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ASSESSMENT OF ARTEMISININ-BASED COMBINATION THERAPY (ACT) PRESCRIPTION PATTERNS AND PRACTICES IN PRIVATE HEALTHCARE FACILITIES IN LAGOS STATE, NIGERIA

IBU, Josephine Moshe[1]; ETIM, John John[2*]; EFEJENE, Israel Ofejiro[3]; EKPO, Ekpo Iyamba[4]; OTALI, Cyril Chinedu[5]; ETIM-JOHN, Obasesam John[6]; AGBIJI, Nneka Ndifon[7]; & IDEM, Iboro Ekaette[8]

[1]*Department of Nursing, School of Allied Health Sciences, Miva Open University, Abuja, Nigeria*

[2]*Health Services Management and Health Policy Unit, Department of Public Health, Faculty of Allied Medical Sciences, College of Medical Sciences, University of Calabar, Nigeria.*

[3]*Department of Pharmacology, College of Medical and Health Sciences, Novena University, Ogume, Delta State, Nigeria*

[4]*Department of Radiography, College of Health Technology, Calabar, Nigeria*

[5]*Department of Biological Sciences, Novena University, Ogume, Delta State, Nigeria*

[6]*Department of Radiography and Radiological Sciences, University of Calabar Teaching Hospital, Nigeria*

[7]*Environmental Health Unit, Department of Public Health, Faculty of Allied Medical Sciences, College of Medical Sciences, University of Calabar, Nigeria.*

[8]*Department of Pharmacology and Toxicology, Faculty of Pharmacy, University of Calabar, Nigeria*

Corresponding author: Etim, John John; University of Calabar, Nigeria, Email: etmjhn@gmail.com; Tel: +2348063809268

Abstract

Malaria remains a significant public health challenge across 97 countries and territories in tropical and subtropical regions. Prompt and accurate diagnosis is essential for effective malaria management. This study aimed to evaluate the prescription patterns of Artemisinin-Based Combination Therapies (ACTs) and related practices in private health facilities in Lagos State, Nigeria. A cross-sectional descriptive study design was employed, utilizing a questionnaire checklist to gather data from 21 practicing physicians and 2,720 patients. Data analysis was conducted using the Statistical Product for Social Sciences (SPSS) version 26, with results presented through descriptive statistics. Artemether-Lumefantrine was the most frequently prescribed ACT, accounting for 47.33% of prescriptions (1,305 patients). Commonly prescribed brands included Coartem, Lonart, and Amatem Forte, with formulations adapted as tablets, dispersible tablets, or suspensions where appropriate. Additionally, ciprofloxacin (23.31%) and azithromycin (17.48%) were frequently prescribed, reflecting a tendency toward combining ACTs with antibiotics and analgesics for malaria treatment and management. The findings indicate a prevailing practice of integrating ACTs with other medications, often without strict adherence to confirmatory diagnostic protocols. To optimize malaria treatment outcomes, it is recommended that healthcare practitioners adhere to best practices by utilizing ACTs solely after confirmatory laboratory tests to ensure accurate diagnosis and treatment.

Keywords: Prescription pattern, Artemisinin-Based Combination Therapy, Antimalarial, Practice, Malaria.

Introduction

Malaria remains a major public health challenge, affecting 97 countries and territories across tropical and subtropical regions. Prescription patterns and practices for ACT antimalarial drugs vary significantly by region. Globally, an estimated 214 million malaria cases occur annually, with 3.2 billion people at risk of contracting the disease (WHO, 2015). In 2015 alone, approximately 438,000 deaths were attributed to malaria, with sub-Saharan Africa accounting for 90% of these fatalities (WHO, 2015). To address this crisis, the World Health Assembly in 2005 established a key Millennium Development Goal to reduce malaria infections and deaths by 75% between 2005 and 2015 (WHO, 2005). This ambitious target has influenced prescription practices and shaped efforts to standardize antimalarial drug use globally. Over the past decade, there has been a

significant resurgence of interest in research and innovations targeting malaria, including advancements in diagnostic methods, drug development, vaccines, and control measures aimed at eradication (Korenromp et al., 2013). Consequently, malaria incidence rates experienced a global reduction of 30% and a 34% decline in Africa between 2000 and 2013 (Murray et al., 2014). These achievements are also influenced by variations in prescription patterns and medical practices.

Prompt and accurate diagnosis is essential for the effective management of malaria. The global burden of malaria has driven efforts to develop effective diagnostic strategies, particularly in resource-limited settings where the disease has a profound societal impact. These efforts are also relevant in developed countries, where diagnostic expertise for malaria is often insufficient (Reyburn et al., 2007). Malaria diagnosis involves detecting malaria parasites, antigens, or their products in a patient's blood. While the process may appear straightforward, it is influenced by a range of factors that complicate diagnostic efficacy and subsequent treatment practices. Key factors affecting malaria diagnosis include the complexity of the five malaria species and their various forms, as well as the different stages of erythrocytic schizogony. Additionally, the endemicity of malaria species, levels of transmission, population mobility, and host factors such as parasitemia, immunity, and clinical symptoms all interact to affect diagnostic accuracy. Other challenges include drug resistance, recurrent malaria, and the presence of viable or non-viable parasitemia, as well as parasite sequestration in deeper tissues. Chemoprophylaxis and presumptive treatments based on clinical diagnosis can further complicate the identification and interpretation of malaria parasitemia in diagnostic tests. These complexities also influence prescription patterns and treatment practices (Tangpukdee et al., 2009).

The prescription of antimalarial drugs varies widely, reflecting the diversity of treatment approaches to manage malaria. Current antimalarials used in clinical practice include quinolines, naphthoquinones, acryl alcohols, antifolates, antibiotics, and artemisinins (Maiga et al., 2021). Artemisinin-Based Combination Therapies (ACTs) are particularly significant due to their efficacy in treating Plasmodium falciparum, the most lethal malaria species. However, prescription patterns are shaped by factors such as drug availability, resistance, patient adherence, and diagnostic accuracy. This study focuses on evaluating the prescription patterns of ACTs and related practices in private health facilities in Lagos State, Nigeria. Understanding how ACTs are prescribed and utilized within this context is critical for optimizing treatment outcomes and combating malaria effectively. Addressing the interplay between diagnostic strategies and prescription practices will not only enhance malaria management in resource-limited settings but also contribute to global efforts to reduce the burden of this disease.

Methods

The study was conducted in private hospitals across Lagos State, Nigeria, selected through a randomized process to ensure a representative sample of healthcare facilities. A descriptive cross-sectional study design was employed, which is well-suited for assessing the prescription patterns of Artemisinin-based Combination Therapy (ACT) and understanding associated practices within a defined period and setting. To collect relevant data, the study utilized prescriptions obtained from the pharmacy departments of the selected hospitals. These prescriptions provided direct insight into physicians' prescribing habits concerning ACTs, enabling an evaluation of how this widely recommended antimalarial therapy is implemented in clinical practice. A questionnaire checklist

served as the primary instrument for data collection, designed to gather comprehensive information on prescribing trends and patterns.

The data collection process spanned three months, from June 2021 to August 2021. This period was sufficient to capture a broad range of prescribing practices and patient encounters, ensuring the reliability of the findings. In total, the study involved 26 private medical facilities, encompassing a significant portion of Lagos State's healthcare landscape. Data were obtained from 2,720 patients who received prescriptions during the study period, alongside input from 21 actively practicing physicians. This combination of patient and physician data provided a robust foundation for analyzing prescription trends and identifying factors influencing ACT utilization. Data analysis was conducted using Version 26 of the Statistical Product for Social Sciences (SPSS), a widely recognized software tool for statistical analysis in public health research. The use of SPSS ensured accurate and systematic data processing. Descriptive statistics, including frequencies and percentages, were employed to summarize the data, presenting the findings in a clear and interpretable manner. Tables were used to organize and display the results, facilitating easy comparison and interpretation of the observed prescription patterns.

The study's methodology reflects a rigorous approach to understanding ACT prescription practices within private healthcare settings in Lagos State. By integrating data from multiple facilities and combining patient records with physician insights, the research provides a comprehensive view of how ACTs are prescribed and utilized in a real-world context. The use of a cross-sectional design and standardized analytical methods ensures that the findings are both relevant and reliable, offering valuable contributions to ongoing efforts to optimize malaria management in Nigeria and beyond. This systematic approach not only highlights the importance of monitoring prescription

practices but also underscores the role of private healthcare providers in shaping the effective use of ACTs. The findings from this study can inform strategies to improve adherence to treatment guidelines, enhance patient outcomes, and address challenges associated with antimalarial prescription in resource-limited settings.

Results

A total of 2,720 malaria cases treated with various antimalarial drugs, including Artemisinin-based Combination Therapy (ACT), were recorded. Female patients accounted for 1,397 cases (51.36%), while male patients constituted 1,160 cases (42.65%). The highest proportion of prescriptions was observed in the age group 21–30 years (30.45%), whereas individuals aged above 50 years represented the lowest proportion of antimalarial prescriptions (7.43%). The prescription patterns for the different antimalarial drugs used are detailed in Table 1. ACTs were the most frequently prescribed antimalarials, in alignment with the World Health Organization (WHO) guidelines for the treatment of uncomplicated *Plasmodium falciparum* infections. The observed dosage forms included intramuscular (IM) injections, oral tablets, and pediatric suspensions, reflecting efforts to tailor treatment to patient-specific needs.

Table 1: Antimalarial drug prescribed to patients

Antimalarial drug	Dosage form	Quantity	Percentage
sulfadoxine/pyrimethamine	Tablet	579	21.00%
Artesunate	Tablet	147	5.00%
Artemether+Lumefantrine	Tablet/Syrup	1305	47.33%
I.M Artemether	Injection	172	6.24%
I.M Artesunate	Injection	87	3.16%
Dihydroartemisinin-Piperaquine	Tablet	151	5.48%
Artesunate-Mefloquine	Tablet	26	0.94%
Artesunate-Amodiaquine	Tablet	23	0.83%

Artesunate-Pyronaridine	Tablet	0	0.00%
Artesunate+ SP	Tablet	110	3.99%
Artemether+Lumefantrine+ SP	Tablet	157	5.69%

Discussion

Key Findings

The study highlighted a range of prescribed antimalarial drugs, including both Artemisinin-based Combination Therapies (ACTs) and other treatments. Among non-ACT options, sulphadoxine-pyrimethamine was prescribed in 21% of cases, predominantly as a prophylactic treatment and often as part of antenatal care. This finding aligns with Ayogu et al. (2015), who reported similar prescription trends. ACTs, however, dominated prescription patterns, with Artemether-Lumefantrine observed as the most commonly prescribed ACT, accounting for 47.33% of cases (1,305 patients). Artemether-Lumefantrine's widespread use reflects its general acceptability, availability, and lower incidence of side effects. Commonly prescribed brands included Coartem, Lonart, and Amatem Forte, available in tablet, dispersible, and suspension forms. This trend corresponds with Maiga et al. (2021), who identified similar prescription patterns, emphasizing its reliability and effectiveness in malaria treatment.

The study also revealed the use of other antimalarials. Artesunate monotherapy was prescribed with a frequency of 5%, while intramuscular (I.M.) Artemether and Artesunate were prescribed at frequencies of 6.24% and 3.16%, respectively. Dihydroartemisinin-piperaquine was used in 5.48% of cases. Artesunate-mefloquine and Artesunate-amodiaquine combinations were less commonly prescribed, with frequencies of 0.94% and 0.83%, respectively. Notably, no prescriptions for Artesunate-pyronaridine were recorded due to its unavailability. These findings are consistent with WHO (2018), which noted that prescription patterns vary regionally based on drug availability and

prescriber preferences. Antibiotics were frequently co-prescribed with ACTs to ensure complete parasite clearance. Ciprofloxacin and azithromycin were the most commonly prescribed antibiotics, with frequencies of 23.31% and 17.48%, respectively. Ciprofloxacin's popularity is attributed to its ability to enhance the antimalarial activity of drugs like Artesunate, Artemether-Lumefantrine, and Artesunate-amodiaquine. Ayogu et al. (2015) observed similar trends, suggesting that ciprofloxacin combinations may be beneficial in treating *Plasmodium falciparum* infections or co-infections with salmonellosis.

Azithromycin also emerged as a commonly used antibiotic, supported by Van Eijk (2011), who emphasized its activity against plasmodia in vitro, animal models, and clinical settings. This antimicrobial, often used for respiratory infections, has shown promising activity when combined with chloroquine (CQ). Dunne (2005) conducted a clinical study demonstrating the effectiveness of such combinations, reinforcing the observed prescription patterns in this study. The study revealed that other classes of medications, including multivitamins and analgesics, were frequently prescribed alongside antimalarials. Multivitamins such as folic acid, ferrous sulphate, calcium, and vitamin B complex were prescribed in 21.54% of cases, likely to support overall patient health. Analgesics were even more commonly prescribed, with a frequency of 37.17%, to manage symptoms like fever and pain associated with malaria.

Confirmatory testing played a critical role in the prescription of ACTs. Approximately 71.4% of prescribers indicated that they only prescribed ACTs after a positive laboratory diagnosis, aligning with best practices. However, patient demands occasionally influenced prescription decisions. About 18.8% of prescribers reported that patients requested alternative antimalarials, such as

quinine, believing them to be more effective. Similarly, 12.5% of prescribers encountered patients specifically requesting chloroquine. Responses to these demands varied:

- 61.1% of prescribers counseled patients on the importance of ACTs and resisted non-guideline prescriptions.
- 27.8% accommodated patient requests, prioritizing their preferences.
- 11.1% neither counseled patients nor adhered strictly to ACT recommendations.

These findings resonate with Maryah et al. (2017), who reported similar dynamics in a study on antimicrobial use in Maiduguri, Northern Nigeria. Adverse effects of ACTs were reported by 19% of prescribers, including symptoms such as nausea, dizziness, and rashes. The majority (81%) indicated no adverse reports from patients. This aligns with Akande and Ologe (2007), who found similar outcomes in a study of prescription patterns at secondary health facilities in Ilorin, Nigeria.

Conclusion

The study provides valuable insights into the prescription patterns of antimalarials in private health facilities in Nigeria. The dominance of ACTs, particularly Artemether-Lumefantrine, underscores adherence to WHO guidelines for managing uncomplicated *P. falciparum*. The co-prescription of antibiotics like ciprofloxacin and azithromycin highlights efforts to enhance treatment outcomes, while multivitamins and analgesics address additional patient needs. However, challenges remain, including non-compliance with confirmatory testing and patient-driven requests for alternative treatments. Addressing these gaps through continued education and policy enforcement will enhance the effectiveness of malaria management strategies.

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Authors' contributions

Ibu JM did the corrections and reviews; Etim JJ did the data analysis; Efejene IO conceptualized the study and initial draft; Ekpo EI was involved in the reviews; Otali CC was involved in the supervision of the research; Etim-John, OJ was involved in data curation; Agbiji NN took part in proofreading the manuscript; Idem IE was involved in the methodology.

Conflict of interest declaration

None declared.

Ethical consideration declaration

Administrative and ethical approval was sought and obtained from the College of Medicine of the University of Lagos Health Research Ethics Committee with reference number; CMUL/HREC/0918/19. Verbal informed consent was also sought at the point of data collection.

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Author Biographies

IBU J. M; Miva Open University, Abuja

Dr. Josephine is the Head of the Department of Nursing Science at Miva Open University, Abuja, Nigeria. She is a leader in healthcare education with a passion for improving lives that has been evident throughout her impressive career. She is a Fellow of the West African College of Nursing, a registered nurse, and a midwife. Dr. Josephine has a Ph.D., Master's, and Bachelor of Science in Nursing Education, demonstrating her commitment to knowledge. Her experience is as diverse as her qualifications. She has served as a preceptor at the National Open University of Nigeria, guiding registered nurses in utilizing hospital protocols and bridging the gap between theory and practice. She has also worked with the military and corporate organiztions, managing employee wellness programmes. Her passion for enhancing healthcare in underprivileged communities is fueled by her desire to stop mother-to-child HIV transmission. This passion extends to her research interests which focus on the contributions community health workers can make to strengthening preventive and rehabilitative care.

ETIM J. J (PhD-c); University of Calabar

Etim John John is a distinguished lecturer and researcher at the Department of Public Health (Health Services Management and Health Policy Unit) at the University of Calabar, Cross River State, Nigeria. He is the founder and CEO of Joet's Humanitarian Services. He has lectured at Novena University for four years where he was appointed examination officer, served as a member of the examination monitoring and quality assurance team, developed the Core Curriculum Minimum Academic Standard (CCMAS) for the Nigerian University Commission (NUC) where he developed the 30% additional Public Health courses, Secretary to accreditation preparation team/committee, and reviewer of the students' handbook for the public health undergraduate programme. Etim John is a charismatic, dedicated and conscientious public health professional with research, statistics, Human Resources for Health (HRH), health services management, health

policies and mental health knowledge and experience. A graduate with a Bachelor of Public Health (BPH), Master of Public Health (MPH) with specialization in health services management, and Doctor of Philosophy (Ph.D.) in Public Health (in-view) from the University of Calabar. He also has experience designing public health interventions, systematic reviews and meta-analyses, data collection, analysis and interpretation with proficiency in Microsoft and Statistical Package for Social Sciences (SPSS), Epi-Info, RevMan-5, and R-stat. He has consulted for some NGOs including Sydani Groups (Sydani Institute for Research and Innovations SIRI), Achieving Health Nigeria Initiative -AHNi, Initiative for People's Good Health, etc. Etim is focused, diligent and task-oriented. He intends to contribute immensely to community development, teaching, research and public health programmes. His philosophy is to make research meaningful through effective and efficient use of data from source to coding, analysis, interpretation, reporting and publication in reputable peer-reviewed journals.

EFEJENE I. O; Delta State University, Abraka

Efegene, Ofejiro Israel holds a bachelor's degree in Pharmacology from Delta State University, Abraka with a research on the effect of herbicide garri on haematological parameters and a master's degree from the University of Lagos, with a thesis on the evaluation of antibiotics and analysis of ciprofloxacin and gentamycin residue in fish sample. He is presently undergoing his doctoral program in pharmacology at the DELSU joint Canada-Israel Neuroscience and Biopsychiatric Laboratory, Department of Pharmacology with a keen interest in the impacts of drugs on prenatal depression. He presently teaches, researches and supervises pharmacology to several students at the College of Medical and Health Sciences of Novena University, He has served as a course adviser, departmental examination officer, and CCMAS 30% course committee member. He has attended several scientific conferences in which his abstract has been published in several books of abstract. He has published several research articles in both local and international reputable journals. He is keen to grow his research interest in neuroscience, antimicrobials and public health with also basic skills in the analysis and interpretation of data.

EKPO E. I; College of Health Technology Calabar

Ekpo, Ekpo Iyamba is a Lecturer at the College of Health Technology Calabar, Cross State. He holds a National Diploma in Medical Image Processing/x-ray Technician from the College of Health Technology, Calabar, a Bachelor of Science degree from Ebonyi State University and a Master's degree in-view from the same university with specialty in medical biochemistry. Mr Iyamba worked with General Hospital Ugep in Yakurr Local Government Area before transferring his services to the College of Technology Calabar. In the college, he has been a seasoned lecturer involved in teaching and mentoring students. He has served as a member of the college examinations committee, treasurer Academic Staff Union of Polytechnics (ASUP) College of Health Technology Calabar Chapter, Board member representing Congress in the academic board of the college and presently examination officer in the department of radiography and a deputy director in the consultancy services unit.

OTALI C. C; Novena University Ogume

Cyril is a lecturer in the Department of Biological Sciences, Novena University Ogume, Delta State, Nigeria. He has BSc, masters and PhD degrees in his field of expertise. He has mentored different students and published different manuscripts in both local and international peer-reviewed journals. He has attended different professional conferences where he presented mind-blowing papers and abstracts.

ETIM-JOHN, Obasesam John (MPH-c); University of Calabar Teaching Hospital

Obasesam is a distinguished radiographer and a researcher in the Department of Radiology, at the University of Calabar Teaching Hospital. She holds a Bachelor of Science (B.Sc.) degree in Radiography and Radiological Sciences from the University of Calabar and currently undergoing a Master's programme in Epidemiology. She has professional post-graduate training with certifications in Obstetrics and gynecology ultrasonography from the Nigerian Institute of Radiographers, improving breast and gynecological cancer management and outcomes from the International Center for the Study of Breast Cancer Subtypes (ICSBCS) and Morehouse School of Medicine Atlanta, Georgia. She is a licensed radiographer and a member of the Radiographers Registration Board of Nigeria. She has published in high-impact journals and has a passion for improving radiographic and radiological practice in line with public health practice as an epidemiologist (Public Health Radiographer). She is diligent and dedicated to improving the lives of patients and students as a Public Health Radiographer.

AGBIJI N. N; University of Calabar

Nneka is a distinguished lecturer and a passionate researcher at the Department of Public Health, University of Calabar in Cross River State, Nigeria. She holds a Bachelor of Science in Microbiology and a master's in Public Health and Microbiology both from the prestigious Abia State University Uturu, Abia State, Nigeria. Nneka is currently PhD in Public Health and Environmental Microbiology student. She has been trained and has attended so many conferences. She is an expert in environmental health. Worked with Cross River University and taught so many courses including being the seminar/project coordinator of the Department of Microbiology. Written books on environmental impacts and supervised students. She is a researcher and a consultant to some NGOs including A-STEF, GAP and many others. She believed that education is the door to freedom. Nneka won the award of the outstanding lecturer in the Department of Microbiology, University of Cross River, Calabar.

IDEM I. E; University of Calabar

Dr. Iboro Idem is academically credentialed with a Doctor of Philosophy (Ph.D.) in Pharmacology and Toxicology, awarded by the University of Uyo, Nigeria. Her expertise stretches nearly two decades across primary, secondary, and tertiary levels of education. Her comprehensive experience encompasses a wide array of domains, including but not limited to teaching, academic writing, strategic programme planning, staff recruitment process, capacity enhancement initiatives, career counseling and guidance, technical education methodologies, and the development of curricula. Dr. Idem has served as the Rector of Uyo City Polytechnic, Uyo, Nigeria, a position that underscores her remarkable leadership and administrative skills. She also held the position of Head of the Department of Science and Laboratory Technology at Heritage Polytechnic in Eket, Nigeria. She is a director at Ultra Tomorrow Educational Consult, Uyo, Nigeria. She is presently a senior lecturer in the Department of Pharmacology and Toxicology, Faculty of Pharmacy, University of Calabar, Nigeria.