this context.

4.1. Prevalence of Malaria

The prevalence of confirmed malaria among febrile children in this study was 39%. This finding is consistent with national data from the Demographic and Health Survey in the Democratic Republic of the Congo, which reported a prevalence of approximately 33% among children aged 6 - 59 months, and up to 43.8% in Tshopo Province [4].

Comparable findings have been reported in recent studies across sub-Saharan Africa. For instance, studies conducted in Uganda, Ethiopia, and Ghana have reported malaria prevalence ranging from 30% to 45% among febrile children attending health facilities [5]-[7]. These similarities highlight the persistent high burden of malaria in endemic regions despite ongoing control efforts. Conversely, lower prevalence rates have been observed in specific contexts such as refugee populations, where prevalence as low as 12% - 13% has been reported [8]. However, the prevalence reported in this study remains higher than that observed in some urban settings with better access to prevention and healthcare services [9]. This difference may be explained by environmental and socioeconomic factors, including the equatorial climate, high vector density, and living conditions in Kisangani. Importantly, the prevalence reported here reflects malaria among febrile

children attending health facilities and not the general population. Facility-based studies are known to overestimate prevalence due to the selection of symptomatic individuals [10].

4.2. Plasmodium Species Distribution

The predominance of *Plasmodium falciparum* (89%) observed in this study is consistent with findings across sub-Saharan Africa, where this species accounts for the majority of malaria infections and severe cases [11]. Recent studies confirm this pattern, reporting proportions exceeding 85% in endemic regions [5] [6]. This predominance is explained by the biological characteristics of P. falciparum, including its high virulence and ability to cause severe complications such as cerebral malaria and severe anemia [12]. The low frequency of *P. malariae* and *P. ovale* observed in this study is also consistent with previous reports, although these species may be underdiagnosed due to the limited sensitivity of routine diagnostic tools [13].

4.3. Clinical Forms of Malaria

In this study, uncomplicated malaria accounted for 82% of cases, while severe malaria represented 18%, with anemia being the most frequent severe manifestation. These findings are consistent with the literature, where severe malaria typically represents 10% - 20% of pediatric cases in endemic areas [12]. Recent evidence suggests that delayed access to treatment significantly increases the risk of severe disease, with early treatment preventing progression to complications [14]. The relatively high proportion of severe malaria observed in this study may be explained by delayed consultation, as indicated by the median delay of 5 days before treatment initiation, as well as the high prevalence of malnutrition (28.3%), which is a known aggravating factor [4].

4.4. Preventive Measures

The use of insecticide-treated bed nets (54%) observed in this study remains suboptimal and below WHO recommendations for universal coverage [15]. Recent studies have confirmed that inadequate use of insecticide-treated nets remains a major risk factor for malaria infection among children [6] [8]. Furthermore, evidence shows that consistent use of bed nets significantly reduces malaria incidence and mortality in children under five years of age [16]. These findings emphasize the need to strengthen community-based prevention strategies and improve access to effective vector control interventions.

4.5. Pre-Hospital Treatment Practices

A substantial proportion of children received treatment prior to consultation, including antimalarials and antibiotics. This pattern reflects widespread self-medication practices in sub-Saharan Africa and has been associated with delayed diagnosis and inappropriate treatment [17]. Overdiagnosis and overtreatment of ma-

laria remain important challenges, particularly in settings where biological confirmation is not systematically performed [18].

4.6. Diagnostic Considerations

The study showed higher detection of malaria by microscopy compared to RDTs, which is consistent with previous findings highlighting the limitations of RDT sensitivity [10].

Recent large-scale studies have demonstrated that the use of RDTs improves diagnostic accuracy and clinical outcomes when properly implemented [19]. Microscopy remains the reference standard but is highly dependent on operator expertise [20]. Therefore, the combined use of RDT and microscopy, as applied in this study, is appropriate and recommended [1].

4.7. Treatment Practices

The majority of children with uncomplicated malaria were treated with ACT (90.1%) while injectable artesunate was used in severe cases, in accordance with WHO recommendations [1]. These findings are consistent with reports from other African countries, reflecting improved adherence to treatment guidelines through national malaria control programs [17].

However, the relatively low proportion of injectable artesunate compared to the number of severe cases may suggest under-recognition of severe malaria or limitations in access to recommended treatments.

5. Limitations

This study has certain limitations. First, recruitment based on health facilities may limit the generalizability of the results to the broader population. Second, the use of antimalarial treatments administered at home prior to consultation may have influenced the diagnostic results. Finally, diagnostic errors related to the performance of microscopy or rapid diagnostic tests cannot be completely excluded.

6. Conclusions

Malaria remains highly prevalent among children under five years of age in Kisangani. *Plasmodium falciparum* is the predominant species, and most cases correspond to uncomplicated malaria.

Strengthening malaria prevention strategies, particularly the use of insecticide-treated bed nets, as well as improving early access to diagnosis and treatment, are essential to reduce the burden of malaria among children in this region.

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Authors' Contributions

Scapin Kabongo Mudipanu contributed to the study design. Data collection was

performed by Scapin Kabongo Mudipanu, Pascal Kabangu Tshila, Jean Paul Kasolwa Haraka and Véronique Muyobela Kampunzu. Data analysis was conducted by Jean Hubert Tshishimbi Kalala. Manuscript revision was performed by Gaspard Mande Bukaka, Dadi Falay Sadiki, Emmanuel Tebandite Kasai, and Jean Pierre Alworong'a Opara. All authors read and approved the final version.

Conflicts of Interest

The authors declare no conflicts of interest.

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