PRESCRIBERS' ADHERENCE TO NATIONAL GUIDELINES FOR MALARIA CASE MANAGEMENT AMONG UNDER-FIVES AND ASSOCIATED FACTORS IN TABORA, TANZANIA, 2024

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By

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A Dissertation Submitted in (Partial) Fulfilment of the Requirements for the Degree of Master of Science in Applied Epidemiology of

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CERTIFICATION

The undersigned certify that they have read and hereby recommend for acceptance by Muhimbili University of Health and Allied Sciences dissertation entitled; **‘‘Prescribers’ adherence to national guidelines for malaria case management among under-fives and associated factors in Tabora, Tanzania, 2024’’, in** (partial) fulfillment of the requirements for the degree of Master of Science in Applied Epidemiology of Muhimbili University of Health and Allied Sciences.

Prof. Donath Tarimo

(Supervisor)

Date



Dr. Mohamed Ally Mohamed

(Co-supervisor)

Date

DECLARATION AND COPYRIGHT

I, **Evelyine B. Ngoli**, declare that this **dissertation** is my original work and that it has not been presented and it will not be presented to any other University for the similar or any other degree award.

Signature…… **Date**……...….....

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ABSTRACT

Background: Adherence to prompt and accurate case management of malaria by parasitological confirmation and treatment with standard antimalarials in areas that have maintained high malaria transmission is particularly important for the most vulnerable populations such as young children in whom Plasmodium falciparum malaria can rapidly be fatal. Parasitological confirmation and adherence to test results will reduce unnecessary treatment with antimalarials and prompt the search for the other causes of febrile illnesses. Despite the reported benefits of test-treat policy, non-adherence to guidelines is still a common practice among prescribers, posing a threat to malaria control efforts, especially with the growing concerns of antimalarial drug resistance in several countries. This study aimed to determine prescribers' level of adherence to guidelines for malaria case management among under-fives and explore factors influencing adherence or non-adherence in Tabora region.

Methodology: Facility-based explanatory sequential mixed-methods design was conducted. Exit interviews with caregivers of 487 under-five patients and a review of their clinical records were conducted to evaluate the adherence of prescribers to malaria management guidelines. Adherence was assessed based on three criteria: performing a malaria test, prescribing antimalarials for positive cases, and using Artemether-Lumefantrine (ALu) as the first-line treatment. For quantitative analysis, caregivers' exit interviews and clinical records reviews of 487 under-fives were conducted to determine the proportion of under-fives that were managed per guidelines. Patient-related predictors of guidelines adherence were subjected to bivariable and multivariable analysis using a modified Poisson regression model to determine crude and adjusted Prevalence Ratios and their 95% Confidence intervals, with statistical significance set at $p < 0.05$. Using modified grounded theory, qualitative data analysis involved in-depth interviews (IDIs) with 14 prescribers to identify factors for non-adherence to guidelines.

Results: Out of 487 enrolled under-fives, the majority (469/487, or 96.5%) presented with fever, and 241/487 (49.5%) had one or more comorbidities, most commonly acute respiratory tract infections, 136/241 (56.4%). All 487 under-fives were prescribed antimalarials, but only

353/487 (72.5%) were tested for malaria using either a malaria Rapid Diagnostic Test (mRDT) or microscopy, and 134/487 (27.5%) were not tested. Of those tested, 273/353 (77.3%) were positive, while 80/353 (22.7%) were negative. Out of all tested positive, 262/273 (96.0%) were prescribed the first-line antimalarial Artemether-Lumefantrine (ALu). Overall, 53.2% of the children were managed in adherence to malaria treatment guidelines, with private health facilities showing 21% higher compliance compared to public ones (aPR = 1.21, 95% CI: 1.05–1.40). Factors influencing non-adherence included inconsistent availability of medical supplies, staff shortages, lack of alternative diagnostic tests, distrust in mRDT results, clinical experience, perceptions of malaria prevalence, previous IMCI training, and caregiver expectations.

Conclusion: Prescribers' level of adherence to malaria case management guidelines is sub-optimal. Non-adherence to guidelines was influenced by factors related to prescribers, health systems, and patients/caregivers. Improving health system challenges, conducting supportive supervision and mentorship to prescribers, and community education to align their expectations with evidence-based practices will enhance guideline adherence, improve quality of care, and reduce unjudicial use of anti-malaria medications.

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ABBREVIATIONS

ACT	Artemisinin-based Combination Therapy
ALU	Artemether-Lumefantrine
ARTI	Acute Respiratory Tract Infections
CDC	Centres for Disease Control and Prevention
CHMT	Council Health Management
CIs	Confidence Interval
DMO	District Medical Officer
IDI	In-Depth Interview
IMCI	Integrated Management of Childhood Illness
MIS	Malaria Indicator Survey
MMO	Municipal Medical Officer
MOH	Ministry of Health
MRDT	Malaria Rapid Diagnostic Test
MUHAS	Muhimbili University of Health and Allied Sciences
NMCP	National Malaria Control Program
PORALG	President's Office, Regional Administration, and Local Government Tanzania
PPS	Probability Proportional to Size
RHMT	Regional Health Management Team
TFELTP	Tanzania Field Epidemiology and Laboratory Training Program

DEFINITION OF TERMS

Presumptive malaria case: Case suspected to be malaria based on patient's presenting symptoms without a parasitological confirmation.

Uncomplicated malaria: Malaria case with positive test results but without signs of severity or evidence of vital organ dysfunction.

Confirmed malaria case: Malaria case in which malaria parasite has been identified through microscopy or mRDT.

Malaria case management: Includes strategies and interventions implemented to diagnose and treat individuals infected with malaria.

Adherence to malaria case management guidelines: Malaria case management guideline is adhered to when a suspected malaria case has undergone diagnostic testing and treatment provided to positive test results with recommended first-line anti-malaria, Artemether-Lumefantrine (ALu).

Malaria risk stratification: The categorization of geographical regions is based on the degrees of malaria prevalence and transmission intensity.

Prescriber: Any healthcare provider who evaluates patients, diagnoses their conditions, orders necessary laboratory tests, and decides on the most suitable treatment plan.

CHAPTER ONE

1.0 INTRODUCTION

1.1 Background

Global efforts to combat malaria including initiatives like the distribution of insecticide-treated bed nets, indoor residual spraying, and improved access to accurate diagnosis and effective treatment, have led to a notable decrease in the global malaria burden (1,2). Between the years 2000 and 2019, there was a 27% decrease in the global incidence of malaria cases and a 29% reduction in malaria cases in the African region which bears the highest malaria burden (1). Despite these achievements, malaria remains a significant public health challenge, particularly in African countries, causing substantial morbidity and mortality (2–6). In 2021, malaria cases globally increased to 247 million, with the African region contributing to approximately 95% of all cases (2).

Effective malaria control interventions have significantly reduced the overall malaria burden among under-fives in Tanzania by over 50%, from a prevalence of 18.1% in 2007 to 8% in 2022, with some regions achieving prevalence rates below 1% (7,8). Despite this overall progress, certain regions continue to face moderate to high transmission risk (9). Tabora region, in particular, has maintained a persistently high transmission risk since 2016, exceeding 10%, indicating the ongoing challenges in malaria control efforts (9–11).

Proper management of malaria is crucial in preventing further transmission and reducing malaria cases (12–15). Inadequate treatment and underdosing of medications can lead to hyperparasitaemia, contributing to the development of drug resistance, a growing concern in malaria-endemic regions (16). Plasmodium falciparum, the malaria-causing parasite, has shown resistance to artemisinin-based combination therapies in several countries (17–19), highlighting the urgency of appropriate interventions to combat drug resistance.

For years, presumptive treatment strategies were widely advocated in resource-limited and high-endemic settings, primarily due to the elevated fatality rate associated with malaria and other infections in children under the age of five. In these settings, prescribers received training in

Integrated Management of Childhood Illnesses (IMCI), which involved treating fever cases as malaria without confirmatory testing (20). However, diagnosing malaria based on clinical symptoms like fever is challenging, as these symptoms are not specific to malaria, posing a problem in distinguishing it from other febrile illnesses (21,22). To improve accuracy and avoid unnecessary treatment, the World Health Organization (WHO) recommends “test and treat policy” in high transmission settings, which involves testing all suspected cases for malaria confirmation before administering anti-malarial medications (23), and this policy has proven to be beneficial towards reducing overtreatment with anti-malaria medication (24). The national guidelines for malaria case management mandate that at least 85% of all under-fives suspects of malaria infection be confirmed through MRDT or microscopy. Treatment should be administered only to patients with positive test results, using the first-line anti-malaria medication, ALu, for uncomplicated malaria (25).

Despite the widespread dissemination of clinical practice guidelines, there remains a challenge in effecting significant changes in prescribers' behaviors to align with them (26), non-adherence to malaria case management protocols by prescribers, particularly prescribers is quite a common practice, especially in African countries (27–32). In areas with high malaria endemicity, prescribers may develop a perception that all fevers are caused by malaria leading to over-reliance on presumptive diagnosis and treatment without considering alternative diagnoses (26,33). Furthermore, prescribers may hold the perception that the variations in malaria risk among regions indicate a partial efficacy of the recommended current technologies which may contribute to several challenges in adherence to guidelines (34).

Prescribers may also feel pressured to provide presumptive treatment due to patient expectations and the fear of missing a case, which could lead to severe consequences, including death if left untreated. Consequently, they may be reluctant to deviate from established practices, even in the presence of evidence-based guidelines promoting diagnostic testing before treatment (35). Additional factors such as prescriber's age, sex, education level, and years of clinical practice within healthcare settings may also influence decision-making processes and attitudes toward adherence to guidelines (36–40). Supportive supervisions, training, and availability of essential

resources such as guidelines, malaria diagnostic tests, and anti-malaria medications directly impact prescribers' ability to adhere to malaria case management guidelines. Limited access to essential resources can challenge healthcare providers to adhere to guidelines and may lead to deviations from standard protocols (36). The rise in cases of non-malarial is also a significant challenge to prescribers. Limited diagnostic capabilities for non-malarial fevers often lead to resorting to presumptive diagnoses, often resulting in over-treatment with antimalarial drugs (35).

1.2 Problem statement

Significant achievements in controlling malaria in Tanzania have been attained with several regions experiencing a prevalence below 1%. However, despite this overall progress, certain regions still face a substantial burden of the disease with prevalence exceeding 10% (9,41). Tanzania Demographic and Health Survey and Malaria Indicator Survey (TDHS-MIS) 2022 revealed significant variations in malaria prevalence among under-fives across different regions in Tanzania ranging from less than 1 % in every region in Zanzibar, Arusha, Kilimanjaro, Manyara, Dodoma, Singida and Songwe, to 20% in Mtwara and 23% in Tabora (9). This differential malaria risk stratification may have potential implications on prescribers' adherence to guidelines. In areas such as Tabora, which are classified as high transmission risk, the sustained disease burden may influence prescribers' clinical decisions, potentially leading to deviations from recommended protocols. This can cause prescribers to not comply with testing protocols, dismiss negative test results, opt for antimalarials other than the recommended first-line treatment, and resort to antibiotics due to uncertainties about the causes of fever in cases with negative test results (35). It is not fully understood how various factors impact prescriber adherence to malaria treatment guidelines in high transmission settings. This study aimed to assess the levels of adherence to the guidelines among under-fives as well as to explore the factors that influence adherence or non-adherence.

1.3 Conceptual framework

This study examined the management of malaria among under-fives, addressing both diagnostic and treatment aspects to determine prescribers' level of adherence to guidelines when managing these patients and exploring the influencing factors. The first level of adherence was to determine the extent to which clinical suspicion leads to actual diagnostic testing. The second level was evaluating whether prescribers adhere to test results, prescribing antimalarial drugs only to those confirmed with malaria. And the third level was whether the prescribed antimalaria is the recommended first line. Adherence to malaria case management guidelines can be influenced by several factors which can be related to the patient, prescribers, health system, and other factors.

Patient-related factors characteristics and conditions of patients can influence prescribers' decisions which in turn affects their adherence to guidelines or shapes their attitudes and perceptions. These may include clinical presentation, comorbidities, expectations (28,30,42,43).

Prescriber-related factors that may influence their compliance with guidelines include age, sex, education level of knowledge of the guidelines (37–40). Also, previous IMCI training on presumptive management and perception of regional malaria endemicity as a high risk for malaria may influence guideline adherence (34,35)

Health system factors include the availability of resources and training/supportive supervision can also play a role in the prescriber's adherence to guidelines (36,39). Figure 1 below summarizes the factors that influence adherence to malaria case management guidelines.

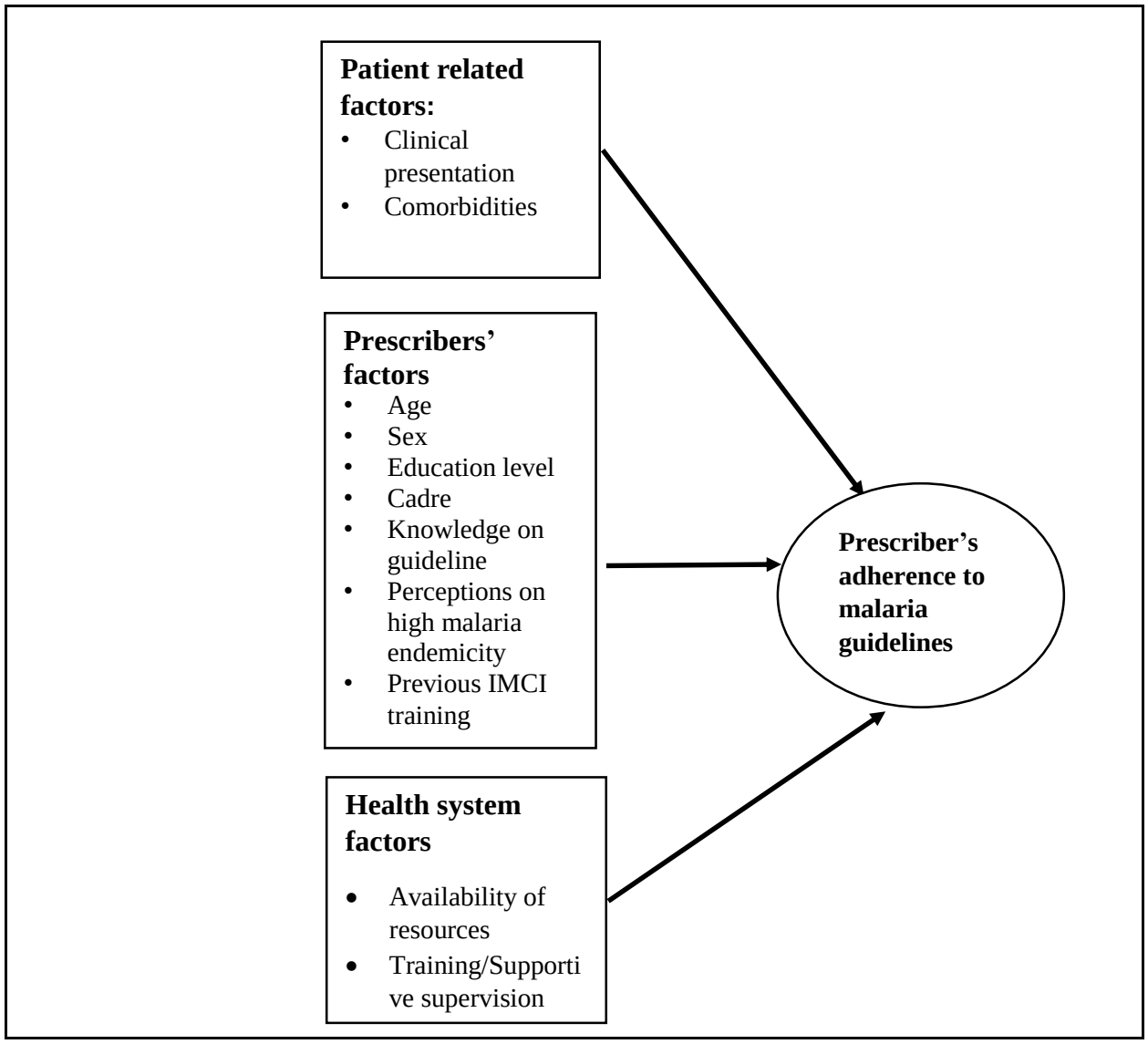


Figure 1: Conceptual framework for factors influencing prescribers' adherence to malaria case management guidelines

1.4 Rationale

The findings of this study will provide insights to policymakers and other stakeholders involved in malaria control regarding the level of prescriber's adherence/non-adherence to malaria case management guidelines and the underlying contributing factors in high transmission settings. These will serve as a foundation for the development of targeted interventions aimed at enhancing adherence to guidelines to improve the quality of care as well as prevention of the development of drug-resistant malaria strains.

1.5 Research questions

1.5.1 Broad research question

What are the levels of adherence to the national guidelines for the case management of uncomplicated malaria and associated factors and possible reasons for prescribers' adherence or non-adherence in Tabora region?

1.5.2 Specific research questions

1. What proportion of children under five with a presumptive diagnosis of malaria undergo malaria testing as recommended by the guidelines?
2. What proportion of children under five are prescribed antimalarials per their test results, in compliance with the guidelines?
3. What proportion of children under five are prescribed the recommended first-line antimalaria as per the guidelines?
4. What patient-related and facility-related factors are associated with adherence to the guidelines for malaria case management among children under five?

1.5.3 Qualitative research question:

What are the factors that influence prescribers' non-adherence to malaria testing and antimalarial prescription guidelines for children under five with presumptive malaria?

1.6 Objectives

1.6.1 Broad objective

To examine the levels of adherence to the national guidelines for the case management of malaria and associated factors and explore possible reasons for prescribers' adherence or non-adherence in Tabora region

1.6.2 Specific objectives

1. To determine the proportion of children under five with a presumptive diagnosis of malaria who undergo malaria testing as recommended by the guidelines in the Tabora region in 2024.
2. To determine the proportion of children under five who are prescribed antimalarials per their test results, in compliance with the guidelines in Tabora region, 2024.
3. To determine the proportion of children under five who are prescribed the recommended first-line antimalaria as per the guidelines in Tabora region in 2024.
4. To determine patient-related and facility-related factors associated with adherence to the guidelines for malaria case management among children under five in Tabora region, 2024.

1.6.3 Qualitative research objective

To explore the factors that influence prescribers' non-adherence to malaria testing and antimalarial prescription guidelines for children under five with presumptive malaria.

CHAPTER TWO

2.0 LITERATURE REVIEW

2.1 Adherence to malaria testing for malaria diagnosis

Accurate diagnosis of malaria is important for effective case management, especially among vulnerable populations such as under-fives. Current recommendations suggest that all suspected cases of malaria undergo testing using either mRDT or microscopy to confirm the presence of malaria parasites before initiating treatment (23,25). The proportion of parasitologically confirmed cases serves as a key indicator of adherence to these testing guidelines, with a low proportion indicating potential overreliance on presumptive diagnosis, which solely relies on clinical symptoms rather than parasitological confirmation

Globally, high rates of malaria testing are observed in various regions including those with low transmission risks, attributed to effective surveillance systems that monitor various malaria interventions and aid in adherence to guidelines (2,5,44). However, in many African countries, including Tanzania, where malaria burden is still prominent, the quality of malaria services remains inadequate despite efforts to optimize care delivery (2,45). Challenges such as low testing rates among suspected cases are prevalent, influenced by factors including prescriber education levels, facility capabilities, and discrepancies between mRDT and microscopy results (27,31,42,46–48). While some healthcare facilities achieve high testing rates due to diagnostic availability, attaining a 100% testing target remains a challenge (36,49,50). Private health facilities, compared to public ones exhibit even lower testing rates due to cost considerations and skepticism regarding mRDT results (36,50).

In Tanzania, the quality of malaria services is still questionable despite various interventions being implemented. In 2022, a study done on the quality of malaria care in 25 low-income and middle-income countries reported that among other countries, Tanzania offers the poorest quality of malaria services with over 70% of suspected cases not tested for the disease (51). Another study done at Meatu, Tanzania, revealed quite a significant rate of non-adherence to malaria case management guidelines among healthcare workers (52).

Despite interventions aimed at improving malaria care, gaps persist in understanding prescribers' adherence to testing guidelines among under-fives with presumptive malaria hence the need for comprehensive assessments of factors influencing testing practices and the development of targeted interventions to address barriers to adherence.

2.2 Adherence to malaria test results for antimalarial prescription

World Health Organization (WHO) emphasizes the importance of universal access to malaria diagnostic testing to ensure all malaria suspects are tested for confirmation before treatment particularly in settings with high malaria transmission rates to optimize the use of antimalarial drugs, minimize the risk of unnecessary drug administration, and mitigate the emergence of drug resistance (23). Prescribers' adherence to guidelines for malaria case management, particularly regarding the antimalarial prescriptions among under-fives with malaria, is a critical aspect of ensuring effective treatment and control of malaria in endemic regions. Several studies shed light on the patterns, challenges, and factors influencing prescribers' adherence to malaria treatment guidelines.

The rate of adherence to malaria test results for drug prescription among under-fives with presumptive malaria is lower in African regions whereby prescribers treat presumptive malaria cases and malaria negative cases with anti-malarial medications which is against the recommended test and treat policy (28,30,46,50,53). Stockouts of diagnostic tools such as mRDTs and type of symptom a patient presents with are some of the reasons that may influence presumptive treatment of malaria (28,30). In addition, an intervention study done in the Volta region, Ghana showed an improvement in adherence to malaria test results when testing for malaria was done before the patient was consulted by a prescriber (46)

Some studies have been done in Tanzania on adherence to malaria test results and the rate of adherence is still sub-optimal. In 2013, a study done in Kibaha district, Pwani region reported a remarkable proportion of 14% of malaria negative and 28% of non-tested patients being treated with anti-malarial medications (54) which is against the recommended test and treat policy. In 2016, another study was done in North Eastern Tanzania, a low transmission setting which

revealed a lower rate of adherence to test results whereby more than 70% of under-fives who tested negative for malaria by mRDT and microscopy were treated inappropriately (22). In 2020, another study done in Meatu district, Simiyu region, a moderate risk transmission setting, showed a relatively higher rate of non-adherence of about 40% whereby prescribers from hospitals displayed a higher rate of non-adherence followed by dispensaries then health centers (52). There is still persistent practice of presumptive treatment for malaria among febrile children, despite the widespread availability of mRDT even at peripheral healthcare facilities (55).

2.3 Adherence to prescribing the recommended first-line antimalarial drug

The emergence of malaria parasite resistance to previously utilized medications such as chloroquine, reported globally (56–60), prompted the recommendation of using artemisinin-based combination therapies (ACTs) for malaria treatment. This transition and use of combination drugs aimed to improve patient outcomes and minimize the risk of resistance development (23). Despite this transition, various countries particularly in Africa, have continued to deviate from the recommendations due to various reasons.

A study in Cameroon highlighted challenges in adhering to ACTs as the primary treatment for malaria, due to the scarcity of protocol guidelines and the lack of on-the-job training (61). Another study done in Sudan revealed a higher rate of prescription to patients with recommended first-line malaria medication for treatment of uncomplicated malaria however there was unjudicial use of artemether injections (62). Although some studies have shown a higher rate of adherence to ACT as the first-line medication for the treatment of malaria among prescribers, non-ACT are still used as first-line drugs by some healthcare workers (63) and this is due to factors such as inadequate knowledge of ACT dosing especially in private sectors (64).

Despite the insights provided, there is a limited exploration into the contextual factors influencing prescribers' adherence to prescribing the recommended first-line antimalarial drug.

2.4 Factors associated with adherence to guidelines for case management of malaria

2.4.1 Patient-related factors

Patient-related factors play a pivotal role in influencing prescribers' adherence to national malaria case management guidelines (65). Studies across multiple countries have emphasized the significant impact of variations in clinical presentation on adherence to treatment guidelines. Clinical manifestations of fever often prompt prescribers to prioritize malaria testing compared to the presence of any other symptom (24,28). The existence of additional health conditions can exert a notable impact on both the diagnosis and subsequent treatment decisions for malaria cases. A study conducted in Gambela town, Ethiopia, revealed that malaria patients presenting with both anemia and gastroenteritis received appropriate malaria treatment when compared to patients without these comorbidities (66).

The expectations and preferences of patients or caregivers can significantly influence prescribers' decisions. Studies have demonstrated that prescribers may be inclined to align their practices with patient expectations to maintain satisfaction and trust. In the context of malaria case management, prescribers may be more likely to prescribe antimalarials or adhere to presumptive treatment if they perceive strong patient demand or expectation for such interventions (67).

2.4.2 Prescribers' related factors

Age

Studies have shown that age can influence prescribers' adherence to guidelines. Younger prescribers may be more open to adopting new practices and guidelines, including those related to malaria case management. Conversely, older providers may be more entrenched in traditional methods and less likely to adhere to updated guidelines (68).

Sex

Studies have shown that the prescriber's sex can influence adherence to malaria case management guidelines whereby female healthcare workers exhibit lower rates of adherence compared to their male counterparts (40). Workload and family responsibilities may disproportionately affect female healthcare workers, leading to increased stress levels and

potential distractions from adhering strictly to guidelines. Female healthcare workers often bear the burden of household and caregiving responsibilities alongside their professional duties, which may leave them with less time and energy to focus on adherence to guideline (69).

Education level

Education level has been consistently linked to guideline adherence. Prescribers with higher levels of education often have a better understanding of evidence-based practices and are more likely to adhere to established guidelines. Conversely, lower levels of education may lead to misconceptions or lack of awareness regarding best practices, potentially impacting adherence. A study done in Kampala showed that individuals with bachelor's degrees exhibited greater adherence to guidelines compared to those with lower levels of education. Additionally, nurses with diplomas demonstrated higher compliance with guidelines compared to nurse assistants (40).

Lack of awareness

Studies indicate that while a significant number of intended users are generally aware of these guidelines, there is some percentage of users who are not informed about them (78,79). When healthcare professionals are not fully informed or aware of the guidelines' existence, updates, or specifics, it presents a challenge to consistently adhere to the recommended procedures. It has been found that compliance with guidelines is closely tied to knowledge of the guidelines (40). Therefore, lack of awareness or incomplete understanding of the guidelines among healthcare professionals can hinder consistent adherence to recommended practices.

Perceptions of high malaria endemicity as high-risk

Differential malaria risk stratification may influence prescribers' perceptions of the efficacy of preventive technologies and impact their adherence to malaria case management guidelines (34). In areas like Tabora with sustained high malaria transmission, prescribers may maintain the notion that the differential risk reflects partial efficacy of recommended preventive technologies. This perception can lead to several consequences, including testing practices whereby prescribers may perceive no need for testing before treatment, assuming a high likelihood of malaria in febrile cases, especially when operating in high-risk regions like Tabora

(70). The perception of partial efficacy of the first-line antimalarial as indicated in policy guidelines may lead prescribers to opt for alternative antimalarials, potentially compromising the effectiveness of the recommended treatment. Prescribers may also disregard negative test results, believing in the unreliability of diagnostic tools, and proceed to prescribe antimalarials based on clinical judgment and due to uncertainties about the causes of fever in cases with negative malaria tests, prescribers may injudiciously prescribe antibiotics, contributing to the broader issue of antimicrobial resistance (35).

Malaria risk stratification involves categorizing regions based on the intensity of malaria transmission and the associated risk levels. In regions categorized as high-risk areas, prescribers may adopt a more aggressive approach to malaria case management, including presumptive treatment for suspected cases, reflecting lower compliance to guidelines (68). In regions where malaria transmission remains persistently high, prescribers may perceive that the effectiveness of interventions, such as those outlined in the guidelines, is only partial (34). This perception may arise from the ongoing prevalence of malaria despite the implementation of recommended interventions.

Previous IMCI training

Historically, in regions with high malaria transmission rates, presumptive diagnosis and immediate administration of antimalarials, especially for severe cases in children under five, were common practices. This approach aimed to address the urgent and often fatal nature of malaria in these areas. Prescribers received specialized training in IMCI advocating for the presumptive treatment of malaria suspects without testing due to limited availability of diagnostic tests (20)**.** However, this approach poses several challenges, including the non-specific nature of clinical symptoms of malaria, leading to misdiagnosis and inappropriate treatment (71–73)**.** Secondly, reliance on clinical symptoms alone may contribute to injudicious use of antimalarial drugs, potentially leading to drug resistance which is a significant threat to malaria control (74,75)**.** With advancements in diagnostic tools, particularly the widespread availability of mRDTs, there has been a global emphasis on confirming malaria cases parasitologically before initiating treatment. This shift is rooted in the need for accurate

diagnosis to avoid unnecessary use of costly antimalarials, reduce drug pressure, and address the emerging issue of antimalarial resistance (23,25).

In high transmission settings like Tabora, prescribers may be influenced to maintain their training in IMCI to treat fever cases as malaria without the need for testing, prescribe alternative antimalarials other than the recommended first-line, disregarding negative tests and prescribing antimalarials, and potentially injudiciously prescribing antibiotics due to uncertainties about the causes of fever in negative tests (35). These deviations from the recommended protocols may be due to their experience of treating presumptive malaria as well as persistent high transmission of malaria compared to other areas, potentially shaping perceptions of the partial efficacy of recommended interventions (34).

2.4.3 Health system factors

Availability of resources

Studies have shown that limited access to diagnostic tools, such as rapid diagnostic tests (RDTs), and medications can lead to deviations from recommended practices (50). In settings where these resources are scarce, prescribers may resort to presumptive diagnosis and treatment due to the unavailability of confirmatory tests. This reliance on presumptive management may result in the inappropriate use of antimalarial drugs and contribute to suboptimal patient care. Furthermore, the absence or shortage of laboratory technicians has been associated with inadequate adherence to malaria testing protocols (76).

Training/Supportive supervision

Training or supportive supervisions play a critical role in promoting guideline adherence among prescribers. Facilities with regular and effective supervision tend to have better adherence to malaria case management guidelines (50,68). Training in supportive supervision provides opportunities for ongoing feedback and mentorship, which can help reinforce adherence to recommended practices. On the contrary, inadequate or inconsistent supervision or training schedules may lead to deviations from guidelines, as prescribers may lack the necessary support or motivation to adhere to established protocols.

CHAPTER THREE

3.0 METHODOLOGY

3.1 Study design

A facility-based explanatory sequential mixed-methods cross-sectional study was conducted. The study began with the collection and analysis of quantitative data, followed by qualitative data collection using a modified grounded theory approach.

3.2 Study setting

The study was conducted in two districts in Tabora region of Tanzania, Tabora Municipal and Sikonge Districts. Tabora region, located in the western part of the country, covers an area of approximately 76,151 square kilometers. It is predominantly rural with a population of 3,391,679, making it the fourth most populated region in mainland Tanzania (77).

The study sites included urban and rural areas, with Tabora Municipal representing the urban setting and Sikonge District the rural setting. The research was carried out in health facilities across these areas. The region experiences two seasons: a wet season from November to April and a dry season from May to October. Malaria transmission is generally high during and immediately after the wet season when mosquito breeding sites increase due to higher rainfall. This study was conducted during the end of the wet season when transmission was considered generally high

Tabora region has 409 health facilities reporting malaria cases (78), ranging from dispensaries and health centers to hospitals. Prescribers in these facilities encompass a range of professionals, including doctors, clinical officers, nurses, laboratory technicians, and medical attendants, who are responsible for diagnosing and treating various health conditions, including malaria.

3.3 Study population

The study population for the quantitative component comprised children under five years of age who were prescribed antimalarials between April and May 2024, accompanied by their parents/ caregivers.

For the qualitative component of the study, the study population consisted of prescribers from the sampled health facilities.

3.4 Inclusion and exclusion criteria

3.4.1 Inclusion criteria

- For the quantitative component, case notes of under-five patients with documented antimalarial prescriptions at the outpatient department between April to May 2024
- For qualitative study, prescribers responsible for diagnosis and treatment of fever-related illnesses to under-fives at the outpatient department

3.4.2 Exclusion criteria

- All under-five patients referred from other facilities
- For the qualitative study, unavailability of prescriber at the study site during data collection period

3.5 Sample size

3.5.1 Sample size for quantitative data collection

A total of 487 under-five patients were included in the study

Sample size formula;

$$n = \frac{Z^2 P(1-P)}{e^2} \times Deff$$

n= minimum required sample

Z=Standard normal deviate (1.96 for 95% confidence interval)

P= proportion of adherence to malaria guidelines which was 54.6% from a recent study done in Tanzania (52)

e= margin of error which is 5% (79)

Deff = Design effect of 1.13% (80)

$$n = \frac{(1.96)^2 \times 0.546\,(1-0.546)}{(0.05)^2} \times 1.13$$

n= 430

Adjusting for non-response of 10% (22)

Final sample size= n/(100%-NRR) = 487

3.5.2 Sample size for the qualitative data collection

A total number of 14 prescribers selected purposively from facilities sampled during quantitative data collection were included in the study for IDIs with the principle of data saturation considered.

3.6 Sampling strategy

3.6.1 Sampling for the quantitative component of the study:

A three-stage probability sampling approach was employed for the quantitative data collection process.

First stage, Sampling of districts: From the eight districts in Tabora region, four districts fall under the high malaria transmission risk strata, and the other four districts are in the moderate transmission risk strata. A list of all districts within each category was compiled and assigned unique numbers. One random number was generated from each category using a table of random numbers, and the districts that corresponded to the respective generated random numbers were sampled. The two districts selected Tabora Municipal and Sikonge Districts from moderate and high transmission strata respectively.

Second Stage, Sampling of health facilities: Lists of all health facilities providing both malaria testing and treatment services in each district were obtained from respective District Malaria Focal Persons (DMIFP). Sikonge district had 2 hospitals, 3 health centers, and 41 dispensaries; Tabora municipal had 4 hospitals, 5 health centers, and 67 dispensaries. For each district, health facilities were organized into three separate lists based on their level: one list for dispensaries, one for health centers, and one for hospitals. Each facility in the list was assigned a unique number. One random number was generated from each list using a table of random numbers. The facility that corresponded to each selected random number was sampled, resulting in one facility from each facility level in each district, which resulted in three facilities per district and a total of six facilities overall.

The third stage, Sampling of study participants: Sampling was conducted at the dispensing points of the selected health facilities. The probability proportional to size (PPS) technique was considered to select study participants. The monthly average number of under-five patients prescribed antimalarial medications at each sampled healthcare facility was calculated to calculate probability weight. The probability weight proportionally determined the sample size of under-five patients from each facility. Finally, under-five patients prescribed antimalarials accompanied by their parents/caregivers were enrolled randomly from all sampled facilities until a sample size of 487 patients was attained. A total of 295 were sampled from dispensaries 124 were sampled from hospitals and 68 from health centers

3.6.2 Sampling for the qualitative component of the study

A purposive sampling method was employed to select participants for qualitative data collection. Initially, the study's purpose was presented to the facility in-charges, who identified potential participants based on their roles in managing fever-related illnesses in the outpatient department.

These potential participants, primarily prescribers, were approached and screened to ensure they met the study's inclusion criteria. They were then informed about the study's objectives and invited to participate, with informed consent obtained to confirm their willingness.

As data collection progressed, a need arose for additional insights to expand the emerging theories. This need guided the inclusion of subsequent participants, specifically laboratory personnel who could provide additional perspectives. Ultimately, 14 participants were selected for in-depth interviews (IDIs): 12 prescribers and 2 laboratory personnel from the facilities involved in the earlier quantitative phase of the study.

3.7 Data collection methods

An explanatory sequential mixed methods design study was conducted between April and May 2024 utilizing both quantitative and qualitative data collection methods. Quantitative data collection was conducted first to determine the level of adherence to malaria case management guidelines. Following the preliminary analysis of the quantitative data, qualitative data collection was carried out to explore and provide deeper insights into the findings of the adherence patterns observed.

3.7.1 Quantitative data collection

Data was collected electronically using the Kobo collect platform. A pre-tested electronic questionnaire was used to gather information about patients' clinical details.

At the dispensing points in the selected health facilities, data collectors (trained research assistants), guided by respective medication dispensers identified and approached parents or caregivers of under-five children who had been prescribed anti-malaria medications. These parents/caregivers were provided with detailed information about the study's objectives, procedures, and rights. All approached caregivers consented to participate so they were asked to sign a consent form to confirm their willingness to provide information and to have their children's medical records reviewed.

Data collectors then conducted structured interviews in private settings with the caregivers and reviewed the under-five patients' case notes. These interviews were guided by a pre-tested electronic questionnaire designed to capture detailed information about the children's clinical details.

After collecting the caregiver-reported data, the research team obtained authorized access to clinical records including outpatient, laboratory, and dispensing registers from the respective healthcare facilities. The data collectors then reviewed these records to gather detailed medical information, including diagnoses, laboratory findings, and anti-malaria prescriptions.

Ensuring the accuracy and completeness of the collected data was crucial collected data from both caregiver interviews and clinical records were cross-checked for consistency. Any discrepancies were addressed through follow-up with the caregivers or by consulting relevant healthcare providers at the facilities.

To protect the confidentiality of the participants, no identifying names were recorded during the data collection process. All data collected were securely stored on password-protected devices, ensuring that the information remained confidential and secure.

3.7.2 Qualitative data collection

To explore the reasons for prescribers' non-adherence to malaria case management guidelines to triangulate the sub-optimal level of adherence revealed in quantitative findings, a combined approach involving observations of clinical practice and in-depth interviews was employed.

3.7.2.1 Observations of Clinical Practice

Data collection began with observations of clinical practices in the outpatient department. Trained data collectors, who were medical students who recently graduated and were familiar with the facilities through volunteer work, observed prescribers as they managed fever-related illnesses while being a part of the service delivery process. These observations provided context and identified potential areas of focus for interviews which provided detailed explanations and personal insights into the challenges and facilitators of guideline adherence.

3.7.2.2 In-depth Interviews: Selection of Participants

Building on the insights gained from the observations, the next step involved conducting in-depth interviews to explore deeper into the factors contributing to guideline non-adherence. The initial group of interview participants consisted of prescribers who were directly involved in diagnosing and prescribing medications for fever-related illnesses in children under five. As the

study progressed, to achieve a comprehensive understanding, the scope of participants was extended to include laboratory personnel and medication dispensers.

3.7.2.3 Interview Process

The in-depth interviews were conducted face-to-face in a private space within the interviewee's workplace to ensure confidentiality and create a comfortable setting for open discussion. Each interview involved two data collectors: a facilitator who led the conversation and a note-taker who documented non-verbal cues and key points not captured in the audio recordings.

To begin each session, the data collectors introduced themselves, explained their roles, and provided an overview of the interview's purpose. They ensured that participants understood the study and obtained both written and verbal consent, with the verbal consent being audio-recorded.

The facilitator used a pre-tested semi-structured interview guide designed to explore various factors influencing prescribers' adherence to the malaria case management guidelines. This guide included open-ended questions that allowed for in-depth discussion. The facilitator encouraged participants to clarify and elaborate on their responses to ensure a thorough understanding of their viewpoints. While the facilitator focused on the interview, the note-taker documented important non-verbal hints such as body language and pauses that could not be captured through audio alone.

Each interview lasted approximately 40 minutes, ranging from 30 to 60 minutes, depending on the depth of responses and the need for follow-up questions. Interviews continued until no new themes or significant information emerged, and responses began to repeat across participants. Data saturation was considered after three consecutive interviews with no new themes that emerged.

3.8 Validity and reliability of investigation tools

3.8.1 Validity of investigation tools

To ensure the validity of the data collection tools, most questions used were adopted from pretested tools from previous studies. Additionally, the data collection questionnaire was piloted

at Umoja dispensary, a facility not included in the study sample in Tabora municipal. This pilot testing allowed for the refinement of the checklist based on feedback and observations from the pilot facility.

3.8.2 Reliability of investigation tools

To ensure the reliability of the research findings, all research assistants underwent training prior to the commencement of data collection. This training covered the study's objectives, data collection tools, ethical considerations as well as interview techniques. Also, research assistants were regularly monitored and provided with ongoing support throughout the data collection process to maintain consistency and address any challenges that arose. Regular feedback sessions and performance evaluations were conducted to ensure compliance with study protocols.

3.9 Variables

3.9.1 Dependent variable

Adherence to malaria case management guidelines was defined using a composite score derived from three aspects of clinical practice: parasitological confirmation of malaria, antimalarial treatment according to test results, and prescription of recommended first-line antimalarial medication. Each of these aspects was assessed and scored individually to determine the overall adherence level

Key Components of Adherence:

Guideline Adherence to Malaria Testing:

- Criteria: Under-five children suspected of having malaria should undergo a diagnostic test, either through mRDT or microscopy.
- Scoring: Each under-five child who received a diagnostic test was assigned a score of 1.

Guideline Adherence to Malaria Treatment:

- Criteria: Anti-malarial medication should be prescribed only to patients who have tested positive for malaria.

- Scoring: Each case where anti-malarial medication was prescribed based on a positive test result received a score of 1.

Guideline Adherence to First-line Anti-malarial Prescription:

- Criteria: For positive malaria cases, the recommended first-line treatment, Artemether-Lumefantrine (ALu), should be prescribed.
- Scoring: Each occasion where ALu was prescribed as the first-line treatment to a patient with a positive test result was given a score of 1.

Overall adherence to guidelines (dependent variable):

The overall adherence to malaria case management guidelines was determined by summing the scores from the three components described above. This composite score was then used to categorize the level of adherence:

Optimal Adherence: A total score of 3, indicating full adherence to all aspects of the guidelines.

Sub-optimal Adherence: A total score of less than 3, indicating that one or two aspects of the guidelines were not followed fully.

3.9.2 Independent variables

Table 1: Lists of independent variables

Patient-related factors	**Values**
Patient's area of residence	Rural/Urban
Age of the patient (months)	1 – 12, 13 – 24, 25 – 36, ≥37
Patient's gender	Male/Female
Level of attended facility	Hospital/health center/dispensary
Facility ownership	Government/Private
Clinical presentation	
Fever	Yes/No
Cough	Yes/No
Runny nose	Yes/No
GI symptoms	Yes/No
Other symptoms	
Presence of comorbidities	Yes/No
ARI	Yes/No
Pneumonia	Yes/No
Unspecified septicemia	Yes/No
Other comorbidities	Yes/No

3.10 Data management

During the data collection process, consistent and systematic data gathering was ensured, with clearly defined data variables. Data files and folders stored in password-protected electronic devices were organized and named accordingly, facilitating easy retrieval. Data entry was electronic, and data validation procedures were implemented to identify any inconsistencies or missing values. Before proceeding with analysis, data was cleaned thoroughly to address discrepancies and ensure data quality. To secure research data, access to sensitive data was restricted to authorized personnel only. Data analysis was conducted using appropriate STATA statistical software version 15 and analysis was conducted according to the research objectives. Ethical principles and data privacy regulations were strictly observed throughout the data collection, storage, and sharing process. Informed consent was obtained from all study participants, and to protect individual privacy, personal identifying information was not included during data collection.

3.11 Data analysis

3.11.1 Quantitative data analysis

Data was cleaned using Microsoft Excel and then entered into the STATA statistical package version 15, for analysis. Data was analyzed to generate descriptive statistics, which included demographic and clinical characteristics of the under-five patients included in the study which were summarized using frequency tables. Since the age distribution of the patients was not normally distributed, as determined by the Shapiro-Wilk test, histograms, and QQ plots, so median and interquartile range (IQR) were used to describe the age of the participants.

Using a modified Poisson regression model, bivariate analyses were then performed to identify potential patient-related predictors of guideline adherence. Variables with P value < 0.2 in these comparisons were selected for further investigation in multivariable analysis. Crude Prevalence Ratios (cPRs), along with their corresponding 95% Confidence Intervals (CIs), were determined.

To control for potential confounding factors and obtain more accurate estimates, Adjusted Prevalence Ratios (aPRs) with their 95% CIs were also computed in multivariable analysis. A P value < 0.05 was considered statistically significant.

3.11.2 Qualitative data analysis

All interviews that were audio-recorded were transcribed verbatim. This ensured that every word spoken during the interviews was captured accurately. The transcriptions were then translated into English to facilitate analysis. Once the transcripts were created, they were thoroughly reviewed to gain a deep understanding of the context. During the review, significant statements and phrases relevant to the research question were highlighted and assigned initial codes. These codes represented concepts emerging from the data.

Codes with similar patterns were systematically organized into categories until all codes were appropriately assigned to specific categories. A total of five key categories emerged from the data.

Throughout the analysis, memos were created to capture the research team's thoughts, insights, and interpretations about the codes and categories. These memos provided valuable context and rationale for the evolving categories. The relationship between the identified categories and the core category which is non-adherence to guidelines was determined.

3.12 Trustworthiness of Qualitative Data

To ensure the trustworthiness of the qualitative research findings, four key parameters were addressed: credibility, dependability, confirmability, and transferability (81).

To ensure credibility, Data collectors spent over a month in the sampled facilities to familiarize themselves with the settings and observe the management of under-fives with presumptive malaria in outpatient departments. Both interviews and observations were employed to collect data from prescribers from all facility levels (hospitals, health centers, and dispensaries). Various data recording tools in the facilities (patient registers and patients' case notes) were reviewed to complement information from the interviews. Data saturation was considered achieved when no new information or themes emerged during data collection after three

consecutive interviews. Two investigators were involved in the analysis and interpretation of the collected data until a consensus was reached. Also, during the analysis process, transcribed data were presented to study participants to confirm the correctness of the interpretations.

To ensure dependability, a thorough methodological description of the study has been provided. Each step from data collection to analysis and interpretation has been elaborated.

To ensure transferability, the study setting, participants, and research methods have been clearly described.

For confirmability, the interpretation of research findings was based solely on the participants' responses, and not on the personal viewpoints of the investigators.

3.13 Ethical considerations

Ethical clearance was obtained from the Institutional Ethical Review Board of the Muhimbili University of Health and Allied Sciences (Approval reference number MUHAS-REC-04-2024-2132). Permission to conduct the study was granted by the President's Office, Regional Administration and Local Government Tanzania (PORALG), Tabora Regional Administrative Secretary (RAS), respective district administrative Secretaries (DAS), DMOs and health facility in-charges. Written informed consent was obtained from the parents/caretakers of under-five children and prescribers. Confidentiality was maintained throughout the study; no participant's identifying names were recorded.

CHAPTER FOUR

4.0 RESULTS

4.1 Quantitative study findings

4.1.1 Demographic characteristics of under-five study participants

A total of 487 under-five patients from the outpatient department were included in the study. The median age of the patients was 20 months, with an interquartile range (IQR) of 12 to 27 months, and the majority were aged between 13 and 24 months. Most patients, 51.8%, were male. The majority of patients, 295 (60.6%), were attended at dispensaries, and most facilities, 298 (61.2%), were government-owned. Fever was the most commonly observed symptom, reported in 469 patients (96.3%). Approximately 241 patients (49.5%) had one or more documented comorbidities, with Acute Respiratory Tract Infections (ARTI) being the most common, affecting 136 patients (27.9%). Table 3 below summarizes the findings

Table 2: Demographic characteristics and clinical features of enrolled under-fives in Tabora region, 2024 (N=487)

Variable	Frequency	Percentage
Age category (months)		
1 - 12	159	32.7
13 - 24	192	39.4
25 - 36	74	15.2
≥37	62	12.7
Median age	*20, IQR (12 - 27)*	
Gender		
Male	252	51.7
Female	235	48.3
Attended health facility level		
Hospital	124	25.5
Health center	68	14.0
Dispensary	295	60.5
Attended health facility ownership		
Government	298	61.2
Private	189	38.8
Clinical presentation		
Fever	469	96.3
Cough	165	33.9
Runny nose	48	9.9
GI symptoms [a]	46	9.5
Other symptoms [b]	18	3.7
Comorbidities		
Upper respiratory tract infections	136	27.9
Pneumonia	46	9.5
Unspecified septicemia	28	5.8
Other comorbidities [c]	34	6.6
No comorbidities	246	50.5

[a] GI symptom including abdominal discomfort, vomiting, passing loose stools, loss of appetite

[b] other symptoms including skin lesions, body weakness, difficulty in breathing, wheezing

[c] other comorbidities including acute watery diarrhea, Urinary tract infection, worms' infestation, skin infections

4.1.2 Adherence to malaria testing for malaria diagnosis

Of the 487 children under five who were prescribed anti-malaria medication, 353 (72.5%) underwent malaria diagnostic testing to confirm the presence of malaria parasites. Among these, 201 (56.9%) were tested using mRDT, and 152 (43.1%) were tested using microscopy. Out of those tested, 273 (77.3%) were confirmed positive for malaria, with the majority, 139 (50.9%), confirmed through microscopy. Tables 3 and 4 below summarize the findings.

Table 3: Laboratory diagnostic tests status for under-five patients prescribed anti-malaria medications in Tabora region, 2024 (N=487)

Variable	Frequency (n)	Proportion (%)
Malarial tested		
Tested	353	72.5
Not tested	134	27.5
Test method		
MRDT	201	56.9
Microscopy	152	43.1
Test result		
Positive	273	77.3
Negative	80	22.7

Table 4: Patients' malaria test results categorized by diagnostic test type in Tabora region, 2024 (N=353)

Test results	Diagnostic test type	
	MRDT, n (%)	Microscopy, n (%)
Positive	134 (49.1)	139 (50.9)
Negative	67 (83.8)	13 (16.2)

4.1.3 Adherence to test results for anti-malaria prescription

All 487 patients enrolled in this study received antimalarial prescriptions, however, only 353 out of the 487 (72.5%) were referred for parasitological confirmation of malaria. Among the 353 referred for parasitological confirmation of malaria, 273 (77.3% had a positive test either by mRDT (49.1%) or microscopy (50.9%). The rate of negative test results was 80 out of 353 (22.3%), Accordingly, those with negative test results also received antimalarial medications, thus the rate of non-adherence to test results was 22.3%. Additionally, the majority of patients, 277 (56.9%) were prescribed antibiotics alongside anti-malaria medications.

4.1.4 Adherence to prescribing the recommended first-line antimalarial drug

The recommended first-line anti-malaria medication, ALu was the most commonly prescribed anti-malarial medication prescribed to 469 enrolled under-fives (96.3%). The remaining 18 children (3.7%) were prescribed anti-malarial medications other than the recommended first-line. Out of 469 under-fives prescribed ALu, 262 (55.9%) had positive test results and 207 (44.1%) were either untested or had negative test results hence the rate of non-adherence to prescribing the recommended first-line anti-malaria medication was 44.1%. Figure 2 below summarizes the findings

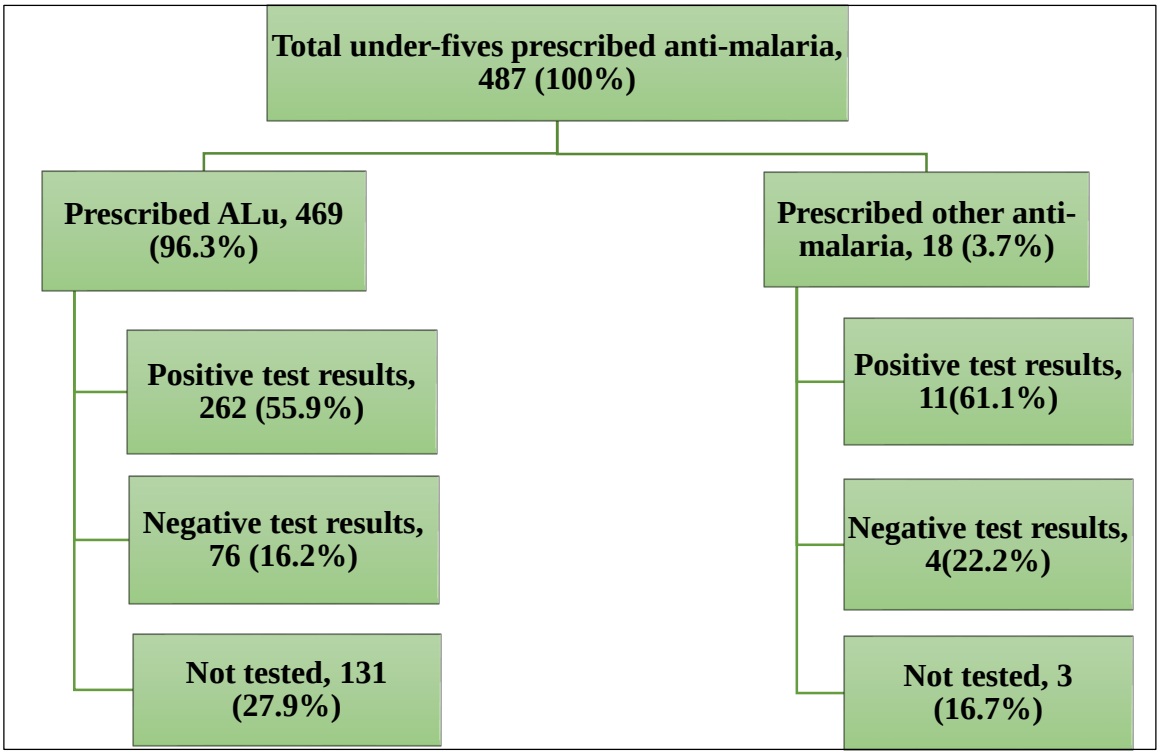


Figure 2: Patterns of types anti-malaria prescribed to under-fives according to the laboratory findings, Tabora region, 2024.

Overall level of adherence to malaria case management guidelines

As shown in Figure 3 below, out of the 487 under-fives managed, most of them, 259 (53.2%) were managed per the guidelines while 228 under-fives (46.8%) were not managed per recommendations from the guidelines.

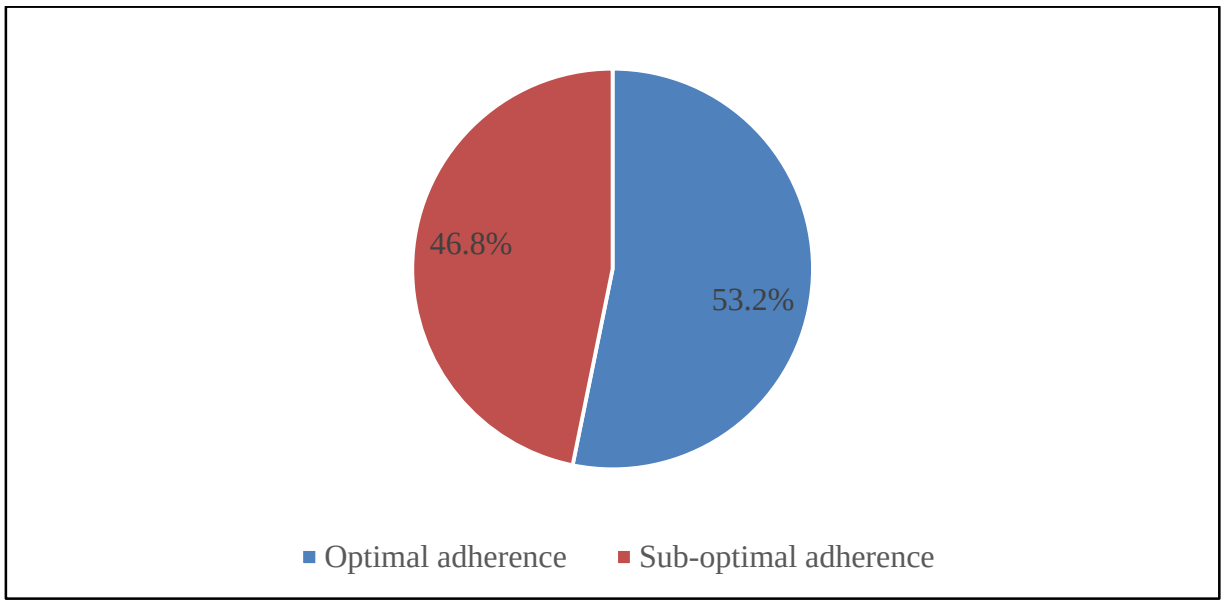


Figure 3: Overall level of prescribers' adherence to malaria case management guidelines among under-fives with presumptive malaria managed in Tabora region, 2024.

4.1.5 Patient-related factors associated with adherence to malaria case management guidelines

Under-five patients with presumptive malaria who were attended at private facilities had a 21% higher likelihood to be managed per the guidelines as compared to the under-fives attended at government facilities [aPRs 1.21, 95% CI, (1.05–1.40)]. Other patient-related factors, such as clinical presentation and comorbidities, did not show a statistically significant association with adherence to malaria case management guidelines. Table 5 below summarizes the findings.

Table 5: Multivariable modified Poisson regression analysis on patient-related factors associated with adherence to malaria case management guidelines, Tabora region, 2024

Variable	Total	Adherence to guidelines, n (%)	Crude Prevalence ratio (95% CI)	P-value	Adjusted Prevalence ratio (95% CI)	P-value
Age category (Months)						
1 - 12	159	77 (48.4)	***Reference***			
13 - 24	192	109 (56.8)	1.06 (0.89–1.25)	0.53		
25 - 36	74	39 (52.7)	1.03 (0.82–1.29)	0.80		
≥37	62	34 (54.8)	1.04 (0.82–1.32)	0.73		
Gender						
Male	252	135 (53.6)	1.01 (0.87–1.16)	0.94		
Female	235	124 (52.8)	***Reference***			
Attended facility level						
Hospital	124	64 (51.6)	0.98 (0.83–1.17)	0.96		
Health center	68	37 (54.4)	1.01 (0.81–1.24)	0.88		
Dispensary	295	158 (53.6)	***Reference***			
Attended facility ownership						
Government	298	120 (40.3)	***Reference***		***Reference***	
Private	189	139 (73.5)	1.24 (1.07–1.43)	<0.01	1.21 (1.05–1.40)	**0.01**
Clinical presentation Fever						
Yes	469	256 (54.6)	1.33 (0.86–2.04)	0.20	1.24 (0.80–1.93)	0.33
No	18	3 (16.7)	***Reference***		***Reference***	
Cough						
Yes	165	63 (38.2)	0.86 (0.74–1.00)	0.06	0.97 (0.79–1.19)	0.77
No	322	196 (60.9)	***Reference***		***Reference***	
Runny nose						
Yes	48	19 (39.6)	0.90 (0.70–1.16)	0.42		
No	439	240 (54.7)	***Reference***			
GI symptoms [a]						
Yes	46	21 (45.7)	0.95 (0.74–1.22)	0.67		
No	441	238 (54.0)	***Reference***			

Variable	Total	Adherence to guidelines, n (%)	Crude Prevalence ratio (95% CI)	P-value	Adjusted Prevalence ratio (95% CI)	P-value
Other symptoms [b]						
Yes	18	5 (27.8)	0.83 (0.55–1.26)	0.38		
No	469	254 (54.2)	***Reference***			
Comorbidities						
Acute respiratory tract infections						
Yes	136	50 (36.8)	0.86 (0.73–1.01)	0.07	0.97 (0.77–1.22)	0.79
No	351	209 (59.5)	***Reference***		***Reference***	
Pneumonia						
Yes	46	15 (32.6)	0.85 (0.66–1.11)	0.24		
No	441	244 (55.3)	***Reference***			
Unspecified septicemia						
Yes	28	16 (39.29)	1.03 (0.76–1.39)	0.86		
No	459	243 (52.9)	***Reference***			
Other comorbidities [c]						
Yes	34	18 (52.9)	1.00 (0.76–1.33)	0.99		
No	453	241 (53.2)	***Reference***			
Comorbidity						
Absent	246	159 (64.6)	0.86 (0.74–0.99)	0.04	0.91 (0.75–1.11)	0.36
Present	241	100 (41.5)	***Reference***		***Reference***	

[a] GI symptom including abdominal discomfort, vomiting, passing loose stools, loss of appetite

[b] other symptoms include skin lesions, body weakness, difficulty in breathing, wheezing

[c] other comorbidities include acute watery diarrhea, Urinary tract infection, worms' infestation, skin infections

4.2 Qualitative study findings

4.2.1 Demographic characteristics of interviewed prescribers

A total of 14 prescribers were interviewed, with the majority, 9/14 being in the age category between 30-44 years. Most of the prescribers, 11/14 were male and the majority, 5/14 were clinical officers. Additionally, about 10/14 of the prescribers had over 3 years of work experience (Table 6).

Table 6: Demographic characteristics of prescribers (N=14)

Characteristic	Frequency (N)
Age groups (in years)	
18-29	2
30-44	9
45-59	2
60-69	1
Gender	
Male	11
Female	3
Cadre	
Medical officer	2
Assistant medical officer	1
Clinical officer	5
Nursing officer	2
Medical attendant	2
Laboratory technician	2
Years of working experience	
<1 year	0
1 – 3 years	4
>3 years	10

4.2.2 Factors that influence prescribers' non-adherence to malaria case management guidelines

The quantitative data findings revealed a sub-optimal adherence to malaria case management guidelines. To triangulate the findings observed, in-depth interviews were carried out with fourteen prescribers complemented with clinical practice observations to explore reasons for non-adherence to guidelines. As illustrated in Figure 4 below, four key categories related to non-adherence to malaria case management guidelines were identified: health system factors, prescriber factors, and patient-related factors. Each category and its respective subcategories have been explained in detail, highlighting their relationship to the core category of non-adherence to malaria case management guidelines.

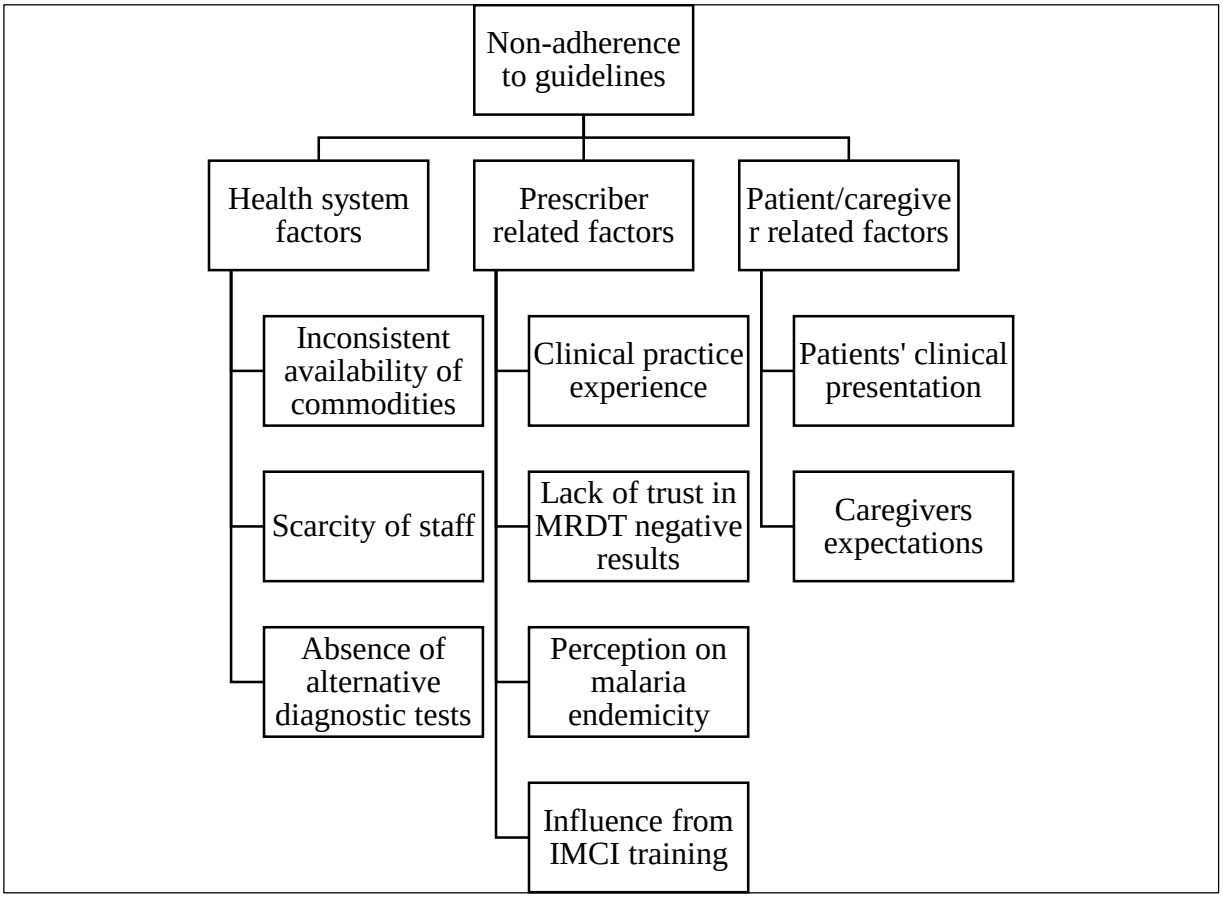


Figure 4: Factors influencing prescribers' non-adherence to malaria case management guidelines in Tabora region, 2024.

4.2.2.1 Health system factors

Inconsistent availability of commodities

Of the prescribers interviewed, 10 reported that essential malaria commodities were consistently available at their facilities. Meanwhile, 4 prescribers reported having experienced occasional stock-outs which that the inconsistent availability of essential supplies forced them to deviate from recommended guidelines. One participant elaborated on this issue, stating:

"*I recall a few occasions when ALu was unavailable at our facility for 2 to 3 days. During these times, I had to prescribe sulfadoxine-pyrimethamine (SP) to patients as an alternative. It is not very common for malaria commodities like ALu to be out of stock but it does happen sometimes. For years, we had experienced shortages of ALu at our facility two times, each lasting 2 to 3 days."*

Also, some of the prescribers reported that one of the reasons they adhered to prescribing the recommended first-line anti-malaria is because it is the only available anti-malaria for treating uncomplicated malaria in their facilities. One of them stated:

"*We only prescribe ALU for malaria because it is the only anti-malaria we have for treatment of uncomplicated malaria at our facility. Even if I wanted to give a different malaria medicine that I think might be better, I cannot. We are restricted in what we can order from the electronic logistic system (ELMIS). If we try to order any commodity that is not approved, the Council Health Management Team usually contacts us to change before being sent to the main store (MSD)"*

Scarcity of staff

During the observations, it was noted that staffing levels in some facilities particularly dispensaries were not adequate. For the visited public dispensaries, only one provider was scheduled per an eight-hour shift. This one provider was responsible for several tasks including attending to patients in the outpatient department, performing laboratory tests, dispensing medications, and providing care for women in labor. The overwhelming workload for a single provider in such settings often leads to significant challenges in maintaining adherence to patient management protocols.

In health centers, the situation was somewhat different but still presented notable challenges. One clinician was assigned to handle patients in the outpatient department. Laboratory staff were only available during morning and evening shifts, which meant that clinicians had to perform basic laboratory tests themselves, such as MRDT during night shifts. This added burden on clinicians, especially during the night shifts when laboratory staff were not available, potentially compromising the quality of patient care and adherence to clinical guidelines.

Hospitals were slightly better staffed compared to dispensaries and health centers. Each department in the hospitals had at least one provider assigned for every shift.

All interviewed prescribers from health centers and dispensaries and some from hospitals pointed out that scarcity of staff was a significant challenge that impacted their ability to provide optimal care. One prescriber elaborated,

"*Since we have only one laboratory technician at our facility, during most night shifts, we prescribers are given the MRDT kits to conduct laboratory tests on our own. It is not very easy because sometimes there is a long queue of patients, so you just end up treating them clinically*."

Absence of alternative diagnostic tests

Prescribers reported deviating from guideline recommendations, opting to administer anti-malaria medication even in cases where test results are negative, primarily due to the absence of tests for other fever-related illnesses. In some facilities, the only diagnostic test available for fever-related illnesses was MRDTs. This also contributed to over-prescription of antibiotics as a result of the lack of tests to confirm alternative infections. One prescriber stated

"*In my clinical practice, when a patient tests negative for malaria, I usually prescribe antibiotics to treat urinary tract infection. Occasionally, I may also administer anti-malaria medication just in case. The outcome is usually good in most cases."*

4.2.2.2 Prescriber related factors

Prescriber's clinical practice experience

Most participants interviewed had more than three years of working experience, which they acknowledged as a significant factor in their adherence to guidelines. These experienced

prescribers admitted to treating patients without testing, as well as treating malaria-negative patients when their symptoms resembled those of malaria. They noted that most times, the patients' outcomes were good, which boosted their confidence in these practices. This was a statement by one of the prescribers:

"*Sometimes, even though malaria test results are negative, I still prescribe antimalarial medication as long as the patient's symptoms resemble those of malaria such as fever presentation. I have done this on many occasions, and the outcome is good in most cases*"

Additionally, the interviewed prescribers who had less than three years of working experience and were mainly volunteers indicated that while they did not fully review the guideline, they received orientation from facility in-charges on malaria case management. Despite this orientation, they appeared to adopt the practices of more experienced prescribers. One prescriber mentioned:

"*Before I started managing patients, the facility in-charge told me that all patients prescribed anti-malaria treatment should undergo testing first. Administering anti-malaria medication without testing is not advisable, and it complicates the documentation for monthly reports. However, due to the high patient load and being the sole provider in the outpatient department at times, sending them to the laboratory is like attending them twice, it is not very easy. I have observed most clinicians here, they also do that*"

Lack of trust in negative MRDT results

Many prescribers expressed doubts about the reliability of Malaria Rapid Diagnostic Tests (MRDTs), particularly in detecting low levels of malaria parasites. A common belief among these prescribers was that MRDTs may not be sensitive enough to identify malaria infections when parasite counts are below five. They believed that parasite count below five can only be accurately detected through microscopy.

Due to these concerns, most prescribers reported occasions where they did not strictly adhere to negative MRDT results, particularly in cases where clinical symptoms strongly indicated malaria. In such situations, prescribers often felt compelled to treat malaria based on their clinical judgment rather than relying on the diagnostic test results.

Prescribers also reported caregivers/patients' lack of trust in mRDT negative results which also played a role in non-adherence to mRDT negative results. Some patients/caregivers preferred to receive treatment based on presenting symptoms or insisted on confirmatory testing using microscopy. Due to this, prescribers were further pressured to administer treatment against mRDT results. This was one of the statements from one of the prescribers concerning a lack of trust in mRDT negative results

"I have often heard from lab technicians that mRDTs can't detect malaria when the parasite count is below five. I even came across an article that confirms this, So, I sometimes doubt a negative MRDT result if the clinical signs point towards malaria"

Perception of regional malaria endemicity level as high risk

Malaria endemicity level in the region was known by most of the prescribers. Their awareness of the high prevalence of malaria in their region influenced their behavior of treating suspected cases of malaria without testing them as well as disregarding negative test results. One prescriber stated:

"We often treat malaria without testing because malaria burden is very high here in our region. Even if tests are negative for malaria, we might still give anti-malaria medications, especially during the rainy season when malaria spreads a lot. I sometimes do this too, but not always."

Influence from IMCI training

Not all the interviewed prescribers had received IMCI training. Out of twelve prescribers, five had received IMCI training, and three of them admitted its influence on the management of malaria cases. The following statement was made by a prescriber,

"I received the training a long time ago, and it covered various fever-related illnesses in children under five years, such as pneumonia and malaria. We were taught that if a child presents with a high fever, the first step is to control the fever to prevent convulsions by sponging and then to administer antimalarial medication immediately. I believe this practice has more positive effects because most of the children recover well."

4.2.2.3 Patient/caregivers related factors

Clinical presentation

Prescribers acknowledged that patients' clinical presentations significantly influenced their adherence to malaria treatment guidelines. Many reported that when patients exhibited multiple symptoms commonly associated with malaria, they often relied on their clinical judgment to make treatment decisions. This sometimes led them to treat based on symptoms alone, even when test results were negative. One prescriber stated:

"*Sometimes, patients may present with all the symptoms of malaria, but their test results turn out negative. In such cases, I decide to give the patient ALU…. I have had experience with patients like that and when I give them anti-malaria and antibiotics, the response is good in most cases"*

Expectations from caregivers

Prescribers frequently deviated from guideline recommendations due to pressure from patients/caregivers. Some prescribers reported that their patients would come to their facilities with positive test results from other facilities particularly private laboratory facilities. Even after being rechecked and MRDT test results turned out negative, they would refuse to accept the results and eventually demand to be given antimalarial medication**.** One prescriber from a private health facility stated,

"*I have encountered caregivers who demanded being given ALU because they believed they had malaria because they were familiar with the symptoms of malaria. And if you do not give these patients anti-malaria, they end up buying them from other private pharmacies"*

CHAPTER FIVE

5.0 DISCUSSION

The recommended approach in malaria case management guidelines for malaria treatment in high transmission areas such as Tabora is the "test and treat" policy. This policy requires all suspected malaria cases to undergo diagnostic testing for confirmation, using either Malaria Rapid Diagnostic Tests (MRDT) or microscopy, and that anti-malarial medication should be prescribed only to patients who test positive for malaria (23,25). This study assessed the compliance of prescribers to test and treat policy when managing under-fives patients.

5.1 Adherence to malaria testing for malaria diagnosis

This study revealed a high proportion of the patients prescribed anti-malaria were tested for malaria using either MRDT or microscopy with a relatively high positivity rate among those tested. Although MRDT was the predominant testing method, almost half of patients were also tested using microscopy. Despite the high testing rate observed in this study, it remains below the recommended testing rate target of 85% before the provision of anti-malarial medications. These findings are consistent with several other studies that reported high testing rates among febrile patients, such as a study in Eastern Uganda that found a testing rate of 78% (82). Two other studies conducted in Uganda and Ghana, both high transmission settings reported malaria testing rate of over 90% (83,84). Other studies also reveal lower rates of malaria testing compared to this study’s findings. Studies done in Sudan and Nigeria revealed lower testing rates of under-five patients of under 50% (31,85). This higher testing rate observed in our study could be attributed to the wide availability of malaria diagnostic tests, particularly MRDTs. This is similar to a study conducted in rural Tanzania which observed a significant improvement in malaria diagnostic testing following the introduction of MRDTs (55). The high testing rate could also be attributed to the inclusion of private health facilities, which have a high tendency to test patients before treatment (86).

This study found that more than half of the malaria-positive cases among patients were confirmed through microscopy. While microscopy is considered the gold standard for malaria diagnosis, it is susceptible to various challenges that can affect its accuracy. The accurate identification and quantification of malaria parasites under a microscope requires skilled laboratory personnel. Errors in microscopy, such as false-positive results due to misidentification of other blood elements as malaria parasites, can contribute to malaria over-diagnosis. A study conducted in Southern Tanzania revealed that relying solely on microscopy for malaria diagnosis resulted in an over-diagnosis rate of nearly 80% (87). Another study conducted in Dar es Salaam revealed that routine microscopy performed across various levels of health facilities was of poor quality, which resulted in a significant number of false-positive malaria diagnoses (88). Effective quality assurance programs are essential to maintain the reliability of microscopy results. However, these quality assurance systems are inadequate in many of our settings, so there is a high risk of diagnostic errors and misinterpreting results. This in turn may result in improper use of antimalarial medications, increasing the risk of development of drug resistance.

5.2 Adherence to malaria test results for antimalarial prescription

The findings of this study revealed that slightly more than half of the patients received anti-malaria treatment following their positive test results. However, a notable proportion, over 20%, were prescribed anti-malaria medication despite having negative test results. Additionally, almost 20% of the patients were given anti-malaria drugs without being tested for malaria. This highlights a substantial proportion of over 40% of under-five children who were prescribed anti-malaria medications without being tested or despite having negative results.

The level of non-adherence to test results for anti-malaria prescription observed in this study was remarkable but appears lower than findings from similar studies in other regions. More than 90% of patients in a study conducted in Lagos State, and 65% in Sokoto Metropolis, both in Nigeria, were treated presumptively (85,89). Another study done in Mali also revealed 76% non-adherence to treatment (90). The findings from this study are inconsistent with a study

conducted in Busoga, Eastern Uganda which reported over 80% adherence to test results for anti-malaria prescription (36).

These variations in adherence to malaria test results across different studies can be attributed to multiple factors, including differences in study populations and contexts. This study specifically focused on children under five, who are particularly susceptible to malaria and other febrile illnesses. The overlapping symptoms of these conditions and the increased risk of severe disease complications in this age group likely influenced prescribers' decisions to provide empirical treatment. The need for prompt treatment in fear of complications of severe disease in this age group may have contributed to prescribers' decisions to administer antimalarials without testing or despite negative test results.

5.3 Adherence to prescribing the recommended first-line antimalarial drug

All the under-fives included in this study were prescribed anti-malaria with ALU being the predominant anti-malaria of choice. Over 90% of the patients received ALU, the recommended first-line treatment for malaria, however, this prescription practice did not necessarily align with diagnostic test results. Slightly more than half of the children prescribed ALU had positive malaria test results, confirming the appropriateness of their treatment according to the guidelines. Almost half of the under-fives were prescribed ALU despite having negative test results or without undergoing any diagnostic testing. This significant proportion highlights reliance on clinical judgment and presumptive treatment practices rather than strict adherence to diagnostic protocols. Additionally, a small proportion of under-five patients was prescribed anti-malaria other than ALU with most of the cases having positive diagnostic test results. This suggests that while ALU is generally preferred, deviations from the recommended first-line treatment also occur.

These findings are consistent with Tanzania National Malaria Strategic Plan 2021-2025 which indicated that approximately 89% of patients in the country receive treatment with Artemisin-based Combination Therapies (ACTs) (11). Other studies conducted in rural Uganda and Lagos state, Nigeria also reported a higher tendency of prescribers to provide ALU to patients whereby

more than 80% of patients diagnosed with malaria were prescribed ALU (38,89). The findings of this study were different from a study conducted in Sudan which revealed more than 70% of patients were prescribed quinine, a non-recommended first-line anti-malaria (31).

The higher proportion of patients prescribed ALU in this study could be due to its widespread availability across health facilities in the country. The Tanzanian government has actively supported the procurement of ACTs by providing them for free in public health facilities and reducing their costs in private facilities (91). These measures have significantly increased the accessibility of ALU, encouraging its use as a primary treatment option. These efforts aimed to ensure adherence to recommended treatment protocols by expanding access to first-line therapies. However, despite the availability of ALU and these supportive policies, the trend of prescribing ALU without confirming a malaria diagnosis could lead to over-treatment and contribute to the development of drug resistance.

Additionally, the study found that over half of the patients were prescribed antibiotics alongside antimalarial medication, indicating a potential overuse of these medications in febrile conditions. This high rate of antibiotic use is consistent with findings from other research, such as a study in Mali, where more than 50% of patients received antibiotics in addition to anti-malaria treatment (90). The common prescription of antibiotics could be due to limited availability of alternative diagnostic tests in most healthcare facilities. The administration of antibiotics may reflect a cautious approach by prescribers aiming to treat potential bacterial co-infections. However, this raises concerns about the overuse of antibiotics and the risk of antimicrobial resistance.

5.4 Patient-related factors associated with adherence to malaria case management guidelines

This study revealed that under-five patients who attended private facilities were more likely to be managed in adherence to the malaria case management guidelines compared to those under five who attended public health facilities.

These findings are consistent with a study conducted in private facilities in Kampala, Uganda, which found that over 60% of healthcare providers demonstrated high adherence to malaria case management guidelines, including diagnostic testing and appropriate antimalarial prescription (40). Similarly, another study conducted in North-Western Ethiopia also revealed a high rate of adherence to malaria diagnostic testing and antimalaria prescription by test results among clients in private facilities (86). In contrast to our study, a study conducted in Nigeria found that over 90% of healthcare workers in private facilities diagnosed malaria presumptively, often without confirming the diagnosis through recommended testing protocols (50).

The qualitative component of our study provided deeper insights into the factors contributing to the higher adherence observed in private facilities. Several private facility prescribers reported that patients frequently demand diagnostic testing, preferably microscopy, before receiving treatment.

5.5 Prescribers' reasons for non-adherence to malaria case management guidelines

The findings from the study highlighted several reasons related to the health system, prescribers, patients/ caregivers, and other factors that contributed to sub-optimal adherence to malaria case management guidelines.

5.5.1 Health system-related factors

The quality of malaria case management depends on the health system's structure, with factors such as the availability of essential commodities, the adequacy of healthcare staff, and access to diagnostic tests playing pivotal roles. Essential malaria commodities such as MRDT test kits and anti-malaria medications are widely available in most public facilities in Tanzania because these commodities are freely distributed to all public health facilities as vertical commodities (91). In Private facilities were also directed to sell anti-malaria medications at cheaper prices so that they can be accessible to all community members (91). This study revealed that most healthcare facilities had a consistent supply of essential commodities particularly MRDT testing kits and anti-malaria medications with some facilities still facing occasional shortages especially the ones located in remote areas. However, even with the consistent supply of these

commodities, the overall level of prescribers' adherence to guidelines was not as high as anticipated.

The other challenge observed was limited number of healthcare staff scheduled to manage patients in the outpatient departments in most of the facilities visited, both public and private. It was found out in some occasions same prescriber was handling all tasks related to malaria case management such as attending patients, conducting laboratory investigations as well as medication dispensing. This overwhelming workloads for the available staff may interfere with their ability to strictly follow all the required procedures. Some studies have reported that overloaded prescribers may struggle to follow recommended procedures when managing a high volume of patients, leading to deviations from the guidelines (54).

Another significant health system related factor was the absence of alternative diagnostic tests to confirm or rule out other non-malarial febrile illnesses. This posed a challenge for prescribers who were forced to rely more on their clinical judgment in the absence of confirmatory diagnostic tools. Studies have shown that prescribers face difficulties when they encounter negative malaria test results due to absence of reliable diagnostic tests to identify other causes of fever. This often results in the over-prescription of antibiotics, as prescribers attempt to cover all possible causes of the patient's symptoms (35,92).

5.5.2 Prescribers related factors

The attitudes and perceptions of prescribers handling patients with presumptive malaria may play a major role in adherence to malaria case management guidelines influenced by various factors such as years of working experience, trust in diagnostic results, perception of malaria endemicity, and training received in IMCI.

Most of the prescribers interviewed had more than three years of clinical experience, which they acknowledged influenced their approach to treating presumptive malaria patients. Experienced prescribers often rely on their clinical judgment rather than strictly adhering to diagnostic tests, especially when they have previously observed positive outcomes from their clinical judgment. Their extensive experience can sometimes make them resistant to adopting new guidelines that they feel conflict with their established clinical practices. (93). However, these prescribers often

overlook self-limiting non-malarial febrile illnesses. Many febrile illnesses are due to non-malarial causes, such as viral infections, which generally resolve without medical intervention. The immune system effectively combats these infections, leading to the spontaneous resolution of symptoms, including fever (94). Therefore, it is crucial to differentiate between malaria and other febrile illnesses to avoid unnecessary treatment with anti-malarial drugs and to ensure appropriate care for patients.

Mistrust of MRDT negative test results by both prescribers and caregivers was also revealed to be a potential barrier for adherence to guidelines. There was a common belief among prescribers that MRDTs may not be sensitive enough to detect malaria infection when parasite levels are below a count of five. Due to the fear of missing a malaria case, prescribers often administered anti-malaria medications even when the MRDT results were negative. Caregivers' mistrust of negative MRDT results also played a role in prescribers' non-adherence to guidelines. Many community members often express doubts to MRDT negative results and prefer being tested through microscopy. This finding is similar to several studies conducted which have reported doubts about the reliability of MRDT negative results by both healthcare providers and patients (92,95).

All the interviewed prescribers were aware of the high prevalence of malaria in their region which they reported to influence them to treat malaria cases presumptively. This finding is consistent with findings from a study conducted in highlighted how prescribers in high-endemic regions often resort to presumptive treatment due to the perceived high risk of malaria, even in the face of negative diagnostic tests. In regions with high malaria endemicity, the frequent occurrence of malaria might lead to the assumption that fever in patients is almost always due to malaria. However, this perception can be misleading, as not all fevers are caused by malaria. Other infectious diseases, such as bacterial or viral infections, can present similar symptoms like fever, chills, and headaches. Studies have also reported that majority of under-fives with fever usually have self-limiting non-malarial febrile illnesses (35,94). So, relying solely on clinical judgment without diagnostic testing can result in misdiagnosis and inappropriate treatment, which may neglect other potentially serious conditions. Therefore, even in high-

endemic areas, it is crucial to confirm malaria diagnosis through reliable diagnostic tools whenever possible to ensure accurate and effective patient management.

5.5.3 Patient related factors

In high malaria transmission areas, before diagnostic tests were widely available, prescribers used to diagnose and treat presumptive malaria in under-fives based on clinical symptoms to avoid mortalities associated with severe disease (20). Some prescribers have continued to maintain this practice from their previous IMCI training and continue with presumptive treatment based on clinical presentation. Interviews revealed that prescribers with a higher tendency to treat presumptively relied on the recognizable malaria-like symptoms presented by patients. This practice was driven by the frequent occurrence of these symptoms in their clinical experience.

This study revealed that prescribers often faced pressure from patients or their caregivers to prescribe anti-malaria medications, regardless of guideline recommendations or negative test results. This pressure suggests a strong expectation among patients that febrile illnesses should be treated with antimalarials, influenced by community beliefs or previous experiences. In communities where malaria is highly prevalent, there may be a strong expectation among community members for antimalarial treatment when experiencing febrile illnesses even with negative diagnostic test results. This pressure can influence prescribers to deviate from guidelines and provide antimalarial drugs even in the absence of diagnostic evidence. Some community members express a preference for testing for malaria by microscopy due to the perception that it is more reliable than MRDTs. This preference can lead prescribers to favor microscopy results or even resort to clinical judgment over MRDT outcomes, especially in cases where MRDTs yield negative results but clinical suspicion remains high. High-quality microscopy may serve as the gold standard for malaria diagnosis. However, in many African settings, the quality of microscopy is still questionable and various studies have reported over-diagnoses of malaria when microscopy is used for testing.

5.6 Study limitations

One limitation encountered during data collection was incomplete information in patients' case notes. This challenge was addressed by utilizing additional records, such as patient registers and laboratory reports, to supplement missing data to ensure completeness and accuracy.

CHAPTER SIX

6.0 CONCLUSION AND RECOMMENDATION

6.1 Conclusion

The level of prescribers' adherence to malaria case management guidelines among under-five patients is sub-optimal, with a significant proportion of patients being administered anti-malaria medications without testing or despite having negative laboratory test results. While microscopy was commonly used as a method for diagnosing malaria, it poses a significant risk of overdiagnosis because of the insufficient quality assurance programs in the country. Private healthcare facilities have a higher prevalence of adherence to guidelines compared to public facilities. Qualitative exploration identified several primary contributors to prescribers' non-adherence to guidelines. These included health system factors such as inconsistent commodity availability, staffing shortages, and the absence of alternative diagnostic tests. Prescriber-related factors, including varying levels of clinical experience and mistrust in MRDT negative results, also played significant roles. Patient and caregiver expectations, influenced by perceptions of high malaria endemicity, further influenced non-adherence. Addressing these challenges necessitates improving health system resources, implementing regular supportive supervision and mentorship for prescribers, establishing quality assurance programs for diagnostic tests, and engaging communities to align their expectations with evidence-based practices.

6.2 Recommendations

CHMT to provide mentorship to prescribers and other healthcare providers involved in the whole chain of malaria case management on the importance of adhering to guidelines emphasizing the benefits of accurate diagnosis through diagnostic tests before prescribing anti-malarial medications.

MOH should establish quality assurance programs to supervise healthcare facilities performing microscopy diagnostic tests, ensuring the accuracy and reliability of test results to prevent over-treatment with anti-malaria medications

CHMT and facility in-charges should ensure adequate facilities stock status for essential malaria commodities to ensure their continuous availability in both public and private healthcare facilities. Timely ordering of commodities and appropriate redistribution can enhance the consistent availability of these commodities.

MOH in collaboration with RHMT and CHMT to provide education to the community on the benefits of diagnostic testing and the risks of presumptive treatment will reduce demand for unnecessary medications.

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APPENDICES

Appendix I: Quantitative data collection questionnaire

SECTION 1: HEALTH FACILITY INFORMATION

1. District:
2. Level of healthcare facility

   □ District hospital

   □ Health center

   □ Dispensary

3. Ownership

   □ Government/public

   □Private

4. Location
   □ Urban
   □ Rural
5. Date of assessment day|_____|_____| month|_____|_____| year |_____|_____|
6. Name of researcher: ……...
7. Phone number of researchers...…….
8. GPS coordinates……...

SECTION 2: PATIENT'S DETAILS

9. Patient ID:
10. Age of the Patient (in months) ...……...
11. Documented weight of the patient in kg……
12. Gender of the patient
    □ Male
    □ Female
13. Does the patient present with fever?

    □ Yes

    □ No

14. Is there any danger sign present?

    □ Yes

    □ No

15. If yes, specify

□ inability to drink or breastfeed

□ vomiting everything

□ history of convulsions during the current illness

□ convulsions

□ lethargy or unconsciousness

□ Other, specify

16. Any other presenting symptom (specify)……
17. Does the patient present with any comorbidities?
    □ Yes
    □ No
18. If, yes which comorbidity (specify)
    .....

SECTION 3: LABORATORY INFORMATION

19. Was a laboratory test done?

    □ Yes

    □ No

20. Type of malaria test done
    □ MRDT
    □ Microscopy
    □ Other (specify)……
21. Result of patient's laboratory test for malaria

    □ Positive

    □ Negative

    □ Not documented

22. Laboratory report (write all other tests done, and results. If none write NONE)
    ……
    ….
23. Malaria severity classification by clinician

    □ Severe

    □ Not severe/uncomplicated

    □ Not classified

24. Malaria severity classification as per national guideline

□ Severe

□ Not severe/uncomplicated

SECTION 4: TREATMENT

25. Antimalarial drug prescribed to the patient for positive laboratory result?
□ Yes
□ No
26. Antimalarial drug prescribed to the patient for negative laboratory result?
□ Yes
□ No
27. Antimalarial drug prescribed to the patient for without being tested for malaria?
□ Yes
□ No
28. What was the prescribed antimalarial drug to the patient?

□ Artemether-lumefantrine (ALU)

□ Dihydroartemisinic-piperaquine (DP)

□ Other (please specify):

29. Drug dosage according to weight/age …….
30. Correct drug choice according to disease classification

□ Yes

□ No

□ Difficult to tell

31. Correct drug dosage according to weight/age

□ Yes

□ No

□ Difficult to tell

32. Any other medication prescribed
□ Yes
□ No

33. if yes, which medication has been prescribed…….

Appendix II: Observation checklist

1. Assessment and Diagnosis

Initial Assessment

☐ Takes patient's temperature.

☐ Checks for other symptoms (e.g., fever, lethargy, vomiting, etc.).

☐ Asks relevant questions about the child's history of malaria.

☐ Inquires about recent travel to high-risk malaria areas.

2. Request for Malaria Test

☐ Orders a malaria diagnostic test (RDT or microscopy).

☐ Explains the reason for the test to the caregiver.

☐ Waits for test results before prescribing any antimalarial.

☐ Records test request and results in the patient's chart.

3. Management Based on Test Results

If Test is Positive

☐ Prescribes Artemether-Lumefantrine (alu) as first-line treatment.

☐ Explains the treatment plan and dosage to the caregiver.

☐ Advises on how to administer the medication.

☐ Provides information about possible side effects and follow-up care.

☐ Ensures caregiver understands the treatment regimen.

If Test is Negative

☐ Does not prescribe antimalarials.

☐ Investigates alternative causes of febrile illness.

☐ Suggests further tests or treatment options.

☐ Explains the next steps clearly to the caregiver.

☐ Records decisions and rationale in the patient's chart.

4. Prescriber's Adherence to Guidelines

Use of Malaria Management Guidelines

☐ Follows national/international malaria treatment guidelines.

☐ Adheres strictly to test results before prescribing.

☐ Demonstrates awareness of the risks of over-prescribing antimalarials.

☐ Ensures all decisions are backed by clinical evidence.

4. Prescription Practices

☐ Avoids unnecessary prescriptions for negative malaria tests.

☐ Always prescribes alu for confirmed positive cases.

☐ Ensures the correct dosage and frequency of alu is given.

5. Potential Barriers to Adherence

Observations of non-adherence

☐ Prescribes antimalarials without confirming test results.

☐ Deviates from treatment guidelines without proper justification.

☐ Fails to order a malaria test despite symptoms.

6. Observer's Additional Notes on Prescriber's Behaviour and Decision-Making

…….

Appendix III: Qualitative data collection English questionnaire

Questionnaire number…….

1. Age of the respondent {in years} .....
2. Gender of the respondent (Tick where applicable)
   - □ Male
   - □ Female
3. Designation of the respondent
   - □ Medical officer
   - □ Assistant medical officer
   - □ Clinical officer
   - □ Laboratory technician
   - □ Pharmacist
   - □ Nursing officer
   - □ Medical attendant
   - □ Others (specify)…….

4. How long have you practiced as a prescriber?
   ……. years
5. Are you aware of presence of national malaria case management guidelines?
   - □ Yes
   - □ No
6. Have you read the current 2020 malaria case management guidelines?

   □ Yes

   □ No

If yes, do you understand the malaria case management guideline

   □ Yes

   □ No

If yes, please state based on the scale below whether or not you agree with case management recommendations in the guidelines

   - □ Strongly agree
   - □ Agree
   - □ Neutral
   - □ Disagree
   - □ Strongly disagree

Explain your response.....

7. Have you received any training or updates on malaria case management guidelines?
   - □ Yes
   - □ No

   If yes, how many times have you been trained
   - □ 1
   - □ 2
   - □ 3
   - □ 4 or more
8. Do you think adhering to malaria case management guidelines will make a difference in patient outcomes?
   - □ Yes
   - □ No

Explain your response.....

9. When a case of suspected malaria comes to your facility what is the first thing that is done?.....

10. Does your health facility laboratory have equipment and reagents necessary for diagnosis of malaria?
    - □ Yes
    - □ No
    - □ I don't know
11. Is your facility laboratory staffed with qualified personnel to conducted malaria tests?
    - □ Yes
    - □ No
    - □ I don't know
12. Are you aware of the malaria prevalence rates in the region where you practice?
    - □ Yes
    - □ No
13. How do you think regional variations in malaria risk may impact your adherence to malaria management guidelines?

    ……..
14. What challenges, if any, do you face in adhering to testing protocols before treatment?

    ……
15. What factors influence your decision to prescribe antimalarials for under-fives with presumptive malaria?

    ……
16. Are there circumstances where you might opt for different anti-malarial medication than the recommended first line? If so, please provide examples:

    …….
17. In cases where test results are negative, what actions do you take?

    ……...
18. Have you ever received training in IMCI?
    - □ Yes
    - □ No

If yes, how does the training in IMCI have influence your approach to treating fever as malaria?

……

19. Are there any other things not covered in this questionnaire that you believe are important in understanding the influences on testing and anti-malaria prescription?

    ……

Appendix III: Qualitative data collection Swahili questionnaire

SEHEMU YA 1: TAARIFA ZA KIDEMOGRAFIA

Nambari ya dodoso …….

1. Umri wa mhojiwa kwa miaka .....
2. Jinsia ya mhojiwa (Weka alama inapohitajika)

   □ Me

   □ Ke

3. Cheo cha mhojiwa
   □ Daktari

   □ Daktari msaidizi

   □ Afisa tabibu

   □ Mtaaalamu wa maabara

   □ Mfamasia

   □ Afisa muuguzi

   □ Mhudumu wa afya

   □ Nyingine (taja)…….

4. Je ni kwa miaka mingapi umekuwa ukitoa huduma ya matibabu kwa wagonjwa wa malaria??

……miaka

5. Je, una ufahamu juu ya uwepo wa muongozo wa kitaifa wa utoaji huduma za malaria?

   □ Ndiyo

   □ Hapana

6. Umewahi kusoma muongozo huo wa utoaji huduma za malaria?

   □ Ndiyo

   □ Hapana

Kama jibu ni ndiyo, unauelewa muongozo huo wa utoaji huduma za malaria?

□ Ndiyo
□ Hapana

Kama jibu ni ndiyo, je, ni kwa kiasi gani unakubaliana/kuafikiana na muongozo huo wa utoaji huduma za malaria?

□ Ninaafikiana sana

□ Ninaafikiana kiasi

□ Nipo katikati

□ Siafikiani

□ Siafikiani kabisa

Toa maelezo ya jibu lako.....

7. Je, umewahi kupata mafunzo au maelekezo yoyote ya maboresho ya muongozo wa matibabu ya malaria?

□ Ndiyo

□ Hapana

Ikiwa ndiyo, je, ni mara ngapi umepata mafunzo/maelekezo hayo

□ 1
□ 2
□ 3
□ 4 au zaidi

8. Je, unadhani kutoa matibabu ya malaria kwa kufuata muongozo kutaleta matoleo yoyote Chanya kwa mgonjwa wa malaria?
□ Ndiyo
□ Hapana

Toa maelezo ya jibu lako.....

9. Mhisiwa wa ugonjwa wa malaria akifika kituoni kwako, je ni jambo gani la kwanza hufanyika?.....
10. Je, maabara ya kituo chako cha kutolea huduma ina vitendanishi au mahitaji muhimu ya hadubini kwa ajili ya uchunguzi wa malaria?
□ Ndiyo
□ Hapana
□ Sijui
11. Je, kituo chako kina wataalamu wa maabara wenye sifa na ujuzi wa kufanya vipimo vya malaria?
□ Ndiyo
□ Hapana
□ Sijui

12. Unafahamu kiwango cha ugonjwa wa malaria kwenye mkoa unaofanyia kazi sasa?

    □ Ndiyo

    □ Hapana

13. Je, unadhani tofauti za kiwango cha maambukizi ya malaria kilichopo kati ya mkoa wako na mikoa mingine kinaathiri ufuataji wa miongozo wakati wa utoaji wako wa huduma za matibabu ya malaria?
    □ Ndiyo
    □ Hapana

Elezea jibu lako.....

14. Ni changamoto gani unakutana nazo katika kufuata miongozo ya kutoa huduma za upimaji na matibabu ya malaria? .....
15. Ni vitu gani vinaathiri uamuzi wako wa kufanya upimaji na kutoa matibabu ya Watoto chini ya miaka mitano? ……..
16. Je, kuna sababu ambazo zinaweza kukupelekea kuchagua dawa tofauti na ile iliyoelekezwa kwenye miongozo ya matibabu ya malaria?
    □ Ndiyo
    □ Hapana

Ikiwa ndivyo, tafadhali elezea sababu hizo:

…….

17. Endapo kipimo cha malaria cha mhisiwa kikiwa hasi, unafanya mambo gani baada ya hapo?

……...

18. Umewahi kupokea mafunzo ya IMCI?

    □ Ndiyo

    □ Hapana

Ikiwa ndiyo, elezea jinsi mafunzo ya IMCI yanavyoathiri ufuataji wako wa miongozo ya matibabu ya malaria?.....

19. Je, kuna sababu zingine za ziada ambazo hazijajadiliwa katika mahojiano haya ambazo unaamini ni za msingi zinazopchangia kufuata/kutofuata miongozo ya matibabu ya malaria?

Appendix IV: Approval for ethical clearance

UNITED REPUBLIC OF TANZANIA
MINISTRY OF EDUCATION, SCIENCE AND TECHNOLOGY
MUHIMBILI UNIVERSITY OF HEALTH AND ALLIED SCIENCES
OFFICE OF THE DIRECTOR – RESEARCH, PUBLICATIONS AND INNOVATION

Ref. No.DA.282/298/01.C/2132 Date: 02/04/2024

MUHAS-REC-04-2024-2132
EVELYINE BARTAZAR NGOLI
MUHAS

RE: APPROVAL FOR ETHICAL CLEARANCE FOR A STUDY TITLED: PRESCRIBERS' ADHERENCE TO NATIONAL GUIDELINES FOR MALARIA CASE MANAGEMENT AMONG UNDER-FIVES AND ASSOCIATED FACTORS IN TABORA, TANZANIA, 2024

Reference is made to the above heading,

I am pleased to inform you that the Chairman has on behalf of the University Senate, approved ethical clearance of the above-mentioned study, on recommendations of the Senate Research and Publications Committee meeting accordance with MUHAS research policy and Tanzania regulations governing human and animal subjects research.

APPROVAL DATE: 02/04/2024
EXPIRATION DATE OF APPROVAL: 02/04/2025

STUDY DESCRIPTION:
Purpose:

The purpose of this mixed method cross sectional study is to assess adherence to guidelines for malaria case management and explore factors influencing prescribers' adherence on non-adherence in Tabora region.

The approved protocol and procedures for this study is attached and stamped with this letter, and can be found in the link provided: https://irb.muhas.ac.tz/storage/Certificates/Certificate%20-%2014554.pdf and in the MUHAS archives.

The PI is required to:

1. Submit bi-annual progress reports and final report upon completion of the study.
2. Report to the IRB any unanticipated problem involving risks to subjects or others including adverse events where applicable.
3. Apply for renewal of approval of ethical clearance one (1) month prior its expiration if the study is not completed at the end of this ethical approval. You may not continue with any research activity beyond the expiration date without the approval of the IRB. Failure to receive approval for continuation before the expiration date will result in automatic termination of the approval for this study on the expiration date.
4. Obtain IRB amendment (s) approval for any changes to any aspect of this study before they can be implemented.
5. Data security is ultimately the responsibility of the investigator.
6. Apply for and obtain Data Transfer Agreement (DTA) from NIMR if data will be transferred to a foreign country.
7. Apply for and obtain Material Transfer Agreement (MTA) from NIMR, if research materials (samples) will be shipped to a foreign country.
8. Apply for and obtain permission to publish the results from National Institute for Medical Research. The application should be before submitting to a publisher and not concurrently through the email publications@nimr.or.tz.
9. Any researcher, who contravenes or fail to comply with these conditions, shall be guilty of an offence and shall be liable on conviction to a fine as per NIMR Act No. 23 of 1979, PART III section 10 (2)
10. The PI is required to ensure that the findings of the study are disseminated to relevant stake holders.
11. PI is required to be versed with necessary laws and regulatory policies that govern research in Tanzania. Some guidance is available on our website https://drp.muhas.ac.tz/.

Dr. Nahya Salim Masoud,
Chairperson, MUHAS Research and Ethics Committee

Muhimbili University of Health and Allied Sciences
DIRECTOR
Research & Publications
Box 65001

Appendix V: Permission letter for data collection

THE UNITED REPUBLIC OF TANZANIA

PRESIDENT'S OFFICE
REGIONAL ADMINISTRATION AND LOCAL GOVERNMENT

Telegrams: MKUUMKOA
Telephone: (026) 2604058/2604116
Fax: (026) 260 4274
Email: ras.tabora@tamisemi.go.tz

Regional Commission's Office,
2 Airport Road,
P.O. BOX 25,
45180 TABORA.

Ref No. AC.54/218/01F/216

15 April, 2024

Municipal Director,
Tabora Municipal Council,
4 Airport Road,
P.O. BOX 174,
45182 TABORA.

District Executive Director,
Sikonge District Council,
4 Bomani Street,
P.O.BOX 70
45382 SIKONGE

REF: STUDENT RESEARCH CLEARANCE

Reference is made to the above mentioned heading.

2. Muhimbili Univeristy of Health and Allied Sciences (MUHAS) has written a letter to this Office introducing **Ms. Evelyne Bartazar Ngoli** who is a bonafide Student of that Institute. She is undertaking research titled **"Prescribers' Adherence to National Guidelines for Malaria Case Management among Under-Fives and Associate Factors: A Case of Tabora Municipal and Sikonge District".**

3. I am writing to inform you that **Ms. Evelyne Bartazar Ngoli** has been granted permission to collect data from your area starting 16 April, 2024 to 16 May, 2024. I therefore request your Office to assist her with whatever she may need, which will enable her to accomplish her assignment.

4. Upon completion of this research feedback should be given to this Office.

Asanterabi C. Sang'enoi
For: REGIONAL ADMINISTRATIVE SECRETARY
TABORA.

TABORA

Copy: Regional Administrative Secretary **(To see in the file)**
TABORA.

Appendix V: Digital Receipt

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Digital Receipt

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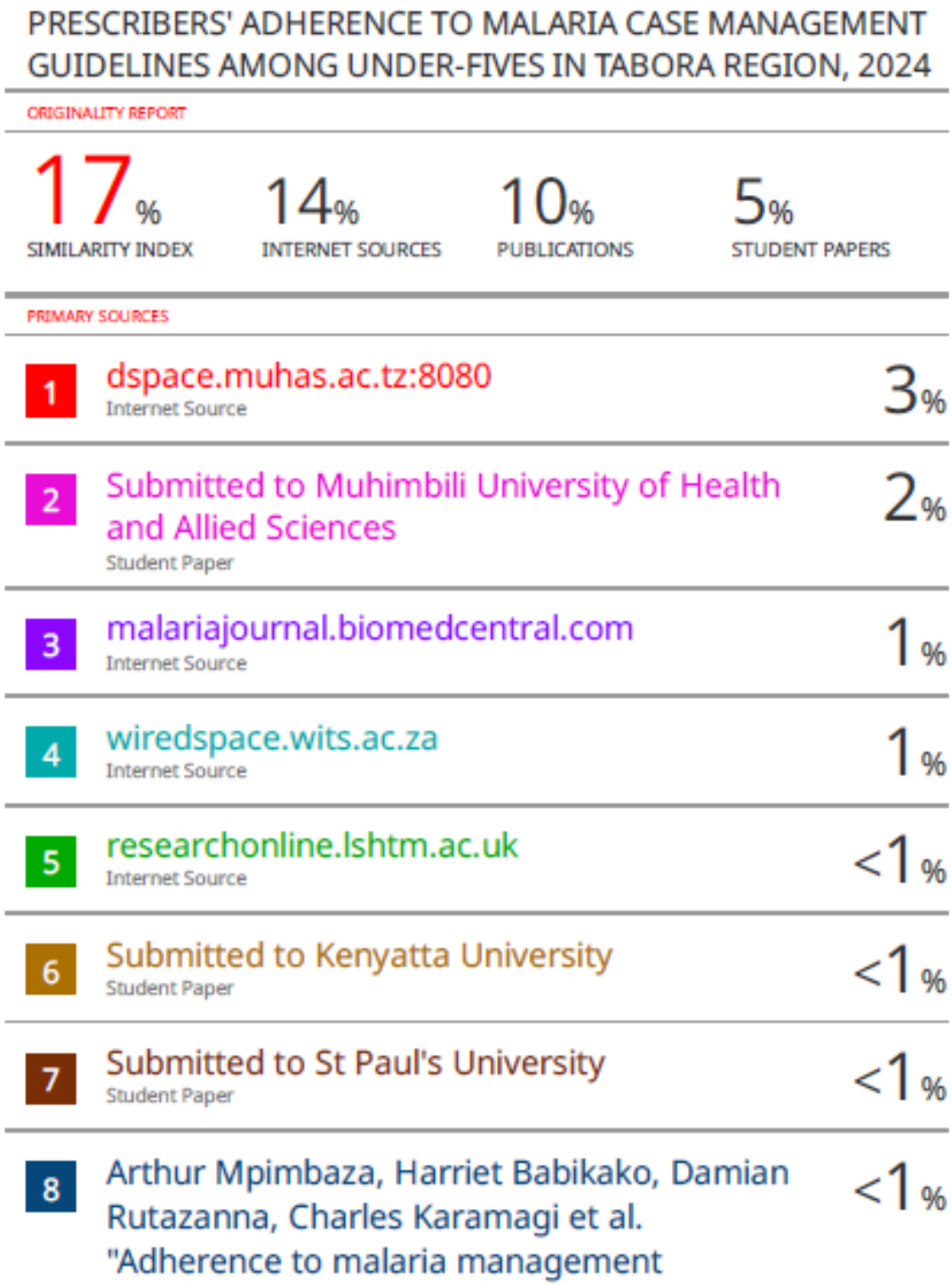
The first page of your submissions is displayed below.

Submission author:	Evelyine Ngoli
Assignment title:	Report
Submission title:	PRESCRIBERS' ADHERENCE TO MALARIA CASE MANAGEMEN...
File name:	EVELYNE_DISSERTATION_PROF_DRAFT_3_FINAL.docx
File size:	1.67M
Page count:	80
Word count:	18,632
Character count:	114,426
Submission date:	26-Jun-2024 02:14PM (UTC+0300)
Submission ID:	2306803474



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Appendix VI: Plagiarism report



PRESCRIBERS' ADHERENCE TO MALARIA CASE MANAGEMENT GUIDELINES AMONG UNDER-FIVES IN TABORA REGION, 2024

ORIGINALITY REPORT

17%	14%	10%	5%
SIMILARITY INDEX	INTERNET SOURCES	PUBLICATIONS	STUDENT PAPERS

PRIMARY SOURCES

1	dspace.muhas.ac.tz:8080 Internet Source	3%
2	Submitted to Muhimbili University of Health and Allied Sciences Student Paper	2%
3	malariajournal.biomedcentral.com Internet Source	1%
4	wiredspace.wits.ac.za Internet Source	1%
5	researchonline.lshtm.ac.uk Internet Source	<1%
6	Submitted to Kenyatta University Student Paper	<1%
7	Submitted to St Paul's University Student Paper	<1%
8	Arthur Mpimbaza, Harriet Babikako, Damian Rutazanna, Charles Karamagi et al. "Adherence to malaria management	<1%