OPEN ACCESS

Orapuh Journal

ORIGINAL ARTICLE

Journal of Oral & Public Health

Evaluation of antibiotic use in patients treated for uncomplicated malaria in the city of Boma, Democratic Republic of the Congo

Kilara, T. K.[1,2], Pholo, J. P. M.[1,3], Mpiempie, T. N.[2], Ngale, M.[2], Divengi, J. P. N.[2], Kondani, M. A.[2], Gimbindu, T. A.[2], Velela, P. K.[2], Ilenga, W. M.[1,4], Balu, C. M.[1], Woto, I. T.[5], Bongenya, B. I.[5], Mandoko, P. N.[1], Nsengi, P. N.[2], Kamangu, E. N.[5], & Mesia, G. K.[2,6]

[1]Faculty of Medicine, Joseph Kasa-Vubu University, Boma, Democratic Republic of the Congo [2]Pharmacology Service, Department of Basic Sciences, Faculty of Medicine, University of Kinshasa, Kinshasa, Democratic Republic of the Congo [3]Otorhinolaryngology Department, Faculty of Medicine, University of Kinshasa, Kinshasa, Democratic Republic of the Congo [4]Anatomopathology Department, Faculty of Medicine, University of Kinshasa, Kinshasa, Democratic Republic of the Congo [5]Molecular Biochemistry Department, Basic Sciences Department, Faculty of Medicine, University of Kinshasa, Kinshasa, Democratic Republic of the Congo [6]Department of Pharmacovigilance and Clinical Pharmacology, Faculty of Pharmaceutical Sciences, University of Kinshasa, Kinshasa, Democratic Republic of the Congo

ARTICLE INFO

Received: *11 June 2025*
Accepted: *15 July 2025*
Published: *18 August 2025*

Keywords:

Antibiotics, antimalarials, uncomplicated malaria, Boma

Peer-Review: *Externally peer-reviewed*

© 2025 The Authors.

Re-use permitted under CC BY-NC 4.0
No commercial re-use or duplication.

Correspondence to:
Dr. Tarcisse K. Kilara
tarcissekilara7@gmail.com

To cite:
Kilara, T. K., Pholo, J. P. M., Mpiempie, T. N., Ngale, M., Divengi, J. P. N., Kondani, M. A., Gimbindu, T. A., Velela, P. K., Ilenga, W. M., Balu, C. M., Woto, I. T., Bongenya, B. I., Mandoko, P. N., Nsengi, P. N., Kamangu, E. N., & Mesia, G. K. (2025). Evaluation of antibiotic use in patients treated for uncomplicated malaria in the city of Boma, Democratic Republic of the Congo. *Orapuh Journal*, *6*(8), e1279 https://dx.doi.org/10.4314/orapj.v6i8.79

ISSN: *2644-3740*

Published by Orapuh, Inc. (info@orapuh.org)

Editor-in-Chief: Prof. V. E. Adamu
Orapuh, Inc., UMTG PMB 405, Serrekunda, The Gambia, editor@orapuh.org.

ABSTRACT

Introduction

Malaria remains one of the leading causes of morbidity and mortality in sub-Saharan Africa. In the Democratic Republic of the Congo (DRC), it accounts for approximately 12% of morbidity, primarily affecting children under five. Following the 2015 World Health Organization (WHO) guidelines, artemisinin-based combination therapy (ACT) is recommended.

Purpose

To assess the use of antibiotics co-administered with antimalarial drugs in the treatment of uncomplicated malaria in Boma.

Methods

This descriptive, cross-sectional study retrospectively reviewed records of patients with uncomplicated malaria registered between January and June 2022 to evaluate antibiotic co-prescription with antimalarials. Data collection occurred in July 2022. The study was conducted in Boma, at the Boma Red Cross Clinic and the Boma/MABAKU inter-diocesan hospital. A non-probability convenience sample of 100 patient files was examined. All patients included had uncomplicated malaria and received antibiotic therapy. Descriptive statistics and 95% confidence intervals (CIs) were calculated using Stata 12.0.

Results

Children aged 0–5 years comprised 36% of patients. Males accounted for 60% (95% CI: 50–69%), and females for 40% (95% CI: 31–50%); no significant sex difference was observed ($p = 0.12$). Before treatment, 80% of patients had a positive thick blood smear, 15% were treated without a definitive diagnosis, and only 5% had blood cultures performed. LA was the most prescribed ACT (90%). Among antibiotics, ceftriaxone was the most frequently prescribed (27%). Overall, 83% received antibiotics not aligned with guidelines, and 12% received quinine combined with doxycycline or clindamycin.

Conclusion

The findings indicate excessive and occasionally inappropriate antibiotic use in managing uncomplicated malaria in Boma health facilities. These results underscore the need for stronger adherence to National Malaria Control Program (PNLP) guidelines and enhanced antibiotic stewardship training for prescribers.

INTRODUCTION

Malaria remains one of the deadliest diseases in sub-Saharan Africa. According to the *World Malaria Report* (WMR) 2022, an estimated 247 million cases occurred worldwide in 2021, compared with 245 million in 2020. The World Health Organization (WHO) African Region accounts for 95% of all malaria cases (WHO, 2022).

The Democratic Republic of the Congo (DRC) is also heavily affected, accounting for around 12% of global morbidity and 11% of mortality due to malaria, most of whose victims are children under the age of five years (WHO, 2019).

Early and accurate diagnosis, followed by rapid and effective treatment, remains the key to controlling malaria. The 2015 WHO malaria guidelines, in force at the time of the study, recommend that all suspected cases be confirmed by microscopy or rapid diagnostic test (RDT), and that treatment should begin for all confirmed cases shortly after diagnosis (WHO, 2015).

WHO estimates that in less developed countries, only 40% of patients in the public primary care sector and 30% in the private sector receive treatment according to clinical guidelines (WHO, 2005, 2010, 2011). For patients with uncomplicated *Plasmodium falciparum* malaria, the 2015 WHO guidelines recommend a three-day artemisinin-based combination therapy (ACT).

In the DRC, the National Malaria Control Programme (NMCP) recommends several regimens combining ACTs for the management of uncomplicated malaria. Four ACTs are currently recommended as first-line treatment for uncomplicated *P. falciparum*: artemether–lumefantrine (AL), artesunate–amodiaquine (ASAQ), dihydroartemisinin–piperaquine (DP), and artesunate–pyronaridine (AP). These treatments are freely available on the Congolese market, but only AL and ASAQ are distributed free of charge in the public sector. Sulfadoxine–pyrimethamine (SP) is also maintained for intermittent preventive treatment (IPT) in pregnant women. If one of the first-line treatments is unavailable, poorly tolerated, or if treatment failure occurs (confirmed by microscopy), the patient may receive quinine combined with clindamycin or doxycycline (Mvumbi, 2017). This recommendation is based on expert opinion (Mavoko et al., 2017).

However, in many regions, febrile patients presenting to healthcare facilities are prescribed both antimalarials and antibiotics, contributing to antibiotic overuse (WHO, 2011). It is therefore important to evaluate antibiotic use in the management of uncomplicated malaria. To date, no study has quantified the systematic co-prescription of antibiotics with ACTs in Boma. This practice may increase the risk of antimicrobial resistance in a context where blood cultures are rarely performed (5% in our sample).

The aim of this study was to evaluate the use of antibiotics in the management of uncomplicated malaria in the town of Boma.

METHODS

Study design

This was a descriptive, cross-sectional study based on a retrospective review of records of patients with uncomplicated malaria registered between January and June 2022, with the aim of evaluating the use of antibiotics in combination with antimalarial drugs. Data were collected in July 2022.

Study site

The study was carried out in the town of Boma. Two health facilities were included: the Boma Red Cross Clinic and the Boma/MABAKU Inter-Diocesan Hospital.

Study population

Patients of all ages and sexes with uncomplicated malaria who had received antibiotic treatment were included. Records of patients with severe malaria at the time of the survey were excluded.

Sample size

A non-probability convenience sample of 100 patient records was analysed, covering the period between January and June 2022.

Statistical methods

Descriptive statistics were generated by calculating the number and percentage (n, %) of observations for each variable. The 95% confidence interval (CI) and χ^2 tests were estimated using *Stata* 12.0 software (StataCorp, 2011). A p-value < 0.05 was considered statistically significant (significance threshold: $\alpha = 0.05$).

Ethical approval

This study was approved by the Ethics Committee of the Kinshasa School of Public Health, University of Kinshasa (ESP/CE/115/2021). Informed consent was obtained from participants, guaranteeing the confidentiality of the collected data. Approval from the managers of the participating health centres was also obtained.

RESULTS

Socio-demographic characteristics

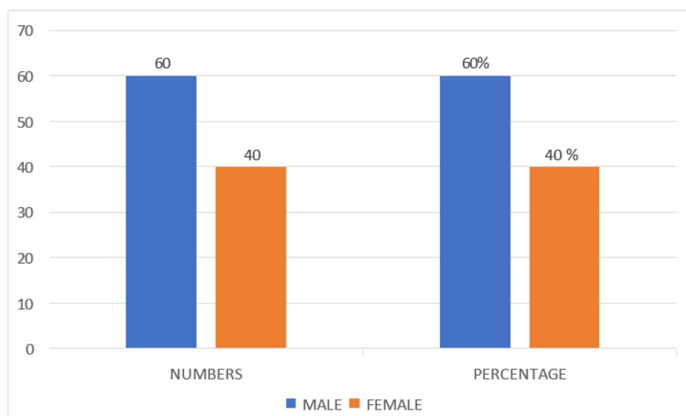
The 0–5-year age group was the most represented, comprising 36% of patients, followed by the 6–10-year age group (27%) and the 11–15-year age group (18%).

Table 1:
Distribution of patients by age group (months)

Age group	Number	Percentage (%)
0–5	36	36
6–10	27	27
11–15	18	18
16–20	7	7
21–25	5	5
26–30	4	4
31+	3	3
Total	**100**	**100**

Males accounted for 60% (95% CI: 50–69%) and females for 40% (95% CI: 31–50%). No significant sex difference was observed ($p = 0.12$).

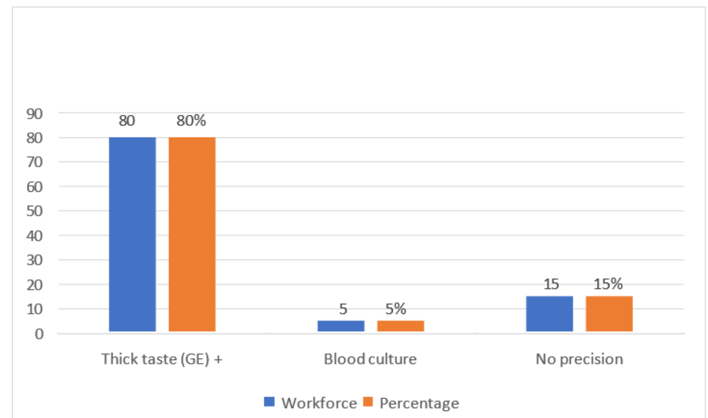
Figure 1:
Breakdown of patients by sex



Paraclinical parameters

A total of 80% (95% CI: 71–87%) of patients had a positive thick blood smear prior to treatment. However, 15% (95% CI: 9–23%) were treated without a confirmed diagnosis, and only 5% (95% CI: 2–11%) underwent blood culture testing.

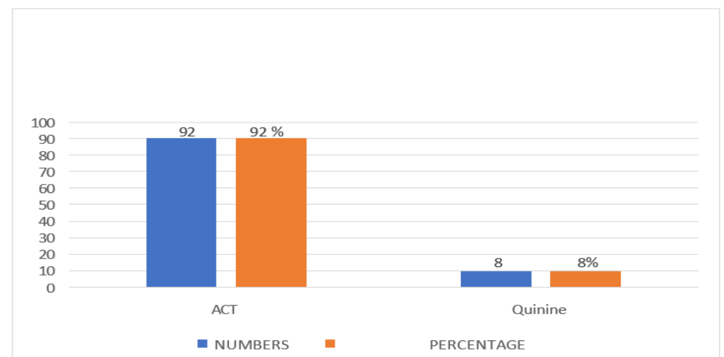
Figure 2:
Presentation of patients by biological and parasitological tests



Antimalarial drugs

ACTs were the most frequently prescribed antimalarial drugs, used in 92% (95% CI: 85–96%) of patients, whereas quinine was prescribed in only 8% (95% CI: 4–15%).

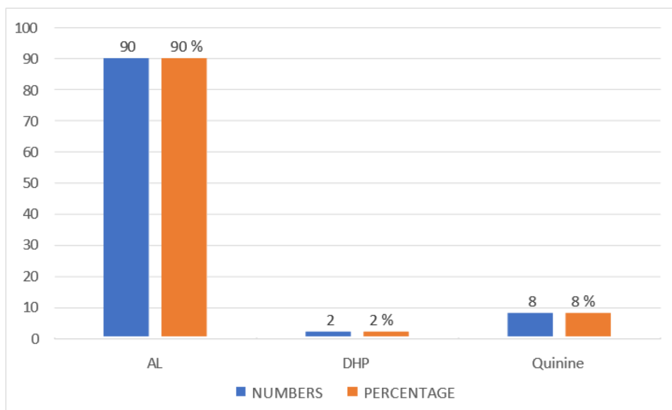
Figure 3:
Breakdown of patients by antimalarial drugs prescribed



Antimalarial drugs by International Nonproprietary Name (INN)

Among ACTs, artemether–lumefantrine (AL) predominated, accounting for 90% of ACT prescriptions.

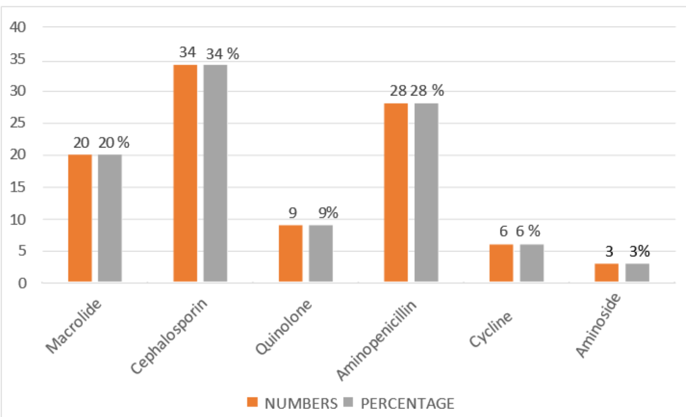
Figure 4:
Distribution of antimalarial drugs by International Nonproprietary Name (INN)



Antibiotics by family

Cephalosporins were the most commonly used antibiotic class (34%), followed by aminopenicillins (28%) and macrolides (20%).

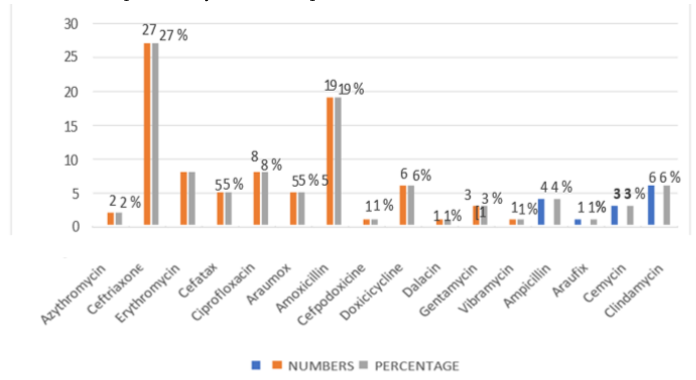
Figure 5:
Breakdown of antibiotics by family



Antibiotics prescribed

Ceftriaxone was the most frequently prescribed antibiotic, administered to 27% of patients, followed by amoxicillin (19%). Erythromycin and ciprofloxacin were each prescribed to 8% of patients.

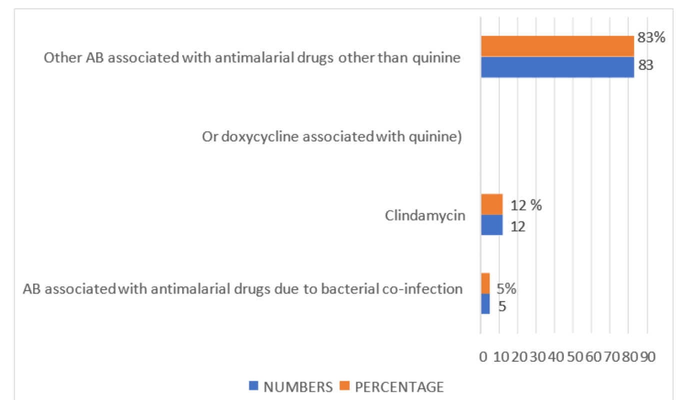
Figure 6:
Breakdown of patients by antibiotics prescribed



Antibiotics associated with antimalarial drugs

A total of 83% (95% CI: 75–90%) of patients received antibiotics other than doxycycline or clindamycin (the only antibiotics recommended for combination with quinine). Only 12% received quinine in combination with doxycycline or clindamycin.

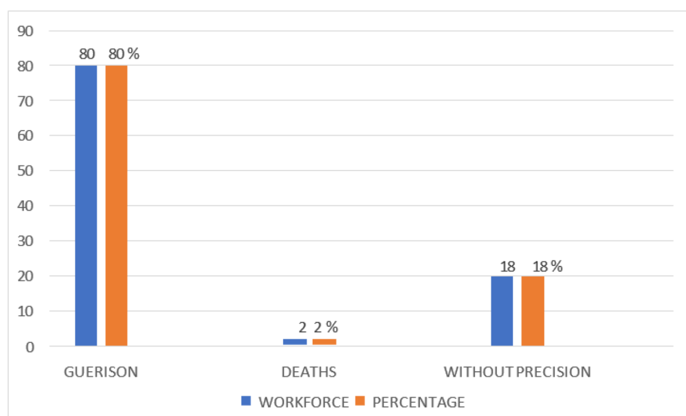
Figure 7:
Presentation of patients according to the use of Antibiotics associated with antimalarial drugs



Clinical outcomes

A favourable outcome was observed in 80% (95% CI: 71–87%) of patients.

Figure 8:
Breakdown of patients by stage of development



DISCUSSION

This study aimed to assess antibiotic use in the management of uncomplicated malaria and examine adherence to national treatment guidelines. Our findings show that antibiotics were prescribed extremely frequently in patients with uncomplicated malaria. Such co-prescription of antibiotics and antimalarials can contribute to the development of antibiotic resistance, a major public health concern (Fomba et al., 2020; Means et al., 2014).

We observed that 36% of patients were under five years of age—a particularly vulnerable group that accounts for a large proportion of malaria cases. This proportion is higher than those reported in previous studies conducted in the DRC in 2018 and in sub-Saharan Africa in 2023 (Ntamabyaliro et al., 2018; Baraka et al., 2023).

In our study, 80% of patients had a positive thick blood smear, whereas only 5% had a blood culture performed. Fifteen percent were treated without confirmatory diagnostic testing. The most commonly prescribed treatment for uncomplicated malaria was ACT, mainly AL, administered to 90% of patients. This is higher than the 82.3% reported in a sub-Saharan African study in 2023 (Baraka et al., 2023).

Although almost all patients with uncomplicated malaria received antibiotics, only 12% were prescribed in accordance with PNLP guidelines (in combination with quinine). In contrast, 83% of patients received antibiotics without specific indication—higher than the 42% reported in Uganda in 2014 (Means et al., 2014) and the 47% reported in Sweden in 2013 (Sandlund et al., 2013). Baraka et al. (2021) found a 65% co-prescription rate in Tanzania.

The majority of antibiotics prescribed in our study were inappropriate. Cephalosporins, particularly ceftriaxone, were most common (27%). Although the cure rate was high, inappropriate antibiotic use remains a concern due to the risk of resistance. Probabilistic antibiotic therapy without bacteriological confirmation—especially when blood cultures are rarely performed—can lead to resistant strains. This differs from practices in Sweden, where blood cultures were routinely obtained and causative organisms identified (Pessanha de Carvalho et al., 2021; Sandlund et al., 2013).

The clinical outcome was favourable in 80% of cases. Nevertheless, antibiotic prescribing did not align with WHO recommendations or the PNLP protocol. Further research is needed to identify factors driving inappropriate antibiotic use and to develop interventions that promote guideline adherence. Expanding sample size and improving prescriber training may contribute to better compliance and more effective management of uncomplicated malaria.

Given the increasing rates of antibiotic resistance worldwide and the frequent overlap of febrile manifestations, it is crucial to identify strategies to promote rational antibiotic use in malaria-endemic countries. Such an approach would limit the risk of resistance emergence and guarantee treatment efficacy for future generations. Further research is needed to better understand the factors underlying these inappropriate prescriptions and to develop strategies to improve clinical practices. In addition, a larger sample size and better training of prescribers could contribute to more compliant and effective management of uncomplicated malaria in the region.

We encountered several limitations. We conducted a retrospective study and selected a non-probabilistic convenience sample. Record keeping and data entry were often incomplete in the two health centres, with some providers possibly failing to record diagnoses. In some medical records, an antibiotic was indicated as prescribed, but in reality, it was never administered, potentially leading to an underestimation of misuse.

CONCLUSION

The inappropriate use of antibiotics in cases of uncomplicated malaria is widespread in Boma. Only 5% of patients underwent blood culture to detect co-infections. There is an urgent need to strengthen adherence to PNLP recommendations, promote rational prescribing, and encourage continuing education for healthcare professionals.

Ethical Approval: This study was approved by the Ethics Committee of the Kinshasa School of Public Health, University of Kinshasa (ESP/CE/115/2021).

Conflicts of Interest: None declared.

ORCID iDs:

Kilara, T. K.[1,2]: Nil identified
Pholo, J. P. M.[1,3]: Nil identified
Mpiempie, T. N.[2]: Nil identified
Ngale, M.[2]: Nil identified
Divengi, J. P. N.[2]: Nil identified
Kondani, M. A.[2]: Nil identified
Gimbindu, T. A.[2]: Nil identified
Velela, P. K.[2]: Nil identified
Ilenga, W. M.[1,4]: Nil identified
Balu, C. M.[1]: Nil identified
Woto, I. T.[5]: Nil identified
Bongenya, B. I.[5]: Nil identified
Mandoko, P. N.[1]: Nil identified
Nsengi, P. N.[2]: Nil identified
Kamangu, E. N.[5]: Nil identified
Mesia, G. K.[2,6]: Nil identified

Open Access: This original article is distributed under the Creative Commons Attribution Non-Commercial (CC BY-NC 4.0) license. This license permits people to distribute, remix, adapt, and build upon this work non-commercially and license their derivative works on different terms, provided the original work is properly cited, appropriate credit is given, any changes made are indicated, and the use is non-commercial. See: https://creativecommons.org/licenses/by-nc/4.0/.

REFERENCES

Baraka, V., Nhama, A., Aide, P., Bassat, Q., David, A., Gesase, S., ... & Manyando, C. (2021). Prescription patterns and compliance with World Health Organization recommendations for the management of uncomplicated and severe malaria: A prospective, real-world study in sub-Saharan Africa. *Malaria Journal, 20*(1), 215. https://doi.org/10.1186/s12936-021-03812-w

Baraka, V., Nhama, A., Aide, P., Bassat, Q., David, A., Gesase, S., ... & Manyando, C. (2023). Prescription patterns and compliance with World Health Organization recommendations for the management of uncomplicated and severe malaria: A prospective, real-world study in sub-Saharan Africa. *Malaria Journal, 22*(1), 215. https://doi.org/10.1186/s12936-023-04650-y

Fomba, S., Koné, D., Doumbia, B., Diallo, D., Druetz, T., Florey, L., ... & Ashton, R. A. (2020). Management of uncomplicated malaria among children under five years at public and private sector facilities in Mali. *BMC Public Health, 20*(1), 1888. https://doi.org/10.1186/s12889-020-09873-1

Mavoko, H. M., Nabasumba, C., Da Luz, R. I., Van Geertruyden, J.-P., Lutumba, P., & D'Alessandro, U. (2017). Efficacy and safety of re-treatment with the same artemisinin-based combination treatment (ACT) compared with an alternative ACT and quinine plus clindamycin after failure of first-line recommended ACT (QUINACT): A bicentre, open-label, phase 3, randomized controlled trial. *The Lancet Global Health, 5*(1), e60–e68. https://doi.org/10.1016/S2214-109X(16)30378-2

Means, A. R., Weaver, M. R., Burnett, S. M., Mbonye, M. K., Naikoba, S., & McClelland, R. S. (2014). Correlates of inappropriate prescribing of antibiotics to patients with malaria in Uganda. *PLoS ONE, 9*(2), e90179. https://doi.org/10.1371/journal.pone.0090179

Mvumbi, D. M. (2017). *Place de la biologie moléculaire dans l'épidémiologie, le diagnostic et l'évaluation de la chimiorésistance du paludisme en République Démocratique du Congo* (Doctoral thesis). Université de Kinshasa.

Ntamabyaliro, N. Y., Burri, C., Nzolo, D. B., Minja, D. T., & Van Bambeke, F. (2018). Drug use in the management of uncomplicated malaria in public health facilities in the Democratic Republic of the Congo. *Malaria Journal, 17*, 1–8. https://doi.org/10.1186/s12936-018-2335-0

Pessanha de Carvalho, L., Kreidenweiss, A., & Held, J. (2021). Drug repurposing: A review of old and new antibiotics for the treatment of malaria: Identifying antibiotics with a fast onset of antiplasmodial action. *Molecules, 26*(8), 2304. https://doi.org/10.3390/molecules26082304

Sandlund, J., Naucler, P., Dashti, S., Shokri, A., Eriksson, S., Hjertqvist, M., ... & Färnert, A. (2013). Bacterial

coinfections in travelers with malaria: Rationale for antibiotic therapy. *Journal of Clinical Microbiology, 51*(1), 15–21. https://doi.org/10.1128/JCM.02149-12

World Health Organization. (2005). *Integrated management of childhood illness (IMCI) manual*. World Health Organization.

World Health Organization. (2010). *Rational use of medicines*. World Health Organization.

World Health Organization. (2011). *World Health Day 2011: Combating drug resistance: No action today, no cure tomorrow*. World Health Organization.

World Health Organization. (2015). *Malaria treatment guidelines* (3rd ed.). World Health Organization. https://apps.who.int/iris/handle/10665/162441

World Health Organization. (2019). *World malaria report 2019*. World Health Organization.

World Health Organization. (2022). *World malaria report 2022*. World Health Organization. https://www.who.int/teams/global-malaria-programme/reports/world-malaria-report-2022