

Effect of In-Service Training Program on the Practice of Healthcare Workers toward Malaria Prevention and Treatment Guidelines during Pregnancy in Health Facilities in Jowhar District, Somalia

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Abstract

Malaria is generally considered a major public health problem in Somalia. Providing early diagnosis and effective treatment is the key element of malaria control strategies in malaria-endemic countries, including Somalia. This required to advocate and ensure health worker's adherence to the national malaria guidelines at all levels of health care service. A well-designed in-service training program may improve the level of health worker's adherence to national malaria treatment guidelines, although results have been inconsistent. This is an interventional health facility-based pre and post comparative study aimed to assess the effect of an in-service training program on the practice of healthcare workers toward malaria prevention and treatment guidelines, during in pregnancy in health facilities in Jowhar district, Middle Shabelle region of Somalia. The study was implemented in three phases: pre-intervention phase, intervention phase and post-intervention phase. The sample size consisted of (n = 150) health workers who were selected from ten public health facilities using proportional to size sampling; the data collection adopted in this research is composed of a structured interview questionnaire and observational checklist. Data was analyzed through the application of descriptive statistical analysis that includes frequency and percentage and the Chi-square (χ^2) test was used to test the associations among variables using SPSS software version 25. The study showed that the level of health workers' awareness of the national malaria guidelines in the treatment and prevention of malaria in pregnancy was found to be good before the intervention 89 (59.3%) and this proportion increased to 150 (100%) post-intervention of the training program. A significance difference has been

observed between health workers' awareness and their adherence to the malarial guidelines at pre-test and post-test with a p-value 0.000. The proportion of health workers who attended previous training on national malaria guidelines in the treatment and prevention of malaria in pregnancy increased from 46 (30.7%) at the pre-test to 150 (100%) after the post-test. A significant difference was observed in the training status among different categories of health worker and their adherence to the guidelines during the pre- and post-intervention of the training program, with a p-value of 0.000. The result showed that health workers were adhering to the guidelines at the pre-test 33 (22%), this increased after the post-test to 87 (58%). The knowledge of the need to adhere led to an increase in the adherence rate after the training program intervention. The study reveals that inadequate awareness was most reason for the non-adherence in the majority of the health workers as indicated by 89 (59.3%) at the pre-test and 56 (37.3%) in the post-test. However, difference was not significant between the availability of anti-malaria drugs in the facilities and the health workers' adherence to the guidelines p-value 0.355 at the pretest and p-value 0.258 at post-test. The study concluded that the in-service training program significantly improved health workers' knowledge and practice to the national malaria guidelines in the treatment, and prevention of malaria in pregnancy. The researcher recommends that the national malaria control programme (NMCP) of the Federal Ministry of Health should provide continuous regular in-service training to frontline healthcare workers at (facility and Community-based) to upgrade their skills and knowledge towards the malaria guidelines, disseminate job aids to the health facilities and undertake regular monitoring to ensure effective implementation of the national malaria treatment guidelines in the treatment and prevention of malaria in pregnancy in achieving desired proper case-management practices of malaria in pregnancy at all levels of health care service.

Keywords

Malaria In Pregnancy, In-Service Training, Healthcare Workers, National Malaria Guidelines, Jowhar District, Somalia

1. Introduction

Malaria is a complex disease with varying epidemiology and public health impact worldwide. According to the most recent world malaria report 2021, there were 241 million malaria cases in 2020, up from 227 million cases in 2019 [1]. In Sub-Saharan African countries, almost 90% of these fatalities occurred [1].

Malaria remains a major public health problem in Somalia; it is estimated that approximately 51% of Somalia's population is at risk of malaria due to living in areas with high *Plasmodium falciparum* transmission [2] [3]. Children under five years of age, lactating women and pregnant women are the most vulnerable [2] [3]. However, there are limited national data on the actual burden of malaria in pregnancy in Somalia. According to the world malaria report 2020, Somalia

had approximately 759,000 cases and 1942 deaths in 2019 [2]. For the effective and efficient prevention and control of malaria in pregnancy, WHO and Roll Back Malaria advised malaria-endemic countries to adopt a number of interrelated measures concurrently [4]. These include the use of long-lasting insecticidal nets (LLINs) in all areas of Africa with moderate to high malaria transmission, IPTp with sulfadoxine-pyrimethamine (SP), and prompt diagnosis and effective treatment of malaria infections with artemisinin-based combination treatments [4]. These interventions are frequently offered as part of existing antenatal care (ANC) programs. Insecticide-treated nets (ITNs) are distributed in large numbers through house-to-house campaigns [5]. In areas with moderate to high malaria transmission, the WHO recommends interventions such as intermittent preventive treatment in pregnancy with sulfadoxine-pyrimethamine (IPTp-SP) and folic acid supplementation as part of antenatal care services to prevent and treat Malaria and anaemia during pregnancy. However, IPTp-SP should be used with insecticide-treated nets (ITNs) and effective malaria case management [6]. Pregnant women should begin taking SP as soon as feasible in the second trimester (13 weeks), and for the remainder of their pregnancy until birth, they should take at least three doses spaced one month apart [6]. Using ITNs and IPTp during pregnancy, reduces disease risk and adverse birth outcomes [7]. They have proven to be efficient financial initiatives [8].

Early diagnosis and treatment are crucial to the prevention and control of malaria. These include accurate clinical evaluation, laboratory confirmation of malaria via malaria rapid diagnostic test (mRDT) or microscopy, and treatment with an effective antimalarial. As a result, the availability of safe, effective, affordable, and accessible antimalarial drugs is a prerequisite for achieving the primary goal of reducing malaria morbidity and preventing malaria mortality [9]. In Somalia, all public health facilities and health posts offer free malaria testing and treatment services. However, the National Malaria Control Programme (NMCP) of Somalia revised and adopted its national malaria guidelines in 2016; the objective as per the national strategic plan 2017-2020 is to diagnose and treat 90% of malaria cases in the public and private health facilities and at community level according to “Guidelines for Malaria Diagnosis and Treatment in Somalia, 2016.” The pre-requests for this are: having a national guidelines for diagnosis and treatment; training of health care providers at all levels; dissemination of guidelines; adherence of care providers to guidelines and compliance of patients to the treatment prescribed; universal access to services including community level Integrated Community Case Management (iCCM); procurement and supply management system (PSM); and supportive supervision [10].

All fever or suspected malaria cases should be tested for malaria using parasitological confirmation (microscopic or rapid diagnostic test), according to the updated national diagnosis and treatment guidelines, and antimalarial medications should only be prescribed once malaria parasitaemia has been determined. In situations without access to laboratory resources (microscopes or quick diag-

nostic procedures), patients should be treated based on a clinical diagnosis [11].

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 (NMG) in 2016, whereby; oral Quinine is 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 [11]. In regions with moderate to high malaria transmission, the recommendations also call for intermittent preventative therapy with antimalarial drugs throughout pregnancy [11]. Three doses of sulfadoxine-pyrimethamine were given as an intermittent preventative therapy during the scheduled ANC visit. The first dose should be given as early as possible during the second trimester of pregnancy, at least one month apart. It should continue until delivery under a directly observed treatment DOTs [11]. Adherence the degree to which health workers adheres to the updated malaria guidelines while diagnosing, treating, and managing malaria during pregnancy. While adherence was categorized as strict or partial, strict adherence to the revised national malaria diagnosis and treatment guidelines (NMTG) meant; diagnosis should be based on parasitological confirmation doing the malaria RDTs or a blood smear with all suspected patients. If the test results a positive result, only recommended antimalarial drugs are prescribed; if the test results in a negative impact, no antimalarial drugs are given [11] [12] [13]. The patient was treated based on the clinical diagnosis when there was no parasitological confirmation of the case, and the antimalarial used was in accordance with the national malaria treatment guidelines [13]. Non-adherence happened when parasitological evidence of cases was absent and antimalarial medications were not selected in accordance with national recommendations for treating malaria [12].

Health worker's adherence, however, continues to be an issue in many Sub-Saharan African countries, according to the experiences of other nations that have updated their respective malaria treatment guidelines in a similar manner, reports indicate varying level of adherence to malaria diagnosis and treatment guidelines [14] [15]. Recent studies noted that health worker adherence to revised national malaria guidelines improves over time [16].

Studies that assessed impact of a designed in-service training program on health worker's adherence to national malaria guidelines found mixed outcomes [17] [18]. In addition, eleven African countries included: Ghana, Madagascar, Côte d'Ivoire, Sierra Leone, Mali, Zambia, and the Democratic Republic of the Congo (DRC), Kenya, Rwanda, and Niger are working to improve the standard of their country-driven malaria services implementing outreach or onsite train-

ing and supportive supervision plus (OTSS+) approach particularly those from government-run health facilities staff. Periodic refresher training and mentorship are used to further promote sustainability. The results demonstrated that consistent (OTSS+) programming served as an efficient performance appraisal system integrated into the healthcare system and assisted in ensuring the appropriate application of the guidelines at various levels [19] [20] [21] [22]. Improving universal access to appropriate malaria prevention and case management services that determine a positive health outcome for malaria-affected individuals remains a critical component of a malaria control strategy in preventing mortality and reducing the incidence of malaria.

In Somalia, the main factors constraining proper diagnosis, treatment and prevention of malaria can be summarized as follows: health facilities low readiness to deal with suspected malaria cases, limited procurement and supply system management capacity, little involvement of widespread private practice and inadequate case management infrastructure at the ministry of health MoH, state and regional levels. Other constraining included: low access to health care and low health service utilization, poor quality of diagnosis and poor quality of therapy, inadequate health human resources in the health sector, and inadequate financial resources [9].

Therefore, no previous studies were done to evaluate the impact of in-service training programs on health workers' practices on national malaria guidelines in the treatment and prevention of malaria in pregnancy in Somalia. Thus this study is aimed to assess the effect of an in-service training programme on the practice of healthcare workers towards malaria prevention and treatment guidelines during pregnancy in health facilities in Jowhar district, Somalia.

2. Methodology

This is an interventional health facility-based pre and post comparative study aimed to assess the effect of an in-service training program on the practice of healthcare workers toward malaria prevention and treatment guidelines, during pregnancy in health facilities in Jowhar district, Middle Shabelle region of Somalia during the period of the study July 2017 to July 2022. The sample size consisted of (n = 150) health workers including: (physicians, nurses, auxiliary nurses, midwives, auxiliary 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. 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. The study was implemented in three phases; pre-intervention phase in which a base line survey was conducted, intervention phase training program was offered to the (n = 150) health workers and Post-intervention evaluation were carried out to assess the impact of a designed in-service training program. A structured interview questionnaire was

used to collect data on socio-demographic characteristics, knowledge and practice to the national malaria guidelines in the treatment and prevention of malaria in pregnancy among health care workers. an observational checklist was used to review the availability of antimalarial drugs for treatment and prevention of malaria in pregnancy, malaria diagnostic tests (mRDTs and microscopy) in the selected public health facilities, and job aids such as national malaria treatment guidelines, clinical algorithm (flow chart), malaria rapid diagnostic tests mRDTs use of wall charts, and drug dose wall charts. Patient's medical prescriptions were also reviewed their conformity to the guidelines.

2.1. Data Analysis

The collected data in pre-test and post-test were organized, categorized, tabulated in tables using frequencies and percentage. The Chi-square (χ^2) test was used to test the associations among variables, descriptive statistics were applied (frequency and percentage). Tests of significance were performed to test the study variables to find the statically significant by using SPSS software version 25. Data was analyzed on the basis of the study objectives. A p-value of ≤ 0.05 regarded as a statistically significant.

2.2. Ethical Consideration

Permission was obtained from health authorities and all health facilities in charges, and participants were given verbal consent. Confidentiality was ensured.

2.3. Results

Table 1 showed that majority 98 (65.3%) of the respondents were aged between 25 to 34 years. Most of the respondents 103 (68.7%) were women, and 126 (84%) were married. regarding education level, about 91 (60.7%) of the respondents attained a university degree. qualified nurses made up the majority, 61 (40.7%), followed by qualified midwives 33 (22%). About 77 (51.3%) of by some categories of healthcare workers had experience ranging from 1 to 5 years.

The result in **Table 2** indicates an improvement in health workers' awareness of the revised national malaria guidelines in the treatment and prevention of malaria in pregnancy from 89 (59.3%) at the pretest to 150 (100%) at the post-test. categories of health workers reported the training program is the source of their awareness on the revised national malaria guidelines from 42 (28%) pre-test to 97 (64%) post-test, while some categories of health workers reported senior healthcare workers in their working area reported was the source of their awareness from 51 (34.0%) to 53 (35.35). Those who attended previous training on malaria in pregnancy MIPs treatment and prevention guidelines in relation to the use of national malaria treatment guidelines in 2016 increased from 46 (30.7%) at the pre-test to 150 (100%) at the post-test.

Table 3 showed when the study respondents were asked about their adherence to the guidelines. The proportion of those who reported adhering to the

guidelines increased from 33 (22%) at the pre-test to 87 (58%) at the pre-test. Those who reported a lack of adherence to the guidelines reduced from 117 (78.0%) at the pre-test to 63 (42.0%) post-tests. The outcomes showed significant difference between the pre-test and post-test, with a P value of 0.000. When asked about reasons of not adhering to the guidelines, inadequate of awareness was most

Table 1. Socio-demographic characteristics of healthcare workers.

Variable	Category	Frequency	Percentage
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	100.0%
Sex of Respondents	Male	47	31.3%
	Female	103	68.7%
	Total	150	100.0%
Educational Level	University	91	60.7%
	Midwifery Training Institute	9	6.0%
	Nursing training institute	18	12.0%
	Secondary school	32	21.3%
	Total	150	100.0%
Job category (Cadre of Health workers)	Physician	8	5.3%
	Qualified Nurses	61	40.7%
	Qualified Midwives	33	22.0%
	Auxillary Nurses	21	14.0%
	Auxillary Midwives	13	8.7%
	Lab-Technicians	7	4.7%
	Lab-Technician Assistants	2	1.3%
	Pharmacy Assistants	3	2.0%
	CHWs	2	1.3%
	Total	150	100.0%
Work Experience	1 - 5 Years	77	51.3%
	6 - 10 Years	47	31.3%
	11 - 15 Years	5	3.3%
	16 - 20 Yeats	15	10.0%
	More than 20 Years	6	4.0%
	Total	150	100.0%

Table 2. Health workers' awareness of, and previous training on the revised national malaria guidelines 2016 in the treatment and prevention of malaria in pregnancy.

		Pre-test		Poste-Test	
		Frequency	Percentage	Frequency	Percentage
Awareness of the revised NMG	Aware of the guidelines	89	59.3%	150	100.0%
	Not aware of the guidelines	61	40.7%	0	0.0%
	Total	150	100.0%	150	100.0%
Source of Awareness of the revised NMG	Senior healthcare workers at the facility	51	34.0%	53	35.3%
	Books	0	0%	0	0%
	Training Program	42	28.0%	97	64.7%
	Internet	4	2.7%	0	0.0%
	Do not know/aware	53	35.3%	0	0.0%
	Total	150	100.0%	150	100.0%
Attended previous special training on MIPs treatment & prevention guidelines	Yes	46	30.7%	150	100.0%
	No	104	69.3%	0	0.0%
	Total	150	100.0%	150	100.0%

Table 3. Health workers' adherence to the national malaria guidelines in the treatment and prevention of malaria in pregnancy.

		Pre-test		Post-test	
		Frequency	Percentage	Frequency	Percentage
Health workers' adherence to NMG	Yes	33	22.0%	87	58.0%
	No	117	78.0%	63	42.0%
	Total	150	100.0%	150	100.0%
<i>P-value = 0.000</i>					
Give reasons for not adhering to the guidelines (those adhering gave hypothetical answers)	lack of regular Supervision/Monitoring	9	6.0%	11	7.3%
	Inadequate awareness of malaria guidelines by HCWs	89	59.3%	56	37.3%
	Negative attitude toward malaria guidelines by HCWs	20	13.3%	14	9.3%
	In adequate patient satisfaction with anti-malaria drug compliance	8	5.3%	7	4.7%
	Lack of availability of revised copy of national malaria guidelines at the health facility	11	7.3%	8	5.3%
	Inadequate supply of anti-malaria and diagnostic tests and diagnostic tests at the health facility	8	5.3%	49	32.7%
	Lack of in-service training of the HCWs	5	3.3%	5	3.3%
Total		150	100.0%	150	100.0%
<i>P-value = 0.000</i>					

reason for the non-adherence in the majority categories of the healthcare workers by 89 (59.3%) at pre-test to 56 (37.3%) at post-test. a negative attitude toward the malaria guidelines by HCWs was another reason for non-adherence to the guidelines by some categories of health worker by 20 (13.3%) at the pretest to 14 (9.3%) at the post-test. Lack of adherence to the guidelines is attributed to the lack of availability of revised national malaria guidelines at the facility 11 (7.3%) at the pre-test to 8 (5.3%) at post-test. a lack of in-service training of the HCWs 5 (3.3%) at the pre-test and at the post-test. significant difference was observed with p-value = 0.000.

Table 4 revealed the relationship between difference categories of health workers (Cadre of Health workers) and their adherence to the national malaria guidelines in the treatment and prevention of malaria in pregnancy. Generally, the result showed that 33 (22%) were adhering to the guidelines at the pre-test while 87 (58%) were adhering after the post-test. The number of physicians who adhered to the guidelines increased from 5 (62.5%) in the pre-test to 6 (75.0%) in the post-test. The proportion of qualified nurses who adhering to the guidelines increased from 14 (23%) in the pre-test to 36 (59%) after the post-test. In addition, the proportion of qualified midwives adhering to the guidelines increased from approximately 11 (33.3%) in the post-test to 22 (69.7%) after the post-test. The result indicates that the number of auxillary midwives adhering to the guidelines increased from 2 (15.4%) at the pre-test to 7 (53.8%) post-test. At the pre-test, a significant difference was observed across different categories of health workers (Cadre of Health workers) and their adherence to the guidelines (p-value = 0.017).

The results of **Table 5** showed health Worker's adherence to the national malaria

Table 4. The relationship between by different categories of health workers and their Adherence to the national malaria guidelines in the treatment and prevention of malaria in pregnancy.

Job category (Cadre of Health workers)	Health workers' adherence to national malaria guidelines			
	Pre-test $X^2 = 18.621$, $df = 8$, p-value = 0.017		Post-test $X^2 = 10.418$, $df = 8$, p-value = 0.237	
	Adhering	Not adhering	Adhering	Not adhering
Physician	5 (62.5%)	3 (37.5%)	6 (75.0%)	2 (25.0%)
Qualified Nurses	14 (23.0%)	47 (77.0%)	36 (59.0%)	25 (41.0%)
Qualified Midwives	11 (33.3%)	22 (66.7%)	23 (69.7%)	10 (30.3%)
Auxillary Nurses	0 (0.0%)	21 (100.0%)	8 (38.1%)	13 (61.9%)
Auxillary Midwives	2 (15.4%)	11 (84.6%)	7 (53.8%)	6 (46.2%)
Lab-Technicians	1 (14.3%)	6 (85.7%)	5 (71.4%)	2 (28.6%)
Lab-Technician Assistants	0 (0.0%)	2 (100.0%)	1 (50.0%)	1 (50.0%)
Pharmacy Assistants	0 (0.0%)	3 (100.0%)	1 (33.3%)	2 (66.7%)
CHWs	0 (0.0%)	2 (100.0%)	0 (0.0%)	2 (100.0%)
Total	33 (22%)	117 (78%)	87 (58%)	63 (42%)

guidelines in the management of malaria in pregnancy. The result showed that the proportion of the MIPs confirmed treated with ACT-drug at the pre-test was 25 (16.7%). This number increased to 87 (58%) at the post-test. malaria in pregnancy MIPs confirmed treated with non-ACT-drug reduced from 8 (5.3%) at pre-test to 1 (0.7%) at post-test. The proportion of malaria in pregnancy MIPs clinically treated with ACT-drug reduced from 20 (13.3%) at the pre-test to 15 (10%) at post-test. Furthermore, the pregnant women PWs with fever cases negative to RDT or microscopy clinically treated with ACT-drug reduced from 97 (64.7%) to 47 (31.3%). significant difference was observed p-value = 0.000.

Table 6 showed the relationship between health workers' awareness and their adherence to the malarial treatment guidelines in the treatment and prevention of malaria in pregnancy; the result showed that at the pre-test, the proportion of those who had good awareness among healthcare workers were adhering about 33 (37.1%) at pre-test which increased to 69 (77.5%) at the post-test. At the pre-test and after the post-test, significant difference was observed a p value = 0.000.

Table 7 shows the relationship between health workers' training and their adherence to the national malaria guidelines in the treatment and prevention of malaria in pregnancy, at the pre-test, those who had attended previous training about national malaria guidelines in the treatment and prevention of malaria in

Table 5. Health workers' adherence to the national malaria guidelines in the management of malaria in pregnancy.

How do you Manage MIPs	Pre-test		Post-test	
	Frequency	Percentage	Frequency	Percentage
MIPs Confirmed treated with ACT-drug	25	16.7%	87	58.0%
MIPs Confirmed treated with non-ACT-drug	8	5.3%	1	0.7%
MIPs Clinically treated with ACT-drug	20	13.3%	15	10.0%
PWs with fever cases negative to mRDTs or Microscopy clinically treated with ACT-drug	97	64.7%	47	31.3%
Total	150	100%	150	100%

p-value = 0.000.

Table 6. The relationship between health workers' awareness and their adherence to the national malaria guidelines in the treatment and prevention of malaria in pregnancy.

Health workers' awareness of the revised NMG	Health workers' adherence to the national malaria guidelines			
	Pret-test		Posttest	
	X ² = 28.997, df = 1, p-value = 0.000		X ² = 34.260, df = 1, p-value = 0.000	
	Adhering	Not adhering	Adhering	Not adhering
Aware of the guidelines	33 (37.1%)	56 (62.9%)	69 (77.5%)	20 (22.5%)
Not aware of the guidelines	0 (0.0%)	61 (100.0%)	18 (29.5%)	43 (70.5%)
Total	33 (22%)	117 (78%)	87 (58%)	63 (42%)

pregnancy before the study had a higher number of adhering to the guidelines 30 (65.2%) compared to 3 (2.9%) adherence rate among those who had no previous training. The number of healthcare workers who had previous training and adhering to the guidelines increased from 30 (65.2%) at the pre-test to 43 (93.5%) at the post-test compared to an increase from 3 (2.9%) to 44 (42.3%) for those who had no previous a training. At the pre-test and after the post-test, significant difference was observed p value = 0.000.

Table 8 showed the relationship between availability of varieties of antimalarial drug and the health worker's adherence to the national malaria guidelines in the treatment and prevention of malaria in pregnancy. The responses from categories of health worker that reported availability of anti-malaria drugs in their facilities at the time of the study were adhering to the guidelines about 8 (22.9%) at the pretest this increased to 20 (57.1%) at the post-test. Health workers who reported anti-malaria drugs were rarely (infrequently) available in their health facilities were adhering about 25 (23.1%) at the pre-test; this number increased to 65 (60.2%) at the post-test. However, no significant difference was observed p-value = 0.355 at the pretest and p-value = 0.258 at post-test.

Table 7. The relationship between health workers' training and their adherence to national malaria guidelines in the treatment and prevention of malaria in pregnancy.

Health worker's Previous training on MIPs treatment & prevention guidelines	Health workers' adherence to the national malaria guidelines			
	Pre-test $X^2 = 72.213$, $df = 1$, p-value = 0.000		Post-test $X^2 = 34.282$, $df = 1$, p-value = 0.000	
	Adhering	Not adhering	Adhering	Not adhering
Attended previous training	30 (65.2%)	16 (34.8%)	43 (93.5%)	3 (6.5%)
Not attended previous training	3 (2.9%)	101 (97.1%)	44 (42.3%)	60 (57.7%)
Total	33 (22%)	117 (78%)	87 (58%)	63 (42%)

Table 8. The relationship between availability of varieties of antimalarial drug and the health worker's adherence to national malaria guidelines in the treatment and prevention of malaria in pregnancy.

Availability of anti-malaria drugs in the facility	Health workers' adherence to the national malaria guidelines			
	Pret-test $X^2 = 2.072$, $df = 2$, p-value = 0.355		Post-test $X^2 = 2.711$, $df = 2$, p-value = 0.258	
	Adhering	Not adhering	Adhering	Not adhering
Available	8 (22.9%)	27 (77.1%)	20 (57.1%)	15 (42.9%)
Rarely (infrequently) Available	25 (23.1%)	83 (76.9%)	65 (60.2%)	43 (39.8%)
Frequently absent	0 (0.0%)	7 (100.0%)	2 (28.6%)	5 (71.4%)
Stock out	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
Total	33 (22%)	117 (78%)	87 (58%)	63 (42%)

Table 9 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) 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.

Table 9. Result of observational checklist on availability of varieties of antimalarial drug, malaria diagnostic tests (mRDTs 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 (mRDTs 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 available at the health facility	4 (40%)	6 (60%)
LLINs/ITNs distributed/dispensed to pregnant women at the 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 has malaria cases recording and reporting system e.g. a record books, registers and Cards.	10 (100%)	0 (0%)

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 (mRDTs 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 mRDT 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.

Table 10 findings are based on 50 of patient's medical prescription to review their conformity to the guidelines for (two paths pre and post-test). Antimalarial drug prescriptions where adequately labeled 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 appropriately labeled, while 33 (66%) were not. This increased to 24 (48.0%) at the posttest, antimalarial drug regimens prescribed as 1st line treatment of uncomplicated/Severe MIPs. The result shows that at pre-test, artemether plus lumefantrine ALU (Coartem) was the most prescribed antimalarial drug 31 (62%); this increased to 39 (78.0%). Oral quinine is the second most prescribed drug, as indicated by 9 (18.0%) at pre-test; this number reduces extremely to 3 (6.0%). About 7 (14%) artemether injectables 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. Regarding the prescription pattern for antimalarial drug prescribed combined with other drugs and antimalarial drug prescribed injection form, the most prescribed patterns of anti-malaria drugs combined with other drugs were iron and folic acid tablets combined with antimalarial by 31 (62%) at the pre-test and 34 (68.0%) in the post-test. Antimalarial drugs in injectable form prescribed were 10 (20%) at the pretest and 9 (18.0%) at the post-test. And antibiotics combined with antimalarial drug prescribed were 9 (18%) at pre-test and 7 (14.0%) post-test.

Table 10. Antimalarial drug prescribing practices among health workers in the selected public health facilities in Jowhar district.

Prescriptions indicators	(n = 50 prescriptions)			
	Pre-test		Post-Test	
	Frequency	Per cent	Frequency	Per cent
Prescriptions where antimalarial drug adequately labelled	17	34.0%	24	48.0%
Prescriptions where antimalarial drug not adequately labelled	33	66.0%	26	52.0%
Total	50	100.0%	50	100.0%
Antimalarial drug regimens prescribed as 1st line treatment of uncomplicated/Severe MIPs	Pre-test		Post-Test	
	Frequency	Per cent	Frequency	Per cent
	Artemether+lumefantrine ALU (Coartem)	31	62.0%	39
Oral Quinine	9	18.0%	3	6.0%
Parenteral Quinine	1	2.0%	4	8.0%
Artemether injectable	7	14.0%	2	4.0%
Parenteral Artesunate	2	4.0%	2	4.0%
Total	50	100.0%	50	100.0%
Prescription pattern for Antimalarial drug prescribed combined with other drugs and Antimalarial drug prescribed injection form	Pre-test		Post-Test	
	Frequency	Per cent	Frequency	Per cent
	Antimalarial drug injection form	10	20.0%	9
Antimalarial + antibiotic	9	18.0%	7	14.0%
Anti-malarial + Iron & folic acid tablets	31	62.0%	34	68.0%
Total	50	100.0%	50	100.0%

3. Discussion

This is an interventional health facility-based pre and post comparative study aimed to assess the effect of an in-service training program on the practice of healthcare workers toward malaria prevention and treatment guidelines, during pregnancy in health facilities in Jowhar district, Middle Shabelle region of Somalia. A total of (n = 150) health workers who regularly work at selected public health facilities in the district and are involved in malaria in pregnancy management. 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. According to the current study's findings regarding the demographic characteristics of the study population (Table 1), the majority of the 98 (65.3%) of the study population was aged between 25 and 34 years, and 103 (68.7%) were women, 91 (60.7%) of the respondents attained a university degree, and qualified nurses made up the majority, 61 (40.7%), followed by qualified midwives 33 (22%). About 77 (51.3%) of healthcare workers had experience ranging from 1 to 5 years.

The findings of this study regarding level of health workers' awareness toward

national malaria guidelines in the treatment and prevention of malaria in pregnancy (**Table 1**, **Table 6**) showed that a proportion of health workers had good awareness before the intervention were about 89 (59.3%) and this proportion increased to 150 (100%) in the post-intervention of the training program. significant difference has been observed p -value = 0.000.

Regarding health workers, previous training towards national malaria guidelines in the treatment and prevention of malaria in pregnancy (**Table 2**) showed that the proportion of those who attended previous training increased from 46 (30.7%) and was significantly increased 150 (100%) post-intervention of the training program. (**Table 4**) showed that physicians were more trained by 6 (75.0%) in the pre-test on national malaria guidelines in treatment and prevention in pregnancy. This increased by 8 (100.0%) in the post-test. the proportion of qualified nurses who were trained increased from 18 (29.5%) at pretest to 61 (100.0%) after the post-test. while qualified midwives 14 (42.4%) to 33 (100.0%). The number of healthcare workers who had previously attended training and adhering to the guidelines increased from 30 (65.2%) at the pre-test to 43 (93.5%) at the post-test. regarding the relationship between health workers' training and their adherence to the national guidelines, (**Table 7**) showed that at the pre-test, those who had attended training before the study had a higher number who adhering to the guidelines 30 (65.2%) compared to 3 (2.9%) adherence rate among those who had no previous training on the guidelines. The number of healthcare workers who had previous training and adhering to the guidelines increased from 30 (65.2%) at the pre-test to 43 (93.5%) at the post-test compared to an increase from 3 (2.9%) to 44 (42.3%) for those who had no previous a training. At the pre-test and after the post-test, a significant difference was observed between training status and adherence to the guidelines by health workers with a P . value = 0.000. regarding health worker's adherence to the national malaria guidelines in the diagnosis, treatment and prevention in pregnancy, (**Table 3**) showed that at the pre-test, 33 (22%) were adhering to the guidelines this proportion increased after the post-test to 87 (58%), The knowledge of the need to adhere led to an increase in the adherence rate after the training program intervention. Conversely, those who reported a lack of adherence to the guidelines reduced from 117 (78.0%) at the pre-test to 63 (42.0%) post-tests. The outcomes showed a statistically significant distinction between the pre-test and post-test, with a P value of 0.000.

In addition, adherence to national malaria guidelines in the management of malaria in pregnancy. (**Table 4**) showed that the proportion of the malaria in pregnancy MIPs confirmed treated with ACT-drug at the pre-test was 25 (16.7%). This number increased to 87 (58%) at the post-test. malaria in pregnancy MIPs confirmed treated with non-ACT-drug reduced from 8 (5.3%) at pre-test to 1 (0.7%) at post-test. The proportion of malaria in pregnancy MIPs clinically treated with ACT-drug reduced from 20 (13.3%) at the pre-test to 15 (10%) at post-test. Furthermore, the pregnant women PWs with fever cases negative to

mRDT or Microscopy clinically treated with ACT-drug reduced from 97 (64.7%) to 47 (31.3%). significant difference was observed p -value = 0.000. inadequate of awareness was most reason for the non-adherence in the majority categories of the healthcare workers by 89 (59.3%) at pre-test to 56 (37.3%) at post-test. a negative attitude toward the malaria guidelines was another reason for non-adherence to the guidelines by some categories of health worker by 20 (13.3%) at the pretest to 14 (9.3%) at the post-test. Lack of adherence to the guidelines is attributed to the lack of availability of revised national malaria guidelines at the facility 11 (7.3%) at the pre-test to 8 (5.3%) at post-test. a lack of in-service training 5 (3.3%) at the pre-test and at the post-test. significant difference was observed with p -value = 0.000.

Regarding the relationship between availability of varieties of antimalarial drug and the health worker's adherence to the national malaria guidelines in the treatment and prevention of malaria in pregnancy. (Table 8) showed that healthcare workers who had antimalarial drugs available at their health facilities and adhering to the guidelines were 8 (22.9%); at post-test, this number increased to 20 (57.1%). The number of health workers who had anti-malaria drugs infrequently (rarely) available at their facilities and adhering to the guidelines increased from 25 (23.1%) at the pre-test to 65 (60.2%) at the post-test. However, no significant difference was observed p -value = 0.355 at the pretest and p -value = 0.258 at post-test.

4. Conclusion

In conclusion, the training program significantly improved health workers' knowledge and practice of national malaria guidelines in the treatment, and prevention of malaria in pregnancy. The researcher recommends that the national malaria control programme (NMCP) of the Federal Ministry of Health should provide continuous regular in-service training to frontline healthcare workers at (facility and Community-based) to upgrade their skills and knowledge towards the malaria guidelines, disseminate job aids to the health facilities and undertake regular monitoring to ensure effective implementation of the national malaria treatment guidelines in the treatment and prevention of malaria in pregnancy in achieving desired proper case-management practices at all levels of health care service.

Conflicts of Interest

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

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