

Factors Affecting Adherence to National Malaria Treatment Guidelines in the Diagnosis, Treatment and Prevention of Malaria in Pregnancy among Healthcare Workers in Public Health Facilities in Jowhar District, Somalia

Abdullahi Muse Mohamoud*, Magda Elhadi Ahmed Yousif, Osman Khalafalla Saeed

PHC & HE Center, Faculty of Medicine, University of Gezira, Wad Madani, Sudan
Email: *cabdallamm7@gmail.com

How to cite this paper: Mohamoud, A.M, Yousif, M.E.A. and Saeed, O.K. (2022) Factors Affecting Adherence to National Malaria Treatment Guidelines in the Diagnosis, Treatment and Prevention of Malaria in Pregnancy among Healthcare Workers in Public Health Facilities in Jowhar District, Somalia. *Health*, 14, 1114-1129.
<https://doi.org/10.4236/health.2022.1411079>

Received: July 18, 2022

Accepted: November 6, 2022

Published: November 9, 2022

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Abstract

Introduction: Early diagnosis and effective treatment remain critical elements of a malaria control strategy in preventing mortality and reducing the incidence of severe malaria illness in Somalia. In Sub-Saharan African countries showed different levels of adherence to their national malaria guidelines for malaria treatment and prevention in pregnancy, while experiences from many countries indicated several challenges and constraints that may make the implementation of the guidelines difficult. **Objective:** The study aimed to assess factors affecting adherence to revised national malaria treatment guidelines in the diagnosis, treatment and prevention of malaria in pregnancy among health care workers in public health facilities in Jowhar District, Somalia. **Methodology:** A cross-sectional health facility-based study conducted in Jowhar district. A structured interview questionnaire was used for data collection from (n = 150). Healthcare workers selected from ten public health facilities using proportional to size sampling and an observational checklist was used to assess patient's medical prescriptions to review their conformity to the guidelines and the availability of antimalarial drug, malaria diagnostic tests (mRDTs and microscopy) and job aids, such as the national malaria treatment guidelines, clinical algorithm (flow chart), malaria rapid diagnosis tests mRDTs' use of wall charts, and drug dose wall charts at the facilities. Data was analyzed through the application of descriptive statistical analysis that includes frequency, and percentages by using Statistical Package for Social Sciences (SPSS) Version 25. **Results:** Healthcare workers interviewed were 89 (59.3%) aware of the existence of the revised national mala-

ria treatment guidelines. However, 61 (40.7%) were not aware of the guidelines and only 46 (30.7%) had been trained for the national malaria guidelines in the treatment and prevention of malaria in pregnancy. Overall, 33 (22%) of the workers reported to adhere to guidelines, with 117 (78.0%) reported non-adherence. A significant difference was observed in the training status among different categories of health workers with (p-value of 0.022). **Conclusion and Recommendation:** In conclusion, the study showed that adherence to the national malaria guidelines for Malaria diagnosis, treatment and prevention in pregnancy among health care workers are associated with inadequate awareness of the revised national malaria guidelines among healthcare workers, inadequate supply of diagnostic tests (mRDTs and microscopy) at the health facilities and lack of access to revised national guidelines for malaria diagnosis and treatment, a lack of regular supervision and monitoring and lack of in-service training respectively. The national malaria control program should intensify efforts to strengthen the readiness of the public health facilities in the district to handle malaria in pregnancy cases, diagnosis, treatment and prevention, improve the availability of antimalarial drugs and malaria diagnostic tests (mRDTs and microscopy), job-aids at the health facilities and undertake regular monitoring and on job training to ensure the proper use of the guidelines at all levels of health care service delivery points across the country.

Keywords

Malaria, Guidelines, Adherence, Malaria in Pregnancy, Jowhar District, Somalia

1. Introduction

Malaria constitutes a major public health problem in Somalia. Almost the whole country is considered endemic [1] [2]. Due to climatic and meteorological factors, malaria transmission varies between different parts of the country, ranging from unstable and epidemic-prone areas in the north and some central regions to moderate-to-high transmission in the southern regions. In areas with stable transmission, particularly along the Juba and Shabelle rivers, children under five years of age, pregnant women, and non-immune migrants carry most of the disease burden. All age groups are affected in unstable transmission settings, including epidemic-prone areas [1] [2] [3]. Two peaks of transmission coincide with the two wet seasons: April to June and October to November [4]. *Plasmodium falciparum* (pf) is the dominant species throughout Somalia, accounting for more than 90% of infections, while *Anopheles arabiensis* is the main vector responsible for malaria transmission throughout Somalia [4].

There is limited national data on the true burden of malaria in Somalia. The World Malaria Report 2020 estimated that there were around 759,000 cases and 1942 deaths in Somalia in 2019 [1]. The World Health Organization (WHO) currently recommends a package of interventions for controlling malaria during pregnancy in areas with stable (high) transmission of *P. falciparum* [1], which includes: the use of insecticide treated nets (ITNs), Intermittent preventive treatment (IPT)

and effective case management of malaria and anaemia [1] [5]. prompt diagnosis and effective treatment are a fundamental pillar of the essential malaria interventions strategy [6]. Therefore, effective implementation of the recommended strategy for malaria in pregnancy requires close collaboration between malaria control and reproductive health programmes at all levels, including policy development, planning, logistics, procurement, training and service delivery. Somalia has endorsed the World Health Organization's (WHO) global strategy for malaria control and has vowed to "Roll back malaria". The objective, as per the national strategic plan 2017-2020, is to diagnose and treat 90% of malaria cases in public and private health facilities and at the community level according to "Guidelines for the Diagnosis and Treatment of Malaria in Somalia, 2016" [7]. Providing timely treatment with effective ACT is the cornerstone of malaria control strategies in malaria-endemic countries, including Somalia. In Somalia, the national malaria control programme (NMCP) of the Federal Ministry of Health and Human Services updated its national malaria diagnosis and treatment guidelines (NMTG) in 2016, whereby; oral Quinine was recommended as first-line drug for the treatment of uncomplicated malaria in pregnancy during the first trimester. Artemether-Lumefantrine ALu was recommended as the first-line drug during the second and third trimesters of pregnancy. Oral quinine is recommended as second-line drug for the treatment of uncomplicated malaria in pregnancy during all trimester. Parenteral Artesunate is recommended as the first-line drug for treating severe malaria in pregnancy during all trimester. Quinine Parenteral (if Parenteral Artesunate is unavailable) was recommended as the second-line drug for severe malaria in pregnancy during all trimesters [7]. To prevent malaria in Somalia, all pregnant women in moderate to high transmission areas should receive three doses of the recommended antimalarial drug sulfadoxine/pyrimethamine SP as an intermittent preventive treatment during pregnancy (IPTp) when scheduled for the ANC visit. The first dose should be administered as early as possible during the second trimester of gestation. Each SP dose should be given with a minimum interval of one month apart and up to delivery. To ensure compliance in the uptake of IPTp-SP doses by pregnant women attending antenatal care (ANC), the guidelines emphasized directly observed treatments (DOTs) by a qualified health worker [7] [8]. Currently, the recommended malaria treatments are summarized in the below box.

Management of uncomplicated malaria in pregnancy according to the national malaria guidelines 2016

1. First-line drug according to the current national malaria treatment guidelines in the treatment of uncomplicated malaria in pregnancy.
 - a) First trimester
Quinine tab 300 mg TID for seven days, three times per day.
 - b) Second and third trimesters: ACTs (Artemether plus lumefantrine) two times a day for three days.
 2. Second-line drug according to the national malaria treatment guidelines in the treatment of uncomplicated malaria in pregnancy.
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Continued

a) First trimester

Quinine tab 300 mg three times daily for seven days, or if vomiting, administer quinine injection 20 mg/kg load doses, then maintenance dose of 10 mg/kg three times daily for 24 or 48 hours. Switch to oral if the patient tolerates it.

b) The second and third trimesters

Quinine tab 300 mg three times daily for seven days.

Management of severe malaria in pregnancy according to the national malaria guidelines

First-line drug according to the current national malaria treatment guidelines in the treatment of severe malaria in pregnancy.

a) First trimester

Artesunate injectable 2.4 mg/kg 0 doses, then 12 hours, 24 hours, and then switch to oral.

b) The second and third trimesters

Artesunate injectable 2.4 mg/kg 0 doses, then 12 hours, 24 hours, and then switch to oral.

The second drug option (if artesunate injectables are not available) according to the current national malaria treatment guidelines in the treatment of severe malaria in pregnancy.

c) First trimester

Quinine injection 20 mg/kg load doses then a maintenance dose of 10 mg/kg three times daily for 24 or 48 hrs. Switch to oral if the patient tolerates it.

d) The second and third trimesters

Quinine injection 20 mg/kg load doses then maintenance dose of 10 mg/kg three times for 24 or 48 hours. Switch to oral if the patient tolerates it.

Regarding Adherence Refers to the extent to which the health worker follows instructions provided by the revised malaria guidelines in the diagnosis, treatment and prevention management of malaria in pregnancy. While adherence was categorized as strict, partial; Strict adherence to revised National Malaria Diagnosis and Treatment Guidelines (NMTG) meant; diagnosis should be based on parasitological confirmation doing the malaria RDT or a blood smear with all suspected patient. If the result is positive, only recommended anti-malarial drugs are prescribed; if the result is negative no anti-malarial drug is given [7] [9] [10]. Partial adherence was when there was no parasitological confirmation of cases, the patient is treated on the basis of clinical diagnosis meanwhile the choice of antimalarial matched the national guidelines for malaria treatment [10]. Non-adherence was when there was no parasitological confirmation of cases, and the choice of antimalarial medicines did not follow the national malaria treatment guidelines [9]. Effective implementation of the recommended strategy for malaria in pregnancy requires close collaboration between malaria control and reproductive health programs at all levels, including policy development, planning, logistics, procurement, training, and service delivery. In many developing countries, including Somalia, inappropriate, ineffective, and inefficient use of drugs commonly occurs at health facilities [11]. Lack of medicines, updated guidelines, laboratory facilities,

and inadequate training influence prescribing practices [12]. Early diagnosis and effective treatment remain the key elements of a malaria control strategy in preventing mortality and reducing the incidence of severe illness. In Somalia, the main factors constraining proper diagnosis and treatment can be summarized as follows: Inadequate access to healthcare and low health service utilization, poor quality of diagnosis and treatment, inadequate human resources in the health sector, and inadequate financial resources [13].

Therefore this study is aimed to assess Factors Affecting Adherence to National Malaria Treatment Guidelines in Diagnosis, Treatment and Prevention of Malaria in pregnancy among Healthcare Workers in Public Health Facilities in Jowhar District, Somalia.

2. Methodology

A cross-sectional health facility-based study was conducted in Jowhar District during the period of the study January to April 2022, using a structured interview questionnaire. A total of ($n = 150$) health workers including: (physicians, nurses, Auxillary nurses, Midwives, Auxillary Midwives, lab-technicians, lab-technician assistants, pharmacy assistants and community health workers CHWs) who are regular working at selected public health facilities in the district, and are involved in the management of malaria in pregnancy, and who were on duty on the date of interview. Health workers were selected by using proportional to size sampling. These facilities were sampled based on the criteria of being public health facilities attended by pregnant women. An observational checklist was used to check on the availability of antimalarial drug for treatment and prevention of malaria in pregnancy, malaria diagnostic tests (mRDTs and microscopy) and job aids, such as the national malaria treatment guidelines, clinical algorithm (flow chart), malaria rapid diagnosis tests use of wall charts, and drug dose wall charts at the facilities and 50 of patient's medical prescription were also reviewed to check that the Antimalarial drug prescribing patterns were adequately labeled with the patient name, drug name, when the drug should be taken and in what quantity in to assess their conformity to the national malaria treatment guidelines in diagnosis, treatment and prevention of malaria in pregnancy.

2.1. Data Analysis

The data was collected, processed, and transferred to computer coding. A descriptive statistics were applied, which includes percentages and frequency distribution tables using the Statistical Package for Social Sciences (SPSS) version 25 computer program. A p-value of ≤ 0.05 regarded as a statistically significant.

2.2. Ethical Consideration

A permission was obtained from health authorities and from all health facilities in-charges, consents were taken verbally from participants. Confidentiality was insured.

3. Results

According results in **Table 1**, the majority of participants, 98 (65.3%), were between the ages of 25 and 34. 103 (68%) were women, 126 (84%) of them were married, and 91 (60.7%) of the participants possessed a university degree.

As shown in **Table 2**, according to the distribution by job categories or cadre of health workers, 61 (40.7%) qualified nurses were the majority, followed by 33 (22%) qualified midwives and 21 (14%) Auxillary nurses. 77 (51.3%) of the healthcare workers have experience ranging from 1 to 5 years. OPD, according to departments, had the highest number at 54 (36%).

As shown in **Table 3**, when asked whether the health workers was aware of revised national malaria treatment guidelines in 2016 NMG, the result indicates that all 8 (100%) physicians were aware. Apart from the physicians, 37 (60.7%) qualified nurses, 22 (66.7%) qualified midwives, 8 (38.1%) Auxillary nurses, 7 (53.8%) Auxillary midwives, 4 (57.1%) lab-technicians, 1 (50%) lab-technicians, and 2 (66.7%) pharmacy assistants were also aware of NMG. None of the CHWs reported aware about it. The difference was not significant

Table 1. Distribution of the respondents according to their socio-demographic characteristics.

Variable	Category	Count	N %
Age of Respondents	20 - 24 Years	31	20.7%
	25 - 34 Years	98	65.3%
	35 - 44 Years	14	9.3%
	More than 45 Years	7	4.7%
	Total	150	100%
Gender of Respondents	Male	47	31.3%
	Female	103	68.7%
	Total	150	100%
Marital Status of Respondents	Single	18	12%
	Married	126	84%
	Divorced	6	4%
	Widowed	0	0%
	Total	150	100%
Educational Level	University	91	60.7%
	Midwifery training institute	9	6%
	Nursing training institute	18	12%
	Secondary school	32	21.3%
	Total	150	100%

Table 2. Distribution of the respondents according to their occupational characteristics.

Variable	Category	Count	N %
Job category (Cadre of Health workers)	Physicians	8	5.3%
	Qualified nurses	61	40.7%
	Qualified midwives	33	22%
	Auxillary Nurses	21	14%
	Auxillary Midwives	13	8.7%
	Lab-Technicians	7	4.7%
	Lab-Technician Assistants	2	1.3%
	Pharmacy Assistants	3	2%
	CHWs	2	1.3%
	Total	150	100%
Work Experience	1 - 5 Years	77	51.3%
	6 - 10 Years	47	31.3%
	11 - 15 Years	5	3.3%
	16 - 20 Years	15	10%
	More than 20	6	4%
	Total	150	100%
Work Department	ANC Department	20	13.3%
	OPD	54	36%
	IPD	10	6.7%
	Maternity Department	27	18%
	Lab Department	10	6.7%
	Pharmacy Department	6	4%
	Delivery Room	20	13.3%
	Internal Medicine Department	3	2%
	Total	150	100%

across different categories of health workers or Cadre of Health workers of job category or Cadre of Health workers with ($p = 0.098$).

A total of 46 (30.7%) received training, while 104 (69.3%) did not. The result in the training status among different categories of health workers on special training in MIPs treatment and prevention guidelines in relation to the use of national malaria treatment guidelines in 2016, 6 (75.0%) physicians attended training, followed by 14 (41.4%) qualified midwives, 3 (41.9%) lab-technicians and 18 (29.5%) qualified nurses. A significant difference was observed in the training status among different categories of health workers or cadre of health workers, with a p-value of 0.022.

Table 3. awareness of, training on and adherence to the current national malaria guidelines in the Diagnosis, Treatment and Prevention of Malaria in Pregnancy by Health care worker's category.

	Do you aware of the revised NMG? $X^2 = 13.442$, $df = 8$, p -value = 0.098		Have you ever attended special training on MIPs treatment & prevention guidelines? $X^2 = 17.931$, $df = 8$, $p = 0.022$		Are you adhering NMG? $X^2 = 18.621$, $df = 8$, p -value = 0.017	
	Yes	No	Yes	No	Yes	No
Physicians	8 (100%)	0 (0%)	6 (75%)	2 (25%)	5 (62.5%)	3 (37.5%)
Qualified Nurses	37 (60.7%)	24 (39.3%)	18 (29.5%)	43 (57.6%)	14 (23%)	47 (77%)
Qualified Midwives	22 (66.7%)	11 (33.3%)	14 (41.4%)	19 (57.6%)	11 (33.3%)	22 (66.7%)
Auxillary Nurses	8 (38.1%)	13 (61.9%)	2 (9.5%)	19 (90.5%)	0 (0%)	21 (100%)
Auxillary Midwives	7 (53.8%)	6 (46.2%)	3 (23.1%)	10 (76.9%)	2 (15.4%)	11 (84.6%)
Lab-Technicians	4 (57.1%)	3 (42.9%)	3 (41.9%)	4 (57.1%)	1 (14.3%)	6 (85.7%)
Lab-Technician Assistants	1 (50%)	1 (50%)	0 (0%)	2 (100%)	0 (0%)	2 (100%)
Pharmacy Assistants	2 (66.7%)	1 (33.3%)	0 (0%)	3 (100%)	0 (0%)	3 (100%)
CHWs	0 (0%)	2 (3.3%)	0 (0%)	2 (100%)	0 (0%)	2 (100%)
Total	89 (59.3%)	61 (40.7)	46 (30.7%)	104 (69.3%)	33 (22.0%)	117 (78%)

In response to whether healthcare workers adhering to the national malaria guidelines in the diagnosis, treatment and prevention of malaria in pregnancy, 5 (62.5%) physicians were the most likely job category or Cadre of Health workers showed adherence to the guidelines. 4 (33%) of the qualified midwives and 4 (23%) of the qualified nurses showed adherence to the guidelines. The difference was significant across different categories of health workers or cadre health workers and their adherence to the guidelines with (p -value = 0.017).

As shown in **Table 4** depicts the reasons given by healthcare workers for not adhering to the national malaria guidelines in the diagnosis, treatment and prevention of malaria in pregnancy. 3 (37.5%) of the physicians had a negative attitude toward malaria guidelines and 2 (25%) indicated inadequate awareness of malaria guidelines.

As shown in **Table 4**, most of the qualified nurses, 29 (47.5%), indicated inadequate awareness of malaria guidelines as the reason for non-adherence to the guidelines. Other reasons were negative attitude toward malaria guidelines by HCWs, inadequate supply of anti-malaria and diagnostic tests, and lack of regular supervision and monitoring.

Like nurses, most of the midwives, 16 (48.5%), did not adhere to the guidelines because of inadequate awareness of malaria guidelines. 6 (18.2%) of the midwifery nurses said the adherence to the guidelines was hindered by a lack of revised copies of national guidelines at the facility. 5 (15.2%) pointed out that non-adherence to the guidelines is a negative attitude toward malaria guidelines.

Table 4. Reasons given by the health workers for not adhering to the national malaria guidelines in the treatment and prevention of malaria In pregnancy (those adhering gave hypothetical answers).

	Physician	Qualified Nurse	Qualified Midwife	Auxillary Nurse	Auxillary Midwife	lab-technicians	lab-technician Assistants	Pharmacy Assistants	CHWs	Total
Lack of regular supervision and monitoring	1 (12.5%)	6 (9.8%)	1 (3%)	1 (4.8%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (6%)
Inadequate awareness of malaria guidelines	2 (25%)	29 (47.5%)	16 (48.5%)	18 (85.7%)	11 (84.6%)	6 (85.7%)	2 (100%)	3 (100%)	2 (100%)	89 (59.3%)
Negative attitude toward malaria guidelines by HCWs	3 (37.5%)	12 (19.7%)	5 (15.2%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	20 (13.3%)
Patient satisfaction with antimalaria drug compliance	1 (12.5%)	2 (3.3%)	4 (12.1%)	0 (0%)	1 (7.7%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	8 (5.3%)
lack of availability of revised copy of national malaria guidelines at the health facility	1 (12.5%)	2 (3.3%)	6 (18.2%)	1 (4.8%)	1 (7.7%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	11 (7.3%)
inadequate supply of anti-malaria and diagnostic at the Health facility	0 (0%)	7 (11.5%)	1 (3%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	8 (5.3%)
Lack of in-service training of the HCWs	0 (0%)	3 (4.9%)	0 (0%)	1 (4.8%)	0 (0%)	1 (14.3%)	0 (0%)	0 (0%)	0 (0%)	5 (3.3%)
Total	8 (100%)	61 (100%)	33 (100%)	21 (100%)	13 (100%)	7 (100%)	2 (100%)	3 (100%)	2 (100%)	150 (100%)

$\chi^2 = 53.401$, $df = 48$, $p\text{-value} = 0.274$.

Other reasons include inadequate supply of anti-malaria and diagnostic tests and diagnostic test at the health facility and a lack of regular supervision and monitoring.

Among Auxillary nurses, 18 (85.7%) believed inadequate awareness of malaria guidelines was a reason for non adherence to the guideline. Other reasons mentioned were 1 (4.8%) lack of in-service training of the HCWs, 1 (4.8%) revised copies of national malaria guidelines available at the facility, 1 (4.8%) lack of regular supervision and monitoring, and 1 (4.8%) inadequate awareness of malaria guidelines.

11 (84.6%) of the Auxillary midwives indicated that inadequate awareness of malaria guidelines was the reason for non-adherence to the guidelines. 1 (7.7%) indicated patient satisfaction with antimalarial drug compliance, and 1 (7.7%) indicated lack of national malaria guidelines availability at facility. Furthermore, lab technician assistants 2 (100%), pharmacy assistants 3 (100%), and CHWs 2

(100%) unanimously indicated that inadequate awareness of malaria guidelines was a hindrance to non-adherence to the protocol.

Generally, 89 (59.3%) of the respondents' job category or cadre of health workers indicated that the implementation was hindered by inadequate awareness of malaria guidelines. About 20 (13.3%) indicated a negative attitude toward malaria guidelines, while 11 (7.3%) pointed out revised copies of the national malaria guidelines' availability at the facility, however, difference was not significant (p -value = 0.274).

Table 5 shows the findings of an analysis of ten public health facilities for the availability of varieties of antimalarial drug for treatment and prevention of malaria in pregnancy. Availability of malaria diagnostic tests (RDTs and microscopy)

Table 5. Result of observational checklist on availability of varieties of antimalarial drug, malaria diagnostic tests (RDTs and microscopy) and availability of job-aids in the selected public health facilities in Jowhar district.

Health Facility Assessment Indicators	(n = 10 Health Facilities)	
	Yes	No
Availability of malaria treatment drugs for first-line treatment in MIPs Uncomplicated or severe malaria in all trimesters		
Artemether plus lumefantrine ALU (Coartem)	8 (80%)	2 (20%)
Oral Quinine	4 (40%)	6 (60%)
Parenteral Artesunate	2 (20%)	8 (80%)
Availability of antimalarial drugs for second-line treatment in MIPs Uncomplicated or severe malaria in all trimesters		
Oral Quinine	4 (40%)	6 (60%)
Parenteral Quinine	2 (20%)	8 (80%)
Availability antimalarial drugs (chemoprevention in pregnancy)		
Sulfadoxine/pyrimethamine (SP) fansidar tablet	4 (40%)	6 (60%)
Availability malaria diagnostic tests (RDTs and microscopy) at the facility		
Malaria diagnostic tests mRDT	9 (90%)	1 (10%)
Microscopy	2 (20%)	8 (80%)
Revised national malaria guidelines 2016 available at the health facility	0 (0%)	10 (100%)
Malaria diagnostic tests mRDT uses wall charts available at the health facility	0 (0%)	10 (100%)
Anti-malarial dosing wall charts or brochure available at health facility	4 (40%)	6 (60%)
Clinical algorithm (flow chart) wall charts or brochure at health facility	4 (40%)	6 (60%)
Malaria educational, teaching aides or materials e.g. information and education & communication IEC materials for malaria prevention in pregnancy displayed on wall charts	4 (40%)	6 (60%)
LLINs/ITNs distributed/dispensed to pregnant women at ANC	0 (0%)	10 (100%)
Health facility currently provide pre-referral treatment for severe malaria before transfer to the inpatient ward.	3 (30%)	7 (70%)
Health facility had in place malaria cases recording and reporting system e.g. a record books, registers and Cards.	10 (100%)	0 (0%)

and availability of job aids, such as the national malaria treatment guidelines, Clinical algorithm (flow chart), Anti-malarial dosing and mRDTs' use of wall charts at the facilities and drug dose wall charts at the facilities.

Assessing the availability of antimalarials for first-line treatment of uncomplicated or severe malaria in malaria in pregnancy MIPs for all trimesters reveals that artemether plus lumefantrine ALU (Coartem) is the most commonly available antimalarial drug at about 8 (80%), followed by oral quinine 4 (40%) and parenteral artesunate 2 (20%). This result indicates a shortage of oral quinine drugs that are crucial for pregnant women in their first trimester in 6 (60%) health facilities.

Assessing the availability of antimalarials for second-line treatment of uncomplicated or severe malaria in malaria in pregnancy MIPs during all trimesters reveals that oral quinine were available in 4 (40%) at the health facilities HFs and parenteral quinine were available in 2 (20%) at the health facilities HFs. The result on the availability of malaria chemoprevention in pregnancy indicates that sulfadoxine/pyrimethamine (SP) fansidar tablets were available in 4 (40%) at the health facilities HFs, while only 2 (20%) of the health facilities HFs had microscopy. regarding the availability of parasitological diagnostics (RDTs and microscopy) at the facility also revealed that 9 (90%) of the health facilities HFs had mRDT.

The study reveals a significant shortage of appropriate job aids, including the availability of national malaria treatment guidelines at health facilities were 0 (0%). In addition, the results showed that 4 (40%) of the availability of Malaria educational, teaching aides or materials e.g. information and education & communication IEC materials for malaria prevention in pregnancy displayed as wall charts at health facilities. About 4 (40%) had Clinical algorithm (flow chart), and drug dose wall charts at all facilities, and 0 (0%) of RDT used wall charts at the health facilities.

LLINs/ITNs were not distributed or dispensed at ANC in these facilities during the day of visits. While 3 (30%) were only have referral system for pre-referral treatment for severe malaria before transfer to the inpatient ward while all health facilities had in place malaria cases recording and reporting system.

As shown in **Table 6** is based on 50 of patient's medical prescription to review medical prescriptions their conformity to the guidelines antimalarial drug prescriptions were adequately labeled if shows the patient's name, the drug name, when the drug should be taken, and the dosage. The results indicated that only 17(34%) of the antimalarial prescriptions were adequately labeled, while 33 (66%) were not. This increased to 24 (48.0%) at the posttest. The results indicated that only 17 (34%) of the antimalarial prescriptions were adequately labeled, while 33 (66%) were not.

31 (62%) artemether plus lumefantrine ALU (Coartem) was the most Antimalarial drug regimens prescribed as 1st line treatment of uncomplicated/Severe MIP, followed by 9 (18.0%) Oral quinine. About 7 (14%) artemether injectable were prescribed for first-line treatment for uncomplicated malaria in some health facilities, which is contrary to national malaria guidelines. In addition, only 1 (2%) Parenteral quinine was prescribed as an antimalarial drug for the first-line treatment for severe malaria and 2 (4%) Parenteral artesunate was prescribed for severe malaria.

Table 6. Antimalarial drug prescribing practices among health workers in selected public health facilities in Jowhar district.

	(n = 50 prescriptions)	
	Frequency	Percent
Prescription Indicators		
Prescriptions where antimalarial drug adequately labelled	17	34%
Prescriptions where antimalarial drug not adequately labelled	33	66%
Total	50	100%
Antimalarial drug regimens prescribed as 1st line treatment of uncomplicated/Severe MIP		
Artemether plus lumefantrine ALU (Coartem)	31	62%
Oral quinine	9	18%
Artemether injectable	7	14%
parenteral quinine	1	2%
parenteral Artesunate	2	4%
Total	50	100%
Prescription pattern for Antimalarial drug prescribed combined with other drugs and Antimalarial drug prescribed injection form		
Antimalarial drug injection form	10	20%
Antimalarial plus antibiotic	9	18%
Antimalarial plus iron & folic acid tablets	31	62%
Total	50	100%

Prescription pattern for Antimalarial drug prescribed combined with other drugs and Antimalarial drug prescribed injection form reveals that 10 (20%) patients were prescribed antimalarial drugs in injectable form. In 9 (18%), antibiotics were combined with antimalarial drug, while in 31 (62%), iron and folic acid tablets were combined with antimalarial drug.

4. Discussion

Early diagnosis and effective treatment remain the critical elements of a malaria control strategy in preventing mortality and reducing the incidence of malaria. In Somalia, low access to healthcare and low health service utilization, poor diagnosis and treatment quality, inadequacy of health human resources in the health sector, and inadequacy of financial resources are the main constraints to proper diagnosis, treatment and prevention of malaria. This study highlights factors affecting adherence to the national malaria treatment guidelines in diagnosis, treatment and prevention of malaria in pregnancy among health care workers in public health facilities in Jowhar District, Somalia.

The study participants were 150 health workers, comprising of physicians, nurses,

Auxillary nurses, midwives, Auxillary midwives, lab-technicians, lab-technician assistants, pharmacy assistants, and CHWs who regularly work in selected ten public health facilities. The demographic characteristics of the participants indicate that 98 (65.3%) were between the ages of 25 and 34. 103 (68.7%) of the participants were women. 126 (84%) of the participants were married. At the university level, 91 (60.7%) participants possessed a university degree. The data distribution by Job categories or cadres of health workers was such that qualified nurses made up 61 (40.7%), qualified midwives were 33 (22%), and Auxillary nurses were 21 (14%). 77 (51.3%) of the healthcare workers have experience ranging from 1 to 5 years. OPD, according to departments, was the highest at 54 (36.0%).

A lack of awareness of the revised national malaria guidelines in 2016 in the diagnosis, is revealed in this study as one of the significant factors, specifically among qualified nurses, of whom more than two-thirds did not aware of the revised NMG in 2016. The study results have shown a huge gap in awareness among Auxillary nurses, Auxillary midwives, lab-technicians, lab-technician Assistants and pharmacy assistants. A significant proportion of the healthcare workers indicated a lack of special training. The study reveals that adherence to the malaria guidelines varies significantly ($p\text{-value} = 0.017$) as per the different categories of health worker. Physicians 5 (62.5%) were the most likely of all Cadre of Health workers showed adherence to the guidelines, with 11 (33.3%) qualified midwives and 14 (23%) qualified nurses showed adherence to the protocol respectively.

This study shows that adherence to the malaria guidelines among 3 (37.5%) physicians was hampered by a negative attitude toward malaria guidelines and 2 (25%) because of inadequate awareness of malaria guidelines. 29 (47.5%) of the qualified nurses indicated that inadequate awareness of malaria guidelines was the reason for non-adhering to the malaria guidelines. Other reasons were a negative attitude toward malaria guidelines, inadequate supply of anti-malaria and diagnostic tests and diagnostic tests, and a lack of regular supervision and monitoring.

Inadequate awareness of national malaria guidelines by 16 (48.5%) of midwives hindered its adherence. Furthermore, the result shows that midwifery and nurses said the adherence to the malaria guidelines was hindered by a lack of revised copies of national guidelines at the facility. Other reasons indicated include the negative attitude toward malaria guidelines, inadequate supply of anti-malaria and diagnostic tests and diagnostic tests, and lack of regular supervision and monitoring.

Additionally, inadequate awareness of the malaria guidelines among auxiliary nurses 18 (85.7%) was a reason for non-adhering to the malaria guidelines. 11 (84.6%) assistant midwives indicated that inadequate awareness of malaria guidelines was the reason for non-adhering to the malaria guidelines. They also indicated patient satisfaction with antimalarial drug compliance and revised copies of national malaria guidelines availability at the facility. Furthermore, lab-technician assistants 2 (100%), pharmacy assistants 3 (100%), and CHWs 2

(100%) unanimously indicated that inadequate awareness of national malaria guidelines was a hindrance to the adherence.

About 89 (59.3%) of Cadre of Health workers indicated that the adherence to the malaria guidelines was hindered by inadequate awareness of malaria guidelines, 20 (13.3%) as a result of a negative attitude toward malaria guidelines, and 11 (7.3%) were revised copies of national guidelines availability at the facility, however, difference was not significant (p -value = 0.274).

The study reveals a significant shortage of appropriate job aids, including the national malaria guidelines, clinical algorithms, and malaria educational materials for conducting IEC sessions displayed on wall charts, drug dose wall charts at all facilities, and mRDTs use of wall charts. Furthermore, the study reveals a lack of distribution of LLINs/ITNs to pregnant women at ANC for malaria prevention. A few of the health facilities HFs provide referral system for pre-referral treatment for severe malaria before transferring patients to the inpatient wards, while all health facilities had in place malaria cases recording and reporting system. The result shows a shortage of quinine drugs, crucial for first-trimester pregnant women in health facilities while all health facilities had in place malaria cases recording and reporting system. Oral quinine were available in 4 (40%) HFs and parenteral quinine were available in 2 (20%) HFs. There was a scarcity of malaria chemoprevention in pregnancy, given that the sulfadoxine/pyrimethamine (SP) fansidar table was available in only 4 (40%) of the HFs. There is limited access and utilization of parasitological diagnostics (mRDTs and microscopy) at the facility as the study revealed that only 2 (20%) of the HFs had microscopy and 9 (90%) had mRDT.

The study reveals inappropriate prescription practices and inadequate compliance with national malaria guidelines. The results indicated that only 17 (34%) of the antimalarial prescriptions were appropriately labeled. 31 (62%) of public health facilities prescribed the nationally recommended first-line therapy for uncomplicated malaria in pregnant women in the second and third trimesters of artemether plus lumefantrine ALU (Coartem) that complies with the national first-line treatment guidelines.

The use of artemether injectable further evinces inappropriate practices for first-line treatment for uncomplicated malaria for some health workers at health facilities, contrary to national malaria guidelines. In addition, while only 1 (2%) Parenteral quinine was prescribed as an antimalarial drug for the first-line treatment for severe malaria, 2 (4%) Parenteral artesunate was prescribed for severe malaria. The pattern of antimalarial drug prescriptions reveals that 10 (20%) patients were prescribed antimalarial drugs in injectable form. In 9 (18.0%), antibiotics were combined with antimalarials, while in 31 (62%), iron and folic acid tablets were combined with antimalarials.

5. Conclusion

In conclusion, the study showed that adherence to the national malaria guide-

lines for Malaria diagnosis, treatment and prevention in pregnancy among health care workers are associated with inadequate awareness of the revised malaria guidelines among healthcare workers, inadequate supply of diagnostic tests (mRDTs and microscopy) at the health facilities and lack of access to revised national guidelines for malaria diagnosis and treatment 2016, a lack of regular supervision and monitoring and lack of in-service training respectively. Therefore, effective implementation of the recommended strategy for malaria in pregnancy requires close collaboration between national malaria control programme and reproductive health programmes at all levels, including policy development, planning, logistics, procurement, training and service delivery. The national malaria control program should intensify efforts to strengthen the readiness of the public health facilities in the district to provide management of malaria in pregnancy and improve the availability of Antimalarial drug and malaria diagnostic tests (RDTs and microscopy). The national malaria control programme should also provide appropriate job aids and training for health workers, and constant supervision should be done to ensure that the national malaria guidelines in the treatment and prevention of malaria in pregnancy among healthcare workers continue to be effectively implemented in at all levels of health care service delivery points across the country.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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