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(IMPLEMENTATION SCIENCE)**

TDR Program-WHO

PRACTICUM REPORT

**“Assessing the Effectiveness of Implementing the Community Case
Management of Malaria (CCMm) in the liberated governorates of
Yemen during the period of 2018-2022”.**

By

Dr. Ameera Zain Saeed Ba-Fadhel

Cohort-01

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Under the Guidance of

Dr. Vinod Kumar SV

Professor and Dean In-Charge at SD GUPTA school of public health

IIHMR University

Organization Supervisor's Name

Dr. Abdullatif Alwaqedi

National Health consultant at MoH & WHO- Yemen

CERTIFICATE BY FACULTY ADVISOR

This is to certify that the dissertation titled “*Assessing the Effectiveness of Implementing the Community Case Management of Malaria (CCMm) in the liberated governorates of Yemen during the period of 2018-2022*” is a record of Research work undertaken by Dr. Ameera Zain Saeed Ba-Fadhel, Enrolment No. IIHMR-U/16/2022-24/0004 in partial fulfilment of the requirement for award of the degree **Master of Public Health (Implementation Science)** from IIHMR University, Jaipur, India under my guidance and supervision and his/ her approach to research study has been sincere, scientific and analytical.

Dr. Vinod Kumar
Professor
IIHMR University, Jaipur

Republic of Yemen

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الجمهورية اليمنية
وزارة الصحة العامة والسكان
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Ministry of Public Health & Population

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This is to certify that **Dr. Ameera Zain Saeed Ba-Fadhel**, student of Master of Public Health (Implementation Science) Program offered by IIHMR University, Jaipur has undergone Practicum Training at (The Primary Health Care Sector- Surveillance Department at the Ministry of Public Health and Population -Aden, Yemen. From **November 10th 2023 – July 31st, 2024.**

The candidate has successfully carried out the study designated to her during the practicum training and her approach to study has been sincere, scientific and analytical.

The Practicum Training is in fulfillment of the course requirements.

I wish to Dr. Ameera the success in all her future endeavors.

Dr. Abdullatif Alwagedi

National Health Consultant at MoH and WHO-Yemen



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Abstract:

Since 2015, Yemen has faced a severe humanitarian crisis exacerbated by conflict, political instability, and economic decline. These challenges, combined with the impact of COVID-19, climate change, and extreme weather events, have intensified the population's vulnerabilities, particularly affecting internally displaced persons (IDPs) United Nations: Yemen, 2022.

The health system has been critically impacted, only 51% of healthcare facilities operating at maximum capacity, leading to a significant gap in healthcare access [1].

Two thirds of Yemen's population is susceptible to malaria, which is still a major public health concern. Malaria-related deaths, confirmed cases, and positivity rates increased between 2014 and 2018, especially in cases involving pregnant women and children under five. Plasmodium falciparum is the most common malaria parasite, and Anopheles arabiensis is the primary vector of transmission [13].

Community's access to malaria services is a challenge since there are geographical differences, there is lack of adequate infrastructure, and high levels of poverty. The above issues have however been countered by implementing the Community Case Management of Malaria (CCMm) strategy. This strategy involves ensuring that sufficient trained community health workers are produced to offer efficient and inexpensive first-line community malaria interventions.

The purpose of this study was to establish the effectiveness of CCMm in Yemeni governorates through the mixed methodology. Thus, information was gathered patient enrollment in suspected and confirmed malaria, treatment results, and referrals. Some of the considerations included: ethical use of people by seeking their consent and data security.

This research establishes that CCMm can potentially expand access for malaria diagnosis and treatment prominently decreasing the prevalence of morbidity/mortality among the targeted population. If community volunteers are supported, Yemen can advance considerably in improving malaria control a reoccurring conflict and socio-economic challenges persist.

Methods:

The study employed both quantitative and qualitative data on malaria-suspected cases and, confirmed malaria cases by RDT, malaria cases treated with ACT, complicated malaria cases referred out and malaria attributed deaths among children under five years and pregnancy women which were retrieved from records and analyzed with the use of IBM SPSS Statistics 22.

Conclusions:

This study emphasises the need for CCM while combating malaria in Yemen due to the country's unfavorable environment. Thus, empowering CHVs and preserving the availability of critical health-care services will help Yemen address the problem of malaria morbidity and mortality despite conflict and social and economic challenges.

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Dr. Ameera Zain Saeed Ba-Fadhel

Mukalla-Hadramout-Yemen

Table of contents:

<i>Content</i>	Page No
Introduction	8
Review of literature	12
Research objectives	14
The methodology	25
The results	30
Discussion	44
Conclusion	49
Recommendations	50
References	52
Annexure	55

Abbreviations

ACT: Artemisinin-based Combination Therapy.

CCMm: Community case management of Malaria.

CHV: Community health volunteer.

FGD: Focus Group Discussion.

iCCM: Integrated community case management.

IDPs: *Internal Displaced Persons*.

KII: Key informant interview.

MOH: Ministry of Health.

NGO: Non-governmental organization.

RDT: Rapid Diagnostic Test.

UHC: Universal Health Coverage.

VBD: Vector-Borne Diseases.

List of Tables:

Table1	The CCMm coverage in governorates, areas of implementation and the CHVs	15
Table2	The Stakeholders Mapping of CCMm in Yemen	22
Table3	The Profile of data collection Tool	26
Table4	The education level of the CHVs participants.	31

List of Figures: -

Figure 1	The workflow of the CHVs at the community level.	23
Figure 2	The CHVs mapping showing the implementation of CCMm in Yemen.	55
Figure 3	The Theory of Change in implementing of CCMm in Yemen.	55
Figure 4	The Consolidated Framework of CCMm implementing in Yemen.	56
Figure 5	The Coverage of eIDEWS reporting system at the health facilities level.	57
Figure 6	The geographical Malaria Risk mapping.	57
Figure 7	The Feasibility Intervention Framework of CCMm.	58
Figure 8	The Performance statistics of the CCMm program from 2018-2022.	38
Figure 9	The indicators of the CCMm from the Malaria Control Program 2020-2023.	59
Figure 10	The Pie chart showing the attitude of the community members toward CCMm.	59

Introduction: -

Yemen has been dealing with constant humanitarian crises since 2015 due to conflict, political instability, and declining economy, which hinders the provision of services and development [1].

The situation worsened after 2020 with additional challenges posed by COVID-19, climate change, and extreme weather events such as floods and locust infestations. These elements have made humanitarian needs more urgent, perpetuated cycles of violence, and forced displacement, leaving the population in profound mental and physical distress (United Nations: Yemen, 2022).

The conflict has resulted in over 4 million internally displaced persons (IDPs), with 172,000 newly displaced in 2020 and nearly 160,000 in 2021, predominantly affecting women and children (UNSDCF, 2022). Healthcare delivery has been severely impacted, jeopardizing progress towards universal health coverage (UHC), as half of Yemen's health facilities remain non-functional, compounding challenges such as staff shortages, lack of operational funds, electricity disruptions, and shortages of essential medicines and equipment [1].

Despite efforts to provide healthcare during the conflict, over 19.7 million Yemenis lack access to health facilities due to ongoing conflict, facility closures, geographical barriers in remote areas, and climate-related factors [1].

Around 5.3 million children died worldwide in 2018; pneumonia, malaria, and diarrhea were responsible for 75% of these deaths, which could have been prevented or treated [13].

Malnutrition, pneumonia, diarrhea, malaria, and other common childhood illnesses account for 99% of the world's pediatric mortality and morbidity in developing nations. [11].

Malaria is still a serious public health concern in Yemen, where the risk of infection is around two thirds of the population. In 2017, there were more than 114,000 confirmed cases and 37 deaths reported [10].

Between 2014 and 2018, Yemen saw an increase in malaria positivity rates by microscopy or rapid diagnostic tests (RDTs), rising from 11.0% to 17.0%. Similarly, the slide positivity rate increased from 8.0% to 9.3% during the same period. There was also a notable rise in probable malaria cases, with confirmed cases among pregnant women increasing from 2,034 in 2014 to

3,489 in 2016, and among children under five increasing from 19,068 in 2014 to 44,718 in 2018 [13]. Severe inpatient cases reported a six-fold increase, from 664 cases in 2014 to 3,796 cases in 2018. Malaria-attributed deaths also rose from 23 deaths in 2014 to 57 deaths in 2018 [13].

Plasmodium falciparum accounts for 98.0% of cases of malaria in Yemen; it is an Afro-tropical malaria primarily spread by *Anopheles arabiensis* [13].

According to the WHO Global Health Observatory data in 2023, Yemen reported a malaria incidence of 40.57 per 1000 population, with a mortality rate of 10.29 per 100,000 population in 2020. Yemen is categorized among regions with a high indigenous population, facing challenges in achieving the Global Malaria Action Plan's objective of reducing malaria cases by 75% by the end of 2025 [11].

Globally, preventable diseases continue to claim many lives, with children under five particularly vulnerable. In Yemen, malaria remains a significant public health challenge, affecting approximately two-thirds of the population with thousands of cases reported annually [10].

The country's diverse geography, ranging from coastal areas to mountains and deserts, complicates healthcare access, especially in rural and hard-to-reach areas with underdeveloped infrastructure [Population Census, 2004; WHO, 2003].

Accessibility to malaria services is a significant challenge facing Yemen's National Malaria Control Program in its efforts to achieve improved access, equity, coverage, quality, delivery, and sustainability of antimalarial interventions. Several risk factors and barriers hinder service delivery and health equity in Yemen's malaria context [13].

Yemen's diverse geographical regions—including coastal areas, mountains, the Eastern Plateau Region, deserts, and islands—play a crucial role in population distribution throughout hard-to-reach, urban, and rural areas, particularly in mountainous and rural regions.

Poorly developed road networks and inadequate public transportation exacerbate these challenges. Over 70% of Yemen's population, totaling 19.7 million people (Population Census, 2004), reside in rural areas where primary healthcare services cover only about 30% of the population (WHO, 2003).

Yemen faces severe socio-economic challenges, being ranked as one of the least developed countries according to the latest Human Development Index (HDI). Over three quarters of the population live below the poverty line of US\$3.20 per day[13]. The country's weak economy, high poverty rates, inadequate institutional capacities, and limited resources for adaptation, compounded by rapid population growth and poor resource management, have all hindered access to malaria services in healthcare facilities (NHS, 2010-2025).

Additionally, program funding in Yemen saw a significant decline of nearly 50% from 2015 to 2017 compared to the period of 2012-2014 [13]. The National Malaria Control Program heavily relies on international funding from organizations such as WHO, UNICEF, the Global Fund, IOM, and KSA. However, there has been a notable reduction in financial resources allocated for implementation and elimination activities. This decline is exacerbated by the cessation of domestic funding, concurrent outbreaks of other infectious diseases (including COVID-19, cholera, diphtheria, measles, and dengue), and widespread malnutrition, leading to strain on available resources and donor funding [12].

Yemen faces significant risks from climate change, which further jeopardizes the country's already fragile health conditions. Several tropical cyclones struck the southern coasts of pre-elimination governorates like Hadramout, Al-Mahara, and Socotra between 2015 and 2023. These cyclones resulted in fatalities, internal displacement, damage to infrastructure and roads, and delays in accessing malaria services and treatment. These events have heightened the risk of infectious disease epidemics and other vector-borne diseases (VBDs).

Culture, behavior, and gender dynamics play significant roles in Yemen, influencing malaria incidence, access to services, and treatment utilization. Women in rural areas often cook and fetch water near collection zones, especially in water-insecure regions amidst hilly and mountainous terrain, exposing them to mosquitoes and malaria. During hot summer months, frequent power outages compel people to spend extended periods outdoors or on rooftops, increasing mosquito exposure. Additionally, some rural and agricultural communities reject malaria control measures like indoor residual spraying (IRS) due to concerns that the chemicals could harm domestic animals [13].

To address the accessibility gap in malaria services at health facilities, Community Case Management of Malaria (CCMm) is one of the main strategies Yemen has put into practice.

Community health workers (CHWs) are trained, equipped, and supported by this initiative to provide prompt cost-effective malaria interventions using Rapid Diagnostic Tests (RDTs) and Artemisinin-based Combination Therapies (ACTs) at the community level. The goal is to engage communities and promote sustainability in Yemen's Malaria Control Program.

Effective treatment and timely diagnosis are critical elements of integrated malaria control programs. The feasibility and cost-effectiveness of CCMm, or home-based management of malaria, have been shown in numerous studies [3–11]. Currently, the World Health Organization (WHO) advises CCMm using ACTs based on expert microscopy and/or high-quality RDT results. This method greatly improves access to timely and efficient case management for malaria, especially for those who have limited access to formal healthcare facilities [10].

In Africa, the implementation of Community Case Management has proven to be an effective strategy for managing malaria promptly and effectively. It has been widely accepted by communities and has shown evidence of reducing malaria morbidity and mortality [6-9]. Malawi was among the first countries in sub-Saharan Africa to adopt the Integrated Community Case Management (iCCM) strategy, implementing it nationwide to target areas with limited access to fixed health facilities, especially in rural settings with sparse healthcare services [9].

Uganda introduced a comprehensive CHW strategy in 2010, known as Village Health Teams (VHTs), aimed at enhancing healthcare provision, accessibility, and utilization. Guided by principles of community ownership, equity, and support, VHTs are integrated into the health system, often considered equivalent to 'health center I' in the tiered healthcare system. VHTs provide a basic package of health promotion, behavior change, and preventive interventions, including child treatment interventions through iCCM [17].

Review of literature

Numerous studies have demonstrated the effectiveness of CCM in reducing malaria-related morbidity and mortality. For instance, a study in sub-Saharan Africa found that CCM significantly reduced malaria mortality among children under five by ensuring timely access to treatment [2-6-17].

CHWs play a crucial role in the success of CCM programs. They are trained to diagnose malaria using rapid diagnostic tests (RDTs) and to administer artemisinin-based combination therapy (ACT) following national treatment guidelines. This decentralized approach helps in early case detection and treatment initiation [6].

Successful CCM programs are often integrated into existing health systems, ensuring sustainability and scalability. Integration includes training, supervision, and supply chain management to support CHWs in delivering quality malaria care.

Despite its benefits, CCM of malaria faces several challenges. These include the quality of care provided by CHWs, adequate supervision and support from formal health facilities, drug resistance, community acceptance, and funding constraints [9].

CCM expands access to malaria treatment by bringing services closer to communities. It reduces travel time and costs for patients, particularly in remote areas, and encourages early treatment-seeking behavior, which is critical for reducing severe illness and complications [9].

Policymakers increasingly recognize the value of CCM in malaria control strategies. Evidence from studies and evaluations informs policy decisions regarding the scale-up and sustainability of CCM programs.

The future of CCM of malaria lies in strengthening health systems, improving the quality of care provided by CHWs through continuous training and supervision, integrating digital health solutions for data management, and addressing emerging challenges such as drug resistance and changing malaria epidemiology.

In conclusion, Community Case Management of Malaria has proven to be a valuable strategy in reducing malaria burden, particularly in resource-limited settings. Continued investment in training, supervision, and integration with formal health systems is essential for maximizing its impact and sustainability [6-9-17].

In Yemen, the Community Case Management (CCM) of Malaria was initiated in 2018 across 17 districts under the Malaria Control Program [13]. This involved training, deploying, equipping, and supervising Community Health Volunteers (CHVs) to combat child mortality in places where access to health facilities is restricted. The initiative sought to ensure that confirmed cases of malaria were treated properly and to quickly diagnose suspected cases. Key strategies included strengthening community-based malaria diagnosis and treatment through CCM implementation in targeted districts. Trained CHVs and Community Health Workers (CHWs) provided Rapid Diagnostic Tests (RDTs) and Artemisinin-based Combination Therapies (ACTs) to communities located more than five kilometers from functional health facilities, including vulnerable populations such as Internally Displaced Persons (IDPs). Recently developed tools facilitated data collection to enhance program effectiveness [13].

In my knowledge, this study may be the first implementation research on Community Case Management of Malaria in the liberated Governorates of Yemen, assessing the intervention's effectiveness in reducing malaria mortality from January 2020 to December 2023.

Gaps should be found through scientific evaluations and stakeholder engagement in order to improve program performance. These evaluations not only pinpoint gaps but also provide recommendations for improvement. Moreover, this area has not yet undergone an evaluation of the state of implementation of Integrated Community Case Management (ICCM) for common childhood illnesses.

In conclusion, this study explores the implementation and effectiveness of CCMm in Yemen's liberated governorates, aiming to assess its impact on reducing malaria mortality from 2018 to 2022. By identifying programmatic gaps and recommending improvements, this research seeks to inform policymakers, healthcare providers, and stakeholders involved in enhancing healthcare delivery in Yemen.

The Objectives: -

1. To assess the feasibility of implementing Community Case Management of Malaria (CCMm) in areas with limited access to facility-based treatment services.
2. To assess the community's acceptance of the Community Case Management of Malaria (CCMm).
3. To identify the primary challenges and gaps in implementing Community Case Management (CCMm) within the Malaria Control Program.
4. To determine the best practices in Community Case Management of Malaria (CCMm) program implementation in Yemen.

An overview of Yemen's CCM Malaria Program:

The Ministry of Health (MOH) began implementing the Integrated Community Case Management (iCCM) program following a technical committee meeting in 2015. The national strategy for iCCM, along with the Training Guidelines, was developed with support from UNICEF and the MOH. These guidelines oversee all activities related to Community Health Volunteers, in collaboration with the Health Education Centre, the Maternal, Newborn, and Child Health (MNCH), the Nutrition program, the Malaria program, and the Integrated Management of Childhood Illness (IMCI) program.

In 2016, the MOH revised the guidelines and established a technical unit within the Primary Health Care sector called the "Community Health Workers Unit." This unit focuses on all activities implemented by the Ministry of Public Health and Population (MoPHP) in collaboration with UNICEF, which serves as the major funding agency for iCCM.

Over 500 Community Health Workers were trained on the iCCM guidelines to deliver community-based interventions. The training package primarily focused on managing childhood diseases such as pneumonia, diarrhea, malnutrition, and malaria, in addition to providing health education and communication [13].

Following 2018, it was determined that more community volunteers should be included in areas with a high malaria burden in order to improve community-based malaria case management (CCM) and increase the reach of Community Health Workers (CHWs) [13].

The Community Case Management of Malaria (CCMm) was implemented under the direct supervision of the Malaria Control Program in 17 districts. This initiative was conducted in partnership with the International Organization for Migration (IOM) and The Global Fund (GF), as detailed below.

Table 1: The CCMm coverage in governorates, area of implementation and the CHVs.

<i>Sr.</i>	<i>Governorates</i>	<i>Area of implementation</i>	<i>No of CHVs</i>
1	Hadramout	Hajir	25
		Broom-Mayf'a	25
		Raida-Wa Qusir	25
2	Shabwa	Mafa'a	25
		Rodhum	25
3	Al-Mahara	Sayhout	25
		Al-Maseelah	25
4	Ma'reb	Ma'reb Alwadi	25
5	Al-Hudaidah	Al-Khokha	25
6	Taiz	Al-Mukha	25
		Moza'a	25
		Al-Wazia'a	25
7	Dale'e	Al-Azareq	25
8	Abyan	Khanfar	25
		Ahwar	25
9	Lahj	Musaimier	25
		Tor Albaha	25
	Total		425

425 female community volunteers were selected and trained across these 17 districts. These volunteers were trained in malaria diagnosis, treatment, and health education.

The Malaria Control Program established specific eligibility criteria that align with Yemeni cultural and community traditions to select female volunteers from the same community. The criteria included: Volunteers should ideally have a higher education level (Bachelor's or Secondary). In villages where educated volunteers were scarce, candidates with a primary education level were considered. Preferred age range was 18 to 35 years. Priority was given to volunteers from hard-to-reach areas and villages without health facilities.

Nominations for community volunteers were received from district health offices and local community leaders. Twenty-five volunteers from each district were in charge of reaching out to target populations of roughly 1,000 people in difficult-to-reach places with CCM Malaria services. Based on geographic access to a permanent health facility (more than 8 km or other geographic barriers), each district defined these areas.

As the primary community carers and the first line of care in the healthcare system, CHVs are essential in combating malaria. Since they live in the area and are therefore more accessible and physically closer than medical facilities, they are able to provide care without encountering linguistic or cultural barriers. As a result, their expertise is essential for providing health education and managing malaria cases in the community (iCCM).

CHVs followed the WHO/UNICEF iCCM training curriculum to the letter during a 6-day training session on malaria and malnutrition. Following training, CHVs were given a first supply of medications, which they were able to get more of from their designated fixed health facility at no additional cost. The CHVs, who were supposed to reside in their catchment areas and offer malaria diagnosis and treatment through routine surveillance sessions and on-demand for ill individuals, were initially under the supervision of the Malaria Control Programme. Free ACT treatment and malaria rapid diagnostic tests (RDTs) were given. Cases of complicated malaria were referred to the closest medical facility for additional care.

CHVs are motivated through quarterly and biannual meetings where they receive comprehensive training on CCMm updates, feedback on their performance and monthly reports, necessary

supplies of RDTs and ACTs, and a per diem for 5 days. However, they do not receive a monthly salary.

Sites Characteristics:

Study area: the CCMm were involved in 9 governorates /17 districts with total 425 CHVs.

For the current study, we chose two of Yemen's freed governorates that had already adopted community case management for malaria. We also chose these governorates based on selection criteria that allowed us to focus on high malaria burden and pre-elimination areas. Data from Aden hub was collected from Al-Musaimeir District in Lahj and Hadramout hub data were collected from Broom-Mafia's district.

Aden Hub was reported a high burden of Malaria cases and a site for Internal displacement people and Refugees camps and following the war, a large number of health facilities were destroyed or partially closed. Hadramout Hub was selected as in pre-elimination stage from Malaria and the difficulties in reaching Malaria Services due to the geographical areas and the impact of climate change.

Participants from every village discussed the state of the economy in their individual districts. In Broom-Ma'afaa, residents depend largely on fishing for their livelihoods, with women playing a crucial role in caregiving within the home. In Lahj, people engage in various jobs, with many shifting to Aden in search of employment. Three villages primarily depend on small businesses for their income, whereas four villages primarily depend on a combination of agriculture and animal husbandry.

The study's villages reported lower household incomes, less financial capital, and restricted access to cash resources. Most people rely on small motorbikes for transportation to the main city, which poses a risk for transferring members with malaria symptoms on difficult roads. Both districts lack electricity and depend on solar energy in some houses. Many people sleep outside their homes without electricity, increasing the risk of mosquito bites and malaria infection. Observations indicated a high prevalence of bed nets covering windows in Broom-Ma'afaa and Al-Musaimer districts, highlighting the burden of malaria in these targeted villages. On the other hand, certain medical facilities are overcrowded as a result of the rising demand for services.

Broom-Ma'afaa district in Hadramout represents a scattered population distribution across various geographical areas. In 2024, the estimated total population of the district was 19,530, with 3,846 (16.3%) under-five children and 658 pregnant women, according to the National Vaccine Program report in 2024. The majority of the population depends on fishing for their livelihood and is spread across the second and third catchment areas, with no nearby health facilities or health workers to provide malaria services.

Three out of four health facilities (health centers) in Broom-Ma'afaa district offer malaria services, primarily using RDTs and providing free treatment. Complicated malaria cases are referred to Mukalla city, 40 km from Broom-Ma'afaa, for better intervention.

Al-Musaimier district in Lahj governorate is located 97 km south of Aden city and comprises 229 villages, with 44.1% of the population residing in the second and third catchment areas. In 2024, the estimated total population of the district was 43,118, with 7,065 under-five children and 1,776 pregnant women. Fourteen health centers serve the population, all providing ICCM services. Four health sites offer malaria diagnosis using microscopes, while the remaining sites use RDTs for diagnosis.

The study participants and stakeholders: -

It is important in any health care setting to have all the stakeholders on board as this will provide useful input and support in a bid to achieve the goals and objectives in implementing CCM of Malaria in Yemen. Hence, engaging the appropriate stakeholders is very important in eradicating barriers and expanding the canopy of the CCMm program within the community.

This helps in participation of the different stakeholders in the formulation of the strategic direction and policies. It shows a political will to multilateralism to implement the CCMm of Malaria for the benefits of the people as shown in the collaboration. In so doing, the intended program can benefit from pulling together all available knowledge and efforts from all parties, thus improving the efficiency of efforts in fighting malaria.

In this context, the activities of the CCMm program in Yemen can target the driver and address the need of the community and, thus, increase the effectiveness in combating malaria and, consequently, decreasing malaria-related mortality.

Effective implementation of the Community Case Management of Malaria (CCMm) in Yemen requires collaboration with a diverse group of stakeholders. These stakeholders play crucial roles in various aspects of the program, from strategic planning to on-the-ground execution. Below are the key stakeholders involved in the CCMm program:

Ministry of Health (MoH):

Role: Provide general operation and management of the CCMm program.

Responsibilities: Policy and strategy design, coordination of development and training of CHVs and monitoring evaluation of program effectiveness.

Local Health Authorities:

Role: Supervise delivery and of the CCMm of Malaria program at the regional and district level

Responsibilities: Facilitate the distribution of the Malaria supplies and resources and provide the support and supervision to CHVs.

International Organizations:

Key Players: The World Health Organisation (WHO), UNICEF, King Salman KSA, the Global Fund, and the International Organisation for Migration (IOM)

Role: Offer technical and financial support for the CCMm program.

Responsibilities: Funding and resource allocation, technical assistance and capacity building and monitoring and evaluation support.

Non-Governmental Organizations (NGOs):

Role: Implement CCM activities in collaboration with local health authorities and communities.

Responsibilities: Capacity building and community mobilization.

Community Health Volunteers (CHVs):

Role: Frontline CCM program implementers who offer community-based malaria diagnosis and treatment.

Responsibilities: Rapid Diagnostic Tests (RDTs), Artemisinin-based Combination Therapies (ACTs), community education regarding malaria prevention and control, and the gathering and reporting of case data

Community Leaders:

Role: Facilitate acceptance and support for the CCMm program within the community.

Responsibilities: Supporting CHVs in their work, promoting awareness and adherence to malaria prevention measures and participating in community health education sessions.

Health Facility Staff:

Role: Provide backup support for CHVs and manage severe malaria cases referred from the community.

Responsibilities: diagnosing and treating severe malaria cases, coordinating with CHVs for referral and follow-up and collection and reporting data on malaria cases.

Media and Advocacy Groups:

Role: Raise awareness about malaria and the CCMm program through information dissemination and advocacy.

Responsibilities: creating and sharing educational content about malaria prevention and treatment. Advocating for increased funding and support for malaria control efforts.

Community members:

Role: the community participation in the CCMm in Yemen is inevitable. Some of activities that involve them include health education, environmental management, active involvement in surveillance and provide backing to CHVs. The community participation makes the fight against

malaria sensitive to the local cultures and hence guarantees long-term impact of the malaria control initiatives in Yemen.

Responsibilities: Behavior Change and encouraging behaviors such as using bed nets, eliminating standing water, and seeking medical attention at the first sign of symptoms.

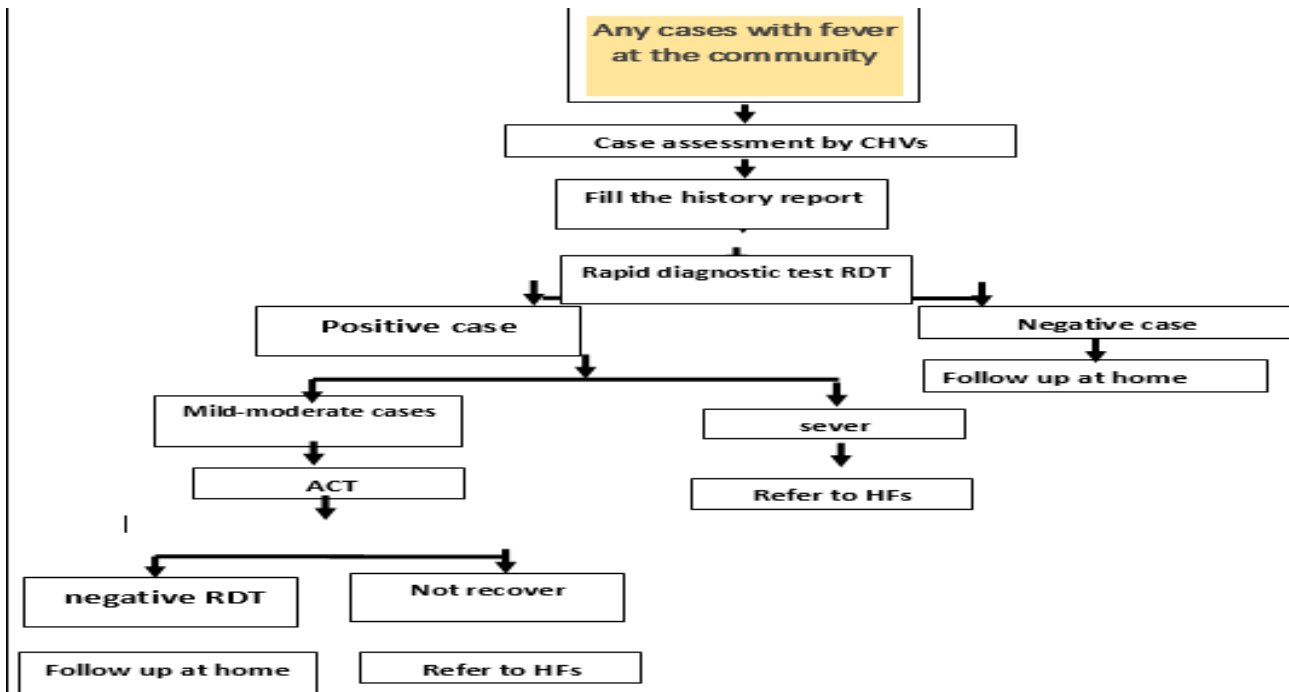
Table2: Stakeholders mapping for CCMm in Yemen:

STAKEHOLDER GROUP	RESPONSIBILITY	INTEREST	INFLUENCE
MOH	IMPROVING THE PROGRAM COVERAGE THROUGH DEVELOPING THE NATIONAL STRATEGY AND POLICY AT THE NATIONAL LEVEL	HIGH	HIGH
MALARIA CONTROL OFFICERS	CONTRIBUTE TO DEVELOPING THE ICCM POLICY AND GUIDELINE + SUPPORT WITH MALARIA DATA AND REPORT	HIGH	HIGH
INTERNATIONAL ORGANIZATION (WHO, UNICEF, KSA, IOM)	FUNDING	HIGH	HIGH
COMMUNITY CASE MANAGEMENT COORDINATOR	COORDINATING THE CCM OF MALARIA AT THE NATIONAL LEVEL	HIGH	HIGH
COMMUNITY VOLUNTEERS	DELIVER THE SERVICES TO THE COMMUNITY.	HIGH	HIGH
COMMUNITY VOLUNTEERS SUPERVISORS	DIRECT SUPERVISION TO CHVs	HIGH	HIGH
COMMUNITY LEADERS	BY ADVOCATING THE BENEFIT OF CHWs AT THE COMMUNITY LEVEL	HIGH	HIGH
COMMUNITY MEMBERS	BY PROVIDING THE RIGHT INFORMATION REGARDING TO CCM SERVICES UTILIZATION AND ACCEPTANCE.	MEDIUM	HIGH

HEALTH CARE PROVIDERS	PROVIDE THE MALARIA SERVICES AT THE HEALTH FACILITIES.	MEDIUM	MEDIUM
ADVOCACY CENTER	PROVIDE THE MALARIA EDUCATION FOR BEHAVIOR CHANGE	HIGH	HIGH

*Source: Malaria Control Program-Yemen

Figure 1: the workflow of CHVs role in CCM of Malaria: -



This workflow shows how to manage community fever cases begins with identifying individuals in the community who present with fever. These cases are initially assessed by Community Health Volunteers (CHVs), who fill out a detailed history report for each patient. After that, the patient has a rapid diagnostic test (RDT) to find out if they have a particular disease, like malaria. If the test result is positive, patients with mild to moderate symptoms receive Artemisinin-based Combination Therapy (ACT) and are subsequently monitored. If they do not recover, they are referred to health facilities; if they test negative after treatment, they continue follow-up at home. Severe cases are referred to health facilities immediately. If the RDT result is negative, the patient is advised to follow up at home with monitoring and supportive care as needed.

The external factors influencing Yemen's community case management of malaria: a review of the literature on the socioeconomic and political aspects: -

The efficacy of Community Case Management of Malaria (CCMm) in Yemen is influenced by a number of external factors. One of the significant factors is the socio-political context, which includes the ongoing conflict in Yemen. The conflict has led to the destruction of healthcare infrastructure, limited access to medical supplies, and displacement of communities, severely hampering malaria management efforts [9].

Economic constraints also play a critical role. Yemen's economy is in crisis, limiting the government's ability to fund health programs adequately. This economic instability affects the availability of essential malaria treatments and diagnostic tools, like Artemisinin-based Combination Therapies (ACTs) and Rapid Diagnostic Tests RDTs [9-15)].

Environmental factors, particularly climate and geography, are crucial determinants as well. Yemen's diverse climate, ranging from arid deserts to humid coastal areas, creates varied malaria transmission patterns. Seasonal rainfall and temperature changes impact mosquito breeding and malaria incidence, necessitating adaptable and robust malaria management strategies [9-15)].

Additionally, social and cultural determinants, including education levels and community awareness about malaria prevention and treatment, influence CCMm's success. Low literacy rates and limited health education reduce the community's ability to engage in preventive measures and seek timely treatment [9].

Lastly, international aid and partnerships are vital for CCMm in Yemen. Support from international organizations helps bridge the gap in resources and expertise, providing essential supplies, training for Community Health Volunteers (CHVs), and funding for malaria control programs [17]

These external determinants collectively shape the landscape of malaria management in Yemen, highlighting the need for a multifaceted approach to address the various challenges effectively.

The Methodology

Sampling and Sample Size: Purposive, non-probability sampling was used to choose study participants. Through talks with the manager of the malaria program, investigators chose national policymakers and CCM program implementers. Program implementers were chosen from UNICEF and the Malaria Control Program at the governorate and district levels. Included were healthcare providers who sent CHWs with patients who needed referral care for malaria.

The study team identified CHWs and CHW supervisors operating in the district in cooperation with UNICEF and the Malaria Control Program. For the purpose of taking part in FGDs, The district administration office, a medical facility, or another central location was requested as the meeting place for CHWs.. The research team visited communities to gather data from locals, speaking with individuals who were chosen based on their familiarity with the community's use of CCM and emergency services. To help choose which homes to include in Focus Group Discussions, they also enlisted the help of neighborhood leaders and guides.

Table3: - The profile of data collection tool: -

PARTICIPANTS	DATA COLLECTION TECHNIQUE	STUDY LEVEL	<i>NUMBER</i>
POLICY MAKERS	KII	NATIONAL	2
CCM PROGRAM IMPLEMENTORS	KII	GOVERNORATES	2
MALARIA CONTROL PROGRAM	KII	NATIONAL	1
CHV SUPERVISORS	KII	GOVERNORATE	2
CHV	FGD	DISTRICTS	25
COMMUNITY LEADERS	KII	COMMUNITY	2
HOUSEHOLDS	FGD	COMMUNITY	30
TOTAL			64

Data Collection Procedures and Tools

Primary and secondary data was utilized in the present study. A mixed-method approach was employed to fulfill the study objectives.

Targeting respondents with knowledge and experience in child health and/or CCM Malaria program design, planning, implementation, coordination, monitoring, and evaluation (M&E) was crucial. This qualitative method is widely used to ensure adequate information on the barriers and facilitators to CCMm implementation in the health system and the level of community acceptance to use CCMm services.

A total of twelve Semi-Structured Key Informant Interview (KIIs) was conducted, comprising 10 male and 2 female respondents. The respondents included two from the Ministry of Health (MoH) and the Malaria Program, three CHV supervisors, two CCMm coordinators, two health facility managers, and one WHO malaria officer. Additionally, six focus group discussions (FGDs) were conducted with community members and CHVs. The interviews were conducted in Arabic, using an interview guide adapted from iCCM. All interviews were audio-recorded.

The goal was to comprehend malaria case management in the community. Activities for focus group discussions (FGDs) were limited to the CCMm intervention areas in Al-Musaimer and Broom-Mayfa'a. Pregnant women and mothers with at least six children, or who were responsible for at least one child under five at the time of participation, were the focus group discussions' target audience. Participants were informed about the goal of the study and the advantages of community involvement in the healthcare system prior to the FGDs. The results showed that moms in these communities who had six children, or more were able to share their personal experiences with illnesses and treatments for their kids. In the community, these mothers are also regarded as role models.

If at least ten mothers in a village had experience in raising at least six children (considering the average size of family in Yemen six or more members at least with four children), that village was chosen to participate in focus group discussions. Mothers with a large number of children (indicating a great deal of experience) were the first to be selected in each village, followed by

those who had previously suffered from malaria. Focus groups consisted of eight to fifteen women having structured discussions. The FGDs were conducted in a secure setting to prevent any interruptions. A template consisting of sub-questions was employed, and thorough notes were made. Furthermore, participants' consent was obtained for audio recording. The following topics were covered in the conversation: -

- Familiarity with regional customs and pediatric ailments.
- Common reactions of parents to a sick child.
- Preferred methods of seeking therapy.
- Universal access to medical care (e.g., traditional, pharmacy, or formal health care facility).
- How gender roles and climate change affect the need for anti-malaria services.
- A general understanding of malaria prevention.
- Shared or common experiences with the past of malaria.
- Experiences using RDT or malaria treatment to diagnose malaria with CHVs.
- Advantages of using CHVs as anti-malaria interventions.
- The means of communication used by CHVs and local women.
- Difficulties with referrals and follow-up.

FGDs were also conducted with CHVs providing CCMm services in the target areas. Twenty-five CHVs were randomly selected based on their locations.

Malaria was the main focus because it accounts for most deaths in children under five. Passive case detection was the primary method of targeting remote and difficult-to-reach communities in the initial design of CCMm. These regions are typified by a lack of socioeconomic infrastructure, including piped water, electricity, and medical facilities. Although our focus remained on the under-five population, active case detection has become a part of iCCM in light of malaria elimination efforts, addressing both adults and under-fives. Under case management, iCCM of pediatric illnesses is a crucial intervention in the elimination of malaria.

Utilizing a quantitative approach, data from multiple sources were analyzed to evaluate the CCMm indicators and feasibility.

Data Recorded in the Malaria Control Program, included data from the Electronic Disease Early Warning System (eDEWS) and CCMm referral data from January 2018 to December 2023,

covering the period about a year after the start of CCM implementation in the Malaria Control Program.

To collect the data, a dedicated data collection team was assigned. The team consisted of two experienced researchers and two volunteers from Hadramout College of Medicine.

Data Management and Analysis:

Arabic verbatim transcriptions of the Focus Group Discussions (FGDs) and Key Informative Interviews (KIIs) were made using audio recording technology. The transcriptions were then translated into English so that they could be examined. In English, a different researcher carried out the transcript analysis. Deductive and inductive thematic analysis were combined with manual data coding to identify themes. Both the framework and the indicators were built upon the components of the CCMm benchmarks framework.

For malaria quantitative data, including suspected cases reported, confirmed cases using Rapid Malaria Test (RDT), treated cases with ACT, referred complicated cases, deaths among children under 5, and pregnant women, as well as stock-outs of antimalarial interventions (RDT, ACT) in Malaria warehouses and Health Facilities (HFs), were collected from records. IBM SPSS Statistics 22 will be utilized for analysis.

Ethical Concerns:

We followed all of the major guidelines for conducting ethical research when we carried out this study. The impact of the suggested intervention is unknown, and its large-scale implementation may not be assured. Assuring beneficence and justice is a major ethical concern.

The intervention is non-invasive, poses no risks to the patient, honors cultural and traditional aspects, and has the potential to help vulnerable groups, especially expectant mothers and infants. Its main goal is to guarantee the poorest people's access to malaria centers.

An attempt was made to pinpoint obstacles to enhancing Yemen's malaria control program. A thorough consent procedure was put in place, and the Ministry of Health, the research committee (research code: REC-184-2024), and the Malaria Control Program have all granted their approval.

Informed consents were obtained from study participants and the local community for the evaluation component, with confidentiality guaranteed. Data were collected through Focus Group Discussions (FGDs) within the community and from routine reports maintained by health facilities. Any sick individuals encountered during the study will be appropriately referred.

Quality Management:

For study design the mixed method were conducted to capture the qualitative and quantitative information. For Study tools an un-structured questionnaire for qualitative method, checklist application for quantitative and SPSS for analysis. Participants were chosen by convenient sampling of key informants and by purposive sampling. Respect for privacy and confidentiality, informed verbal consent, and ethical approval from the relevant parties. Data quality has been ensured by training, pre and post data test and monitoring data collectors.

The Results -

Based on the field interactions with CHVs and the community members and observation of the performance of CHVs in the field, resource availability, CCMm service accessibility and acceptability to identify the major challenges & enablers and list them here: -

The main challenges:

1. The shortage of budget significantly impacted the Community Case Management (CCMm) of malaria program in Yemen by limiting the training, field supervision and resources provided to Community Health Volunteers (CHVs). The budget doesn't enough to cover the anti-Malarial interventions in distribution of the Insecticide -Treated Nets ITNs, the Indoor Residual Spray IRS and the Health Awareness Campaigns in the high burden districts. There was shortage and delay in the monthly allowance of the CHVs to cover the phone communication and the transportation cost of the CHVs during their field work, this overall budget shortfall compromised the effectiveness and reach of the malaria control program.
2. The CCMm guideline need to be updated, from the 2011 guideline to reflect the post-2015 war context and the split in the Ministry of Health, along with expanding the service package to include broader health interventions.

The Community Case Management coordinator in Malaria Control Program emphasized, *“After the war in 2015 and splitting the MOH in 2 parts, MOH -Sa’ana and MOH -Aden”*. There is a huge need to update the guideline according to the context and the epidemiological situation in North and South Yemen.” Others advocated for including additional interventions in the CHV service package to address these broader health needs.

3. Unclear selection criteria of CHVs including in the guidelines, leading to challenges in recruiting qualified volunteers, especially in areas with limited educated candidates. Only forty-eight present 48% of the interviewed volunteers had a secondary school degree and they were from non-medical background, the education level is varying from district to district *“I was the only volunteer with midwifery background in the district and this motivate me to share my knowledge to other volunteers”*. The CCMm coordinator in Lahj explained: *“The recruitment criteria should be flexible in Lahj villages because there are a few qualified girls in the area, and we need to increase the number of volunteers to expand the coverage and to replace the drop-out volunteers.”*

Table4:- The education level of the CHVs participants in the study.

Education level \ Qualification	Number
Diploma in Nursing	3
Secondary Education	12
Primary Education	10
ToTal	25

4. Challenges in access to some hard-to-reach villages and attending training sessions due to distance, transportation costs, cultural barriers and natural disaster. Many volunteers struggled to reach training locations, with one from Ma’afaa noting the long travel time and high

transportation costs, *“My village is far away from the training location in Mukalla city it took for me an hour and half to reach and some time I cannot afford the transportation cost.”*

while another from Al-Musaimer district mentioned the cultural requirement for women to travel with a male companion *“I missed some training session because I cannot travel without my brother or my father, I’m living in an area it’s not accepted for women to travel without a company “Mahram”*. Another volunteer said, “my village is surrounding by a huge lake during the rainy session it closed the ways to other villages, so I spend weeks without leaving my home that affected my participation to any training or meeting.”

5. Limited supervision to the CHVs arears, due to budget constraints to cover the transportation cost from the districts to the CHVs field locations, the natural disasters, and movement restrictions in hard-to-reach areas.

6. Supply chain and lack of resources, there were several factors affected the supply chain of CCMm , recently, the supply chain for malaria commodities was impacted by climate change at all levels from the national level to the local government and district level. Insufficient funding for the CCMm program, the bulk of the medications had to be ordered from outside the country, which caused delays in their arrival. It has been observed in certain instances that medications given to healthcare facilities in order to supply CHWs were used there before the medications could reach the CHWs. The CCMm supervisors at the district level mentioned that *“the supply chain management was played a vital role in the program, but it needs to be strengthened”*. They added that *“The CHVs should be given buffer stock so that they will have enough medication for three months in the event that the test or drugs are delayed”*.

Most of CHVs had complained to the district supervisors about shortage registration documents and they used to register the cases in separate papers, shortage of ID-Card , CCMm guideline, Malaria education brochures ,vest, hat and thermometer. They said providing of registration document will keep the data safe rather than using separate case papers and the ID card with vest will improve the trust between the community and the CHVs.

7. Challenges in report submission and data management, CCMm reports were collected from the CHVs thought using WhatsApp application in the areas with good internet coverage otherwise during the quarterly meeting the district supervisors collected the paper reports from the CHVs and submitted to the CCMm coordinator at the government then directly to the CHVs coordinator at the Malaria Control Program. There were some challenges during the report submission mainly in using smartphone applications in the village with limited internet access or limited phone coverage to contact with the supervisor or the health care providers in the area. A supervisor in Ma'afaa explained, *“Since most villages are in remote locations, we are unable to regularly gather the CHVs' reports. Therefore, we used WhatsApp to get reports from CHWs and to give them feedback. The reports were then gathered by the supervisors during the field visits.”* Regarding the data management, the CCMm supervisors at the district level they reported that they don't have a data base or a data matrix to compile the CHVs reports rather than collecting the paper reports and this led to duplication of data submitted or missing the paper report during the archive.

8. Lack of an integrated referral system and reluctance of community members to accept referrals due to high transportation costs and absence of ambulances. In order to guarantee the integrated referral system that connected CHVs to healthcare facilities, the CHVs recommended offering a referral form that included the reasons for referral as well as the severity of the cases. Because it is expensive to transport people to remote locations and there isn't an ambulance to the closest medical facility, most people in the Brom-Mayfaa district refuse referrals in the event of an emergency.

Referred female cases may not have the ability to leave home especially if they are the households. A health care provider in Broom district said, *“sometimes we refer Malaria cases to Mukalla hospital 60 km far away from the district, because we don't have hospital for admission, we ask the family to pay for the ambulance car to cover the fuel only, we don't have any choice, the fuel price is very high in Hadramout.”*

Despite the challenges faced in the Community Case Management of Malaria (CCMm) program, there were several key enablers that contributed to its success: -

The main enablers: -

1. Community acceptance and trust, the majority of the selected women in Hadramout and Lahj governorate reported that they had trust on the community volunteers after they and their family experienced Malaria symptoms with the effect of the distributed ACT treatment to relief the symptoms after few days that's indicate the quality of the treatment. One of the community volunteers from Ma'afaa district explained *“the people in the village accept the diagnostic test and treatment even they know that I'm not from the medical background, because of my experience in providing CCMm for 3 years and I showed my skills in sharing Malaria prevention information when needed to my village with the support of the district supervisor”*. It was observed that the community trust the trained female community volunteers from the same village and easy to reach them any time align with the cultural norms. A women from Lahj said *“ My husband experienced a fever and shivering symptoms for 3 days and he went to the district hospital for diagnosis but unfortunately he can't afford the cost of diagnosis and went back to home without any treatment, I was remembering other women talking about the village volunteer, I went to her home and explained to her our situation she told me that test and the treatment were free” she added “ After Malaria test the volunteer told me that my husband had Malaria symptoms and he need treatment, and she gave me the tabs with some prescription in how to use the treatment and how to protect my children from Malaria ”* The community health volunteers were working to promote the community awareness, knowledge and good practice about malaria control and prevention among the communities in order to improve the utilization and trust on CCMm services among the community which includes general information about malaria diseases, the wrong practice in dealing with feverish symptom and mis-using of unknown herbal material, the mosquitoes transmission, the best use of malaria treatment and control method LLINs and IRS and the community engagement to reduce mosquitoes breeding sites. Good relationships between CHWs and community members and high levels of utilization were reported by all respondents from the Musaimir and Broom-Ma'faa district.

2. Training and Capacity Building: 425 female CHVs were selected from 9 governorates, with 25 volunteers in each district. Selection criteria were context-specific, often requiring volunteers to be female and from the same community to respect cultural traditions. The Community volunteers were received several trainings provided by Malaria Program during and after the CCMm implementation. The training focusing on diagnosis and treatment Malaria and referral the severe case to nearest hospital. There are quarterly and bi-annual meeting with the volunteers to provide a refreshment training and on job training in the field in how to use the rapid diagnostic test in diagnosis and report the positive cases to the supervisors in real time and treat the non-complicated cases with ACT. The majority of the volunteer's participants reported that, they were satisfied on the effectiveness of the trainings. The supervisor in Musaimer district in Lahj said *“even they were challenges in the CHVs movement, but they were participated in most of the trainings and meetings recorded in the attendance sheet* A volunteer in Aqqan village added that *“My father was my biggest supporter in the program he was encouraging me to participate in the Malaria program trainings to help my village and he always a company me* Continuous training provides the volunteers with the knowledge and practice on dealing with Malaria cases at the community level. *“I joined as a volunteer in 2019 with basic information on Malaria, now I got enough experience in how to diagnose and treat Malaria cases.”* A volunteer from Broom district.

3. Improve the coverage and access to CCMm services, the program was implemented in 17 districts with criteria of hard-to-reach areas, shortage of health facilities providing malaria services, shortage of medical staff, burden areas with Malaria cases, affected areas with natural disasters and presence of Internal displaced persons IDPs. It was clearly noticed that there were no CCM volunteers in Socotra Island, Hadramout Al-Wadi and Aden governorates because it does not meet the selection criteria above. The CCMm program distributed the volunteers over the targeted villages even with some shortage in some villages. The supervisor in Broom-Ma'faa district explained that *“we were tried to distribute the trained volunteers in their same villages to ensure the acceptance of the community even with shortage in some villages* The community can easily access the volunteers and seeking for Malaria services. A 35 woman with 4 children experienced Malaria before explained her journey before implemented of CCMm *I was travelling for 2 hours from my home to reach the health center in the district just for*

treatment and spend 35,000 Yemeni Rials = 40 US dollars for transportation cost and treatment, but now I just call the village volunteer to test and provide me the proper treatment without spending any cost, really they did a great job in the village.”

For the majority of women participated in the focus group discussion in Broom-Ma’faa Hadramout and Al-Musaimir Lahj they reported that, they were facing the cultural barrier to leave home alone without male accompany seeking for health services, the community volunteers solve this issue through visiting home and providing Malaria interventions.

4. Cost effectiveness, the community members reported that there was an acceptance in using the Malaria RDT and ACT treatment because it was free of charge particularly low-income earners. Malaria intervention that delivered free of charge among the well-trained community volunteers along with the treatment effect and the routine following up with Malaria positive cases all these factors impact the utilization of the CCMm Intervention in the community. A women from Lahj said *“My husband experienced a fever and shivering symptoms for 3 days and he went to the district hospital for diagnosis but unfortunately he can’t afford the cost of diagnosis and went back to home without any treatment, I was remembering other women talking about the village volunteer, I went to her home and explained to her our situation she told me that test and the treatment were free” she added “After Malaria test the volunteer told me that my husband had Malaria symptoms and he need treatment, and she gave me the tabs with some prescription in how to use the treatment and how to protect my children from Malaria.”* The effective treatment access, combined with high-quality care provided at no cost, led to a marked reduction in malaria mortality.

Reports from CHVs indicated that from 2020 to 2023, there were zero malaria-related deaths in the targeted villages following the implementation of CCMm. According to carers, CHVs' highly effective Artemisinin-based Combination Therapy (ACT) helped patients recover quickly. The perception of medicines was that they were of high quality, unexpired, and free of adverse effects. *“The treatment they give is so effective and the child is better in three days,”* remarked a mother from Broom District.

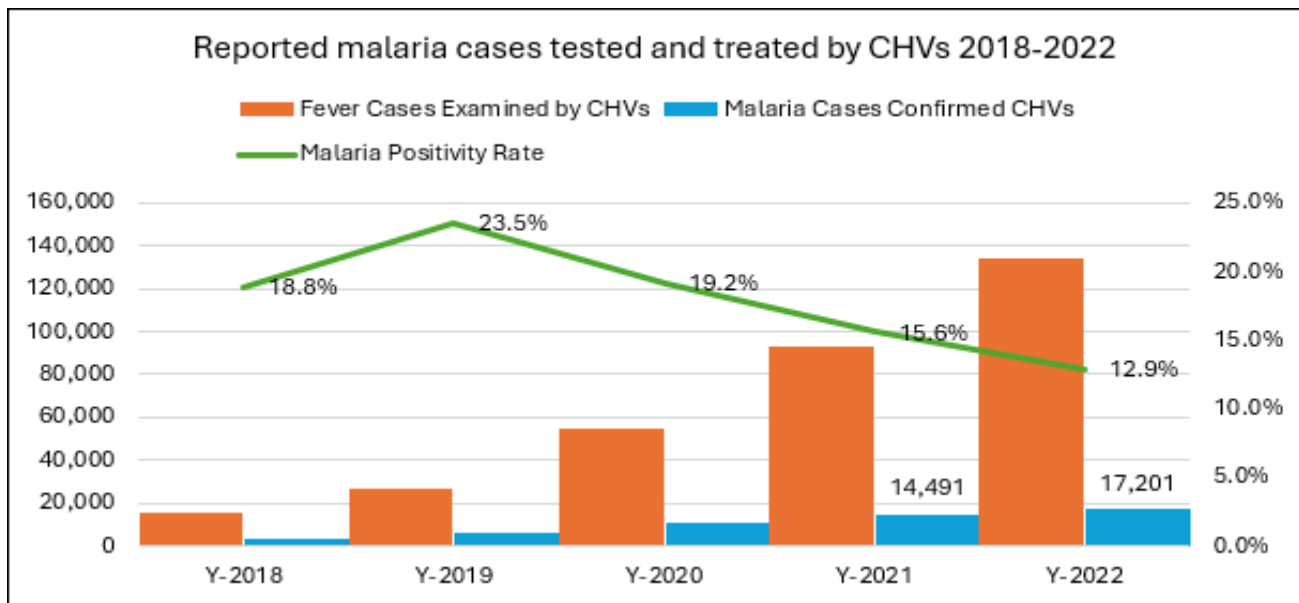
5. Follow-Up and field monitoring, regular follow-up visits by CHVs to ensure the treatment adherence, promoting healthy behaviors, and improving overall quality of care. The majority of the volunteers reported that, they were conducted daily follow up during the treatment to ensure the treatment utilization.

There was also a regular supervision and monitoring on the performance of CHVs in the field to many villages, *“A quarter supervision was conducted at the district level to follow up with the volunteers to ensure the quality of reports and improving the volunteers’ performance in detecting, diagnosis and treated malaria cases.”* Broom Ma’afaa supervisor. To make sure the program was implemented with few difficulties, biannual meetings were also held with the CCMm coordinators at the national level. *“The CCMm program selected the district supervisors from the same community to improve the communication so the CHVs can more easily reach the supervisors.”*

6. Reduction in traditional practices and shifting from traditional healers to CHVs for malaria treatment. Ninety-Three percent 93% of the community participants reported that, they completely shifted to CCMm intervention and stopped using the herbal materials for their weak effective. The community health volunteers were working to promote the community awareness, knowledge and good practice about malaria control and prevention among the communities in order to improve the utilization and trust on CCM malaria services among the community which includes general information about malaria diseases, the wrong practice in dealing with feverish symptom and mis-using of unknown herbal material, the mosquitoes transmission, the best use of malaria treatment and control method LLINs and IRS and the community engagement to reduce mosquitoes breeding sites. Good relationships between CHWs and community members and high levels of utilization were reported by all respondents from the Musaimer and Broom-Ma'faa district.

7. The competency of CHVs, despite many of them were not from medical background, significantly enhanced community acceptance.

Figure 2: The Performance Statistics of CCMm Program from 2018-2022 in Yemen



The secondary data from Malaria Control Program documents reflect a complex interplay between challenges and enablers in Yemen's fight against malaria.

It was shown a steady rise in fever cases examined by CHVs from approximately 25,000 in 2018 to around 135,000 in 2022 this could reflect a growing burden of various febrile diseases within the community, that put additional pressure on CHVs and healthcare resources, potentially affecting the quality and timeliness of care. On the other hand, it shows the ability of CHVs to examine more cases reflects the quality of training, effective communication and trust between CHVs and community members have encouraged more individuals to seek testing and treatment promptly and highlight the power of the awareness campaigns and education about Malaria prevention and the importance of early testing and enhancing the proactive health-seeking behavior among the community members.

In 2019, it was shown the high peak of positivity rate was 23.5% at the early years that suggest significant Malaria transmission and challenges in controlling the spread during that period. The

high rates may also reflect delayed of the implementation of Malaria control measure and treatment strategies. There was a significant decline from 23.5% in 2019 to 12.9% in 2022 that indicates successful implementation and access to effective anti-malarial interventions through CHVs and other control strategies. Improved the ability of CHVs to rapid response to Malaria cases at the community level and community engagement to encourage more individuals to seek testing and treatment promptly.

Over all, the data from 2018 to 2022 underscores significant progress in malaria control efforts, evidenced by the decreasing malaria positivity rate amidst rising fever case examinations. These results highlight the importance of continued investment in community health services, surveillance, and preventive measures to sustain and further this positive trend. Further research and consistent monitoring are essential to adapt strategies and ensure the long-term success of malaria control programs.

Barriers to CCMm implementation in Yemen:

1- Lack of Community involvement in the design phase and program evaluation:

The Community leaders from Hadramout and Lahj districts stated that, they were not involved in the CCM program's development or execution. They emphasized the significance of their involvement in determining and prioritizing community health needs as the main stakeholders to ensure the community support, acceptance and the sustainability.

2- Challenges in updating the guideline:

The iCCM and CCMm program was not integrated in the national health system.

The Malaria Control Program director emphasized that not integrating the CCM of malaria into the national health system that would lead to shortage of the service delivery and financial support. A national iCCM policy, strategy, and action plan should uniform the standards for selecting CHVs and CHWs to unify the program.

3- Fragmented Service Packages and Coordination:

Respondents argued for the inclusion of additional interventions in the CHV service package, such as nutrition, maternal and newborn health, immunization, and reproductive health. The current division of services among different programs and sponsors resulted in a non-unified CCM structure. UNICEF, for example, funded iCCM that addressed malnourishment, pneumonia, and diarrheal diseases, while Gulf Fund GF and IOM funded health education and malaria. "*We don't have enough information about Cholera outbreak to educate the community as my role is to promote health situation among the community,*" said a community volunteer about the role of CHVs during the cholera outbreak in Lahj.

4-Funding Constraints:

Despite initial funding for CHV training and CCM expansion, the program faced multiple stoppages due to insufficient international donor funding and lack of government self-funding, affecting sustainability. Monitoring and evaluation field visits were limited due to high logistic costs. CHVs did not receive salaries, only training per-diems every six months, which was insufficient. This created disparities with CHWs in UNICEF programs who received monthly payments

5-Recruitment Challenges:

It was challenging to find a qualified volunteers with medical background, when there was only one qualified volunteer in a village, it became necessary to recruit from nearby villages. As a result, volunteers were under more work pressure. *"If we need to select two CHVs in the village, we only found one CHV who nearly met the criteria because there are few educated people in the same village,"* the CCMm supervisor in Lahj said.

6-Training challenges:

There was a lack of sustained training budget, with Malaria Control Program providing on-job training. However, conducting trainings with limited budget with the recent climate disaster affected the CHVs training program.

7-Shortage of Equipment and Supplies:

CHVs faced shortages of essential equipment and logistics, including ID cards, IEC materials, formal vests, Malaria gridline, reporting documents and thermometer, which hampered their effectiveness in field visits. The supply chain management issues led to frequent stockouts of CCMm drugs, that may lead to loss of confidence in CHVs among the community.

8-CHV Dropout and Replacement Challenges:

There was a notable dropout among CHVs due to marriage or relocation, with difficulties in finding replacements, impacting the performance of CCMm in villages.

9-Challenges in Monitoring and Evaluation:

Tough terrain, budgetary restriction, logistical problems and the climate change were presented challenges for supervision. Data transmission via mobile phones was the main strategy used to get around these obstacles. *" Since most of the targeted villages are in isolated, difficult-to-reach locations, we were unable to regularly gather the CHVs' reports.,"* the CCMm coordinator clarified.

10-Referral Mechanism Challenges: Many patients could not afford transportation costs for referrals. CHVs lacked an integrated referral system and formal feedback mechanisms from health facilities. Some facilities were not equipped to handle referred cases.

The best practices of implementing CCM of Malaria in Yemen.

The challenges	The best Practices of CCMm
Accessibility challenges to reach out the Malaria services in heard to reach areas.	Improved the community-based interventions.
Funding resource issues.	Community involvement to promoting the mobilization for long-term and ensure the sustainability of delivering the Malaria services
Trust issues: mistrust in healthcare systems, especially in conflict areas and after Covid-19 pandemic	Enhanced Community Ownership: Fostering responsibility and improving the trust through CCM services.
Limited resources to afford Malaria test and treatment in Private sector. Missing Malaria positive cases in hard-to-reach areas.	Cost-effectiveness & timely data reporting
Logistical challenges to conducting regular supervision and assessments for Malaria Surveillance and rapid response team.	Strengthening Malaria Case Management at the community level and ensure the capacity building, ongoing training, supervision, and support for CHVs
Incomplete data, missing data do not reflect the actual Malaria Case	Data quality through quarterly/bi-annually supervision.

Gaps in coverage in certain villages or underserved areas	CHVs Mapping: for tracking the performance to ensure the coverage
Cultural barriers and norms that restrict women's mobility and access the health facilities.	Women Empowerment in CCM Malaria as CHVs to improve the program acceptance
Difficulty in maintaining diagnostic equipment and continuous training in rural hospitals.	Enhanced diagnostic capabilities by providing diagnostic tools and training lab technicians
Resistance to adopting healthier practices due to traditional beliefs or misinformation.	Promoting behavior Change through Community engagement and health advocacy

The successful stories of Malaria Control Program in Yemen.

- 1.Reducing Malaria mortality and morbidity cases in the CCMm areas. It was shown zero Mortality case reported from the CHVs during the period of 2020 till 2023.
- 2.Socotra governorate declared Malaria free and Hadramout at the pre-elimination phase.

Discussion

Since the conflict began in 2015, Yemen has been facing one of the worst humanitarian crises globally. The ongoing conflict has led to widespread displacement, with over 4 million internally displaced persons (IDPs), most of whom are children and women. The political instability and economic downturn have exacerbated the crisis, leaving the population vulnerable and in dire need of humanitarian assistance.

The health system in Yemen has been severely compromised by the conflict. Just 51% of healthcare facilities are operating at maximum capacity, and those that are confronting formidable obstacles, including a shortage of health staff, lack of operational funds, issues with electricity, and shortages of medicine and medical equipment. These challenges have hindered progress toward achieving universal health coverage (UHC) and have left 19.7 million people without adequate access to healthcare services [13].

In Yemen, malaria poses a serious threat to public health, with roughly two-thirds of the population at risk of infection. The prevalence of the disease is highest in pregnant women and children under five. Between 2014 and 2018, there was a rise in confirmed cases, deaths from malaria, and rates of malaria positivity in Yemen. There were 37 malaria deaths and more than 114,000 confirmed cases in 2017. *Anopheles arabiensis* is the primary vector of *Plasmodium falciparum*-caused malaria in Yemen, accounting for the majority of cases.

The socio-economic conditions in Yemen further complicate the delivery of healthcare services. Yemen is among the world's least developed nations, with over three-quarters of the population living below US\$3.20 a day [13]. High poverty rates, a weak economy, rapid population growth, and poor management of resources have exacerbated the challenges faced by the health system. Geographically, Yemen's diverse landscape, including coastal areas, mountains, plateaus, deserts, and islands, creates additional barriers to healthcare access. Poorly developed road networks and lack of public transportation further hinder the population's ability to reach health facilities, particularly in rural areas where 70 percent of the population resides.

Yemen has been severely impacted by environmental factors and climate change. Extreme weather events like flooding, heavy rains, and infestations of desert locusts have affected the nation, causing population displacement and heightened health risks. These elements have made

the already precarious healthcare system even more strained and have complicated efforts to manage and control malaria.

Community-based interventions have been put into place to improve access to healthcare services in response to these difficulties. One such program is the Community Case Management of Malaria (CCMm) approach. This approach entails preparing and arming community health workers (CHWs) to diagnose and treat malaria at the community level in a timely and economical manner. Using community resources and enabling them to actively participate in malaria control, CCMm seeks to close the gap in healthcare access.

The Community Case Management of Malaria (CCMm) strategy in Yemen addresses the substantial public health challenge posed by malaria, which is exacerbated by ongoing conflict, economic difficulties, and a compromised health system. Traditional healthcare infrastructures are inadequate, particularly in rural and hard-to-reach areas, necessitating innovative approaches for malaria diagnosis, treatment, and prevention.

In the context of Yemen, In order to effectively address the substantial public health burden that malaria poses, it was necessary to highlight the Theory of Change (ToC) for the implementation of Community Case Management of Malaria (CCMm) in the liberated governorates of Yemen in order to lay out the strategic approach, expected outcomes, and underlying assumptions required for the successful reduction of malaria morbidity and mortality through community-based interventions.

Yemen continues to have a serious public health problem with malaria, which is made worse by the ongoing conflict, the country's poor health system, and the economic downturn. The population's needs cannot be met by the current healthcare system, especially in remote and difficult-to-reach areas. Innovative methods are desperately needed to enhance the diagnosis, treatment, and prevention of malaria by putting a strategic plan into place for the CCMm program. Training and Equipping Community Health Workers in malaria diagnosis using Rapid Diagnostic Tests (RDTs) and treatment with Artemisinin-based Combination Therapies (ACTs) to provide the services at the community level. The purpose of community engagement and awareness campaigns is to raise community trust and utilization of CHV services by educating

the public about malaria prevention and the value of early diagnosis. Enhancing the support structures for CHWs, including regular supervision, supply chain management for RDTs and ACTs, and establishing referral systems for complicated cases and implementing robust monitoring and evaluation mechanisms to track the performance of CHWs, the impact of CCMm on malaria outcomes, and to identify areas for improvement.

The anticipated Results from the application of CCMm, namely an improvement in CHWs' ability to identify and manage malaria in the short term. increased understanding of malaria treatment and prevention in the community. Improved availability of anti-malaria services in remote and difficult-to-reach areas. in the intermediate term through timely and precise diagnosis and treatment of malaria. decreased frequency of severe malaria cases as a result of prompt intervention and enhanced community members' health-seeking habits.

A notable decline in malaria morbidity and mortality rates over the long term, especially for pregnant women and children under five. strengthened ability of the health system to combat malaria and other health issues, as well as empowered communities to take an active role in their own health management.

The success of the ToC for CCMm in Yemen is based on several critical assumptions, Political and Security Stability in relative stability in the region is necessary to facilitate CHW training, supply distribution, and community engagement activities. Community Acceptance: The community is willing to trust and utilize the services provided by CHWs. Sustainable Funding: Adequate and continuous funding is available to support the training, equipping, and supervision of CHWs. Effective Supply Chain Management, there is an efficient supply chain system to ensure the availability of RDTs and ACTs at the community level. Collaborative Stakeholder Engagement: Active collaboration and support from governmental and non-governmental organizations, as well as international partners.

The Pathways to Change through, strengthen the capacity of CHWs through comprehensive training programs and regular refreshers. Engage community leaders and members through targeted awareness campaigns to foster acceptance and participation. Improve health infrastructure, logistics, and support systems to sustain the implementation of CCMm. Utilize data

from monitoring and evaluation activities to inform and refine strategies, ensuring continuous improvement in malaria control efforts.

The study shows how community-based interventions can increase Yemeni citizens' access to malaria services. In rural and difficult-to-reach areas, community health volunteers (CHVs) are particularly crucial for the diagnosis and treatment of malaria in local communities.

Nonetheless, a large number of the problems with service delivery had less to do with the conflict and more to do with the health system's overall flaws.

In order to guarantee the CCMm program is implemented consistently and effectively and to secure funding, it is imperative that community case management of malaria guidelines be improved, and Terms of Reference (ToR) be established. Create plans to make sure the community takes responsibility for the CCM program, which will increase its efficacy and sustainability.

The importance of expand training program for CHVs to maintain their diagnostic and treatment skills. Emphasize the recruitment of CHWs to work in their villages to improve the community trust and to be able to work in safe and secure areas but if there were a need to travel to distant villages, transportation cost should be covered. Since that most residents of rural areas have low levels of education, recruitment criteria must be reasonable.

In order to ensure that the program meets local needs and is widely accepted, community members should be involved in its design, implementation, and evaluation. Additionally, women should be encouraged to participate in the CCMm program, particularly in remote villages, as this will boost community trust and improve service accessibility. Given that cultural norms required female volunteers to be accompanied by a male relative during the field visits, safety was a major concern.

Budgetary limitations, restrictions on movement, and natural disasters all made regular supervision and monitoring difficult. In order to promote improved communication and support for CHVs, supervisors were chosen from within the same community. Despite the limited internet access in remote areas, the supervisors and CHWs were still able to communicate through the use of smartphone applications like WhatsApp for report submission. During field

visits, supervisors gathered reports; however, the absence of a database resulted in problems with data loss and duplication.

The CCMm intervention was cost-effective, the services were provided free of charge, this improved the community utilization and acceptance and facilitate the accessibility to reach the CCMm in remote areas.

The referral system was crucial for treating cases of severe malaria, but its efficacy was constrained by societal and financial constraints. Many respondents stated that they were unable to pay to take a child who was recommended to a medical facility. Therefore, in order to improve, it would be necessary to pay for the transportation as well as offer a referral form and enhance the integrated referral system that connects CHVs with medical facilities.

Climate change, security concerns, and financial constraints occasionally impacted the malaria commodity supply chain, causing delays and insufficient stocks. Commodity stockouts affecting CCMm posed a significant challenge to delivery. To prevent them from consuming the medications meant for CHWs, it is imperative to make sure that enough supplies are available in medical facilities. To avoid stockouts, it might be necessary to locate storage facilities closer to communities or provide CHWs with adequate buffer stocks.

In order to maintain CHV operations and make infrastructural improvements, financial support is required. In addition, funds were required for CHW training and to increase the geographic reach of CCMm in Yemen. active cooperation with all program participants to guarantee the sustainability of the malaria initiative.

By addressing these areas, the CCMm strategy can significantly reduce malaria morbidity and mortality, empower communities, and build a resilient health system capable of managing malaria and other health challenges effectively.

Conclusion: -

The Community Case Management of Malaria (CCMm) study conducted in Yemen sheds light on the feasibility and efficacy of community-based health interventions in areas affected by conflict. With the help of Community Health Volunteers (CHVs), the CCMm strategy has improved malaria diagnosis, treatment, and prevention with encouraging results.

Key findings highlight that training and equipping CHVs with the necessary tools and knowledge can effectively bridge gaps in healthcare access, especially in rural and hard-to-reach areas. The research underscores the importance of community engagement and awareness campaigns in enhancing the acceptance and utilization of CHV services in Yemen context.

Furthermore, the study emphasizes the need for robust support structures, including supervision, supply chain management, and referral systems, to sustain and enhance the effectiveness of CHVs. The findings also point to the critical role of sustainable funding and collaborative stakeholder engagement in ensuring the longevity and success of the CCMm strategy.

In conclusion, the research validates the potential of community-based approaches to significantly reduce malaria morbidity and mortality in Yemen. It calls for the expansion of training programs, develop and maintain a CCMm database that allows for direct and timely reporting from CHVs, ensure accurate data collection and analysis, strengthening of community engagement, improvement of support structures, and securing sustainable funding to build a resilient health system capable of addressing malaria and other health challenges effectively.

The recommendations: -

1. Accelerate the unifying of all CHVs and CHWs under one umbrella with direct support and supervision from the Ministry of Health.
2. Improve the collaborative efforts between the government bodies and the international organizations to provide the necessary funding, resources, and policy frameworks to support malaria control initiatives.
3. Scaling-up the iCCM guideline including the CCMm to ensure adherence to the national guideline and the country context.
4. Strengthen the community level surveillance and M&E system
5. Strengthening malaria data management systems to ensure the quality of data reporting, mapping and dissemination to action and policy.
6. Establish a digital application via smartphones for timely data collection and reporting.
7. Improve the Capacity building through provide Malaria case management on job training and conducting ToTs workshops on the CCMm guidelines at the community level.
- 8- Strengthen the supply chain management and promoting the decentralization of supply management, warehousing, logistics and distribution services at governorate and/or district levels
9. strengthen the health advocacy, communication and social mobilization through developing advocacy materials meet with the community need and the country context.
10. Expand the coverage of CCMm program in endemic and pre-elimination areas and ensure allocate the budget.
- 11- Ensure continues providing of CCMm intervention (RDTs and ACTs) to hard-to-reach communities and vulnerable populations, such as IDPs, to achieve a universal, equitable and sustainable community-based CCMm coverage.

12. Promoting the collaboration with research institutions to conduct independent M&E and implementation studies.
13. Developing public-private partnership strategy for effective involvement of the private sector in maximizing coverage with preventive interventions.
14. Strengthening of the referral system for severe malaria case management according to the national guidelines.
15. Propose actionable steps to address the climate change on Malaria Control Program.

The Limitations: -

- 1.Lack of resources and data on CCM of Malaria Program.
- 2.Dificulties to reach the community volunteers in hard-to-reach areas and villages.
- 3.The period of conducting the data collection was in the rainy season, challenges during travels.

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Annexure:

Figure 2: The CHVs mapping showing the areas implementation of CCM malaria in Yemen.



Figure 3: The Theory of Change in implementing CCM of Malaria in Yemen.

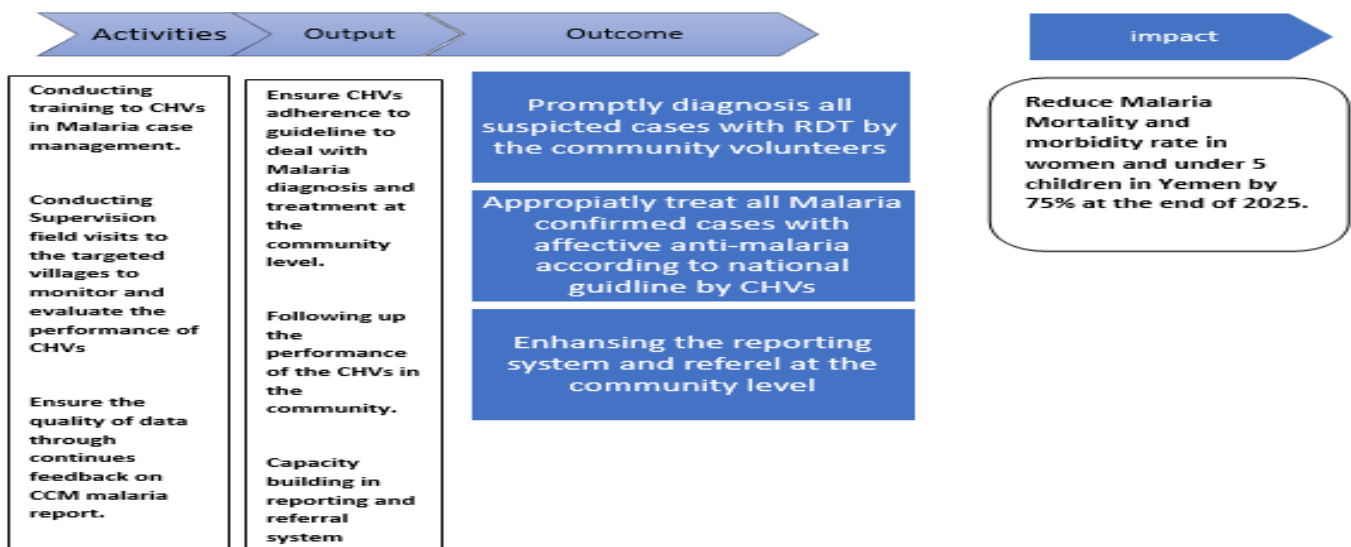


Figure 4: The Consolidated Framework for CCMm implementation in Yemen

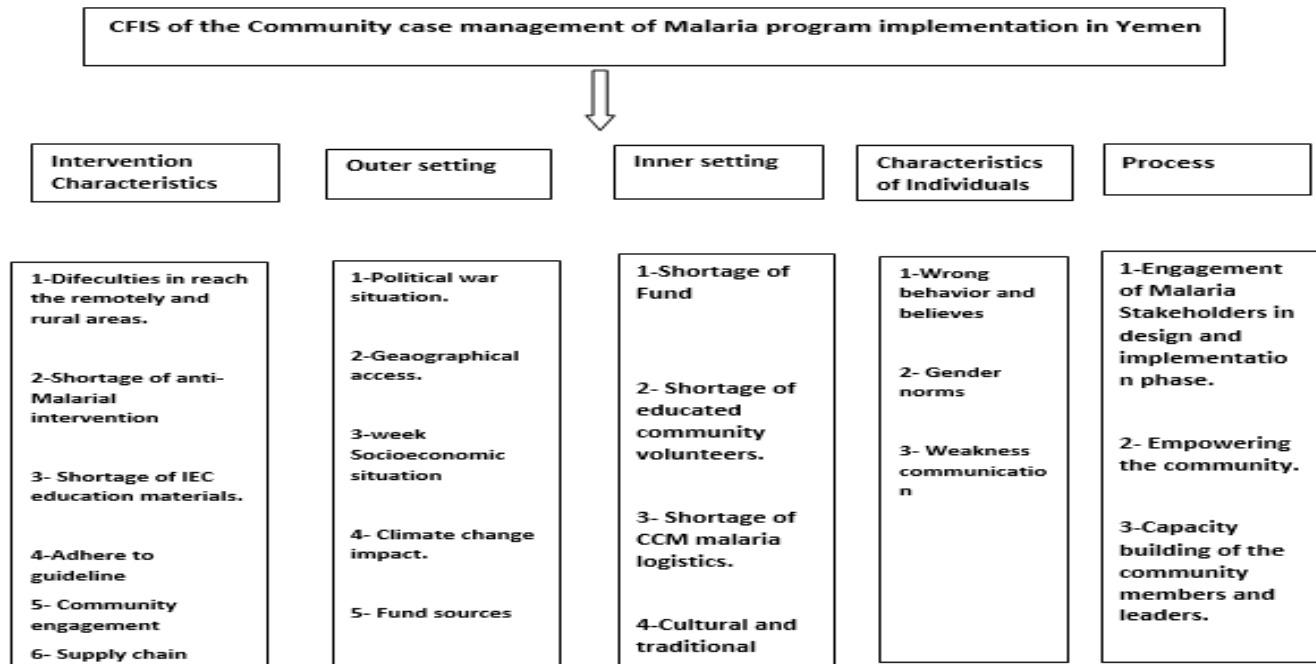


Figure 5: Figure 8: the coverage of the elDEWS reporting system at the health facility level.
Source MCP 2018.

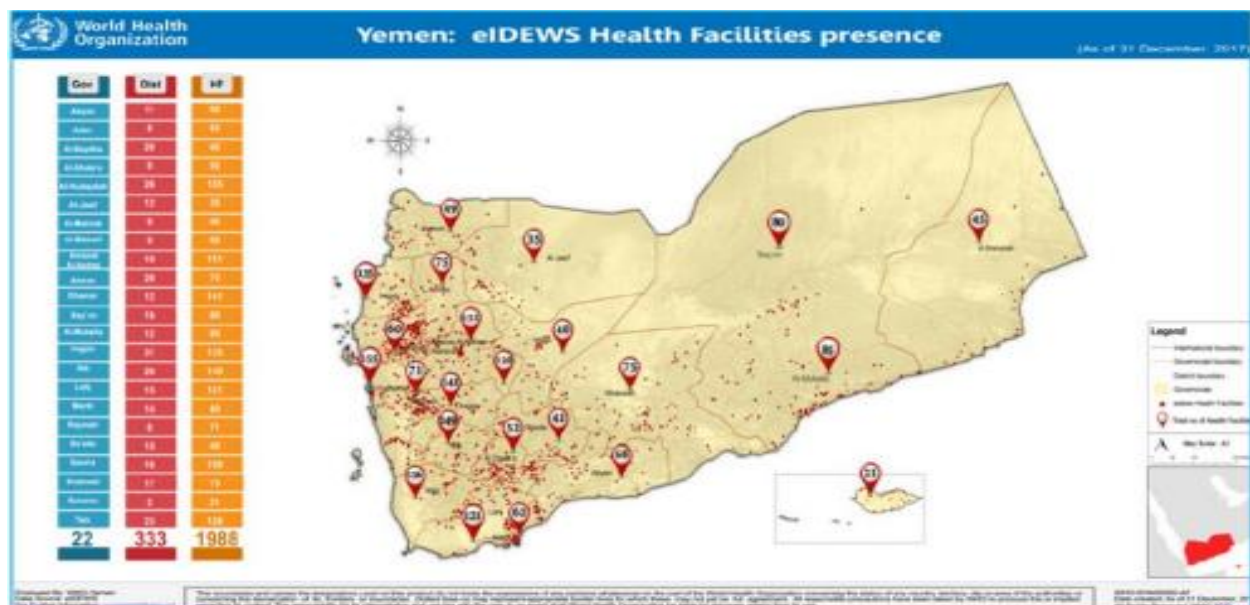


Figure 8: Coverage of eIDEWS reporting system in Yemen

Figure 6. The geographical Malaria Risk Mapping, source MCP 2018.

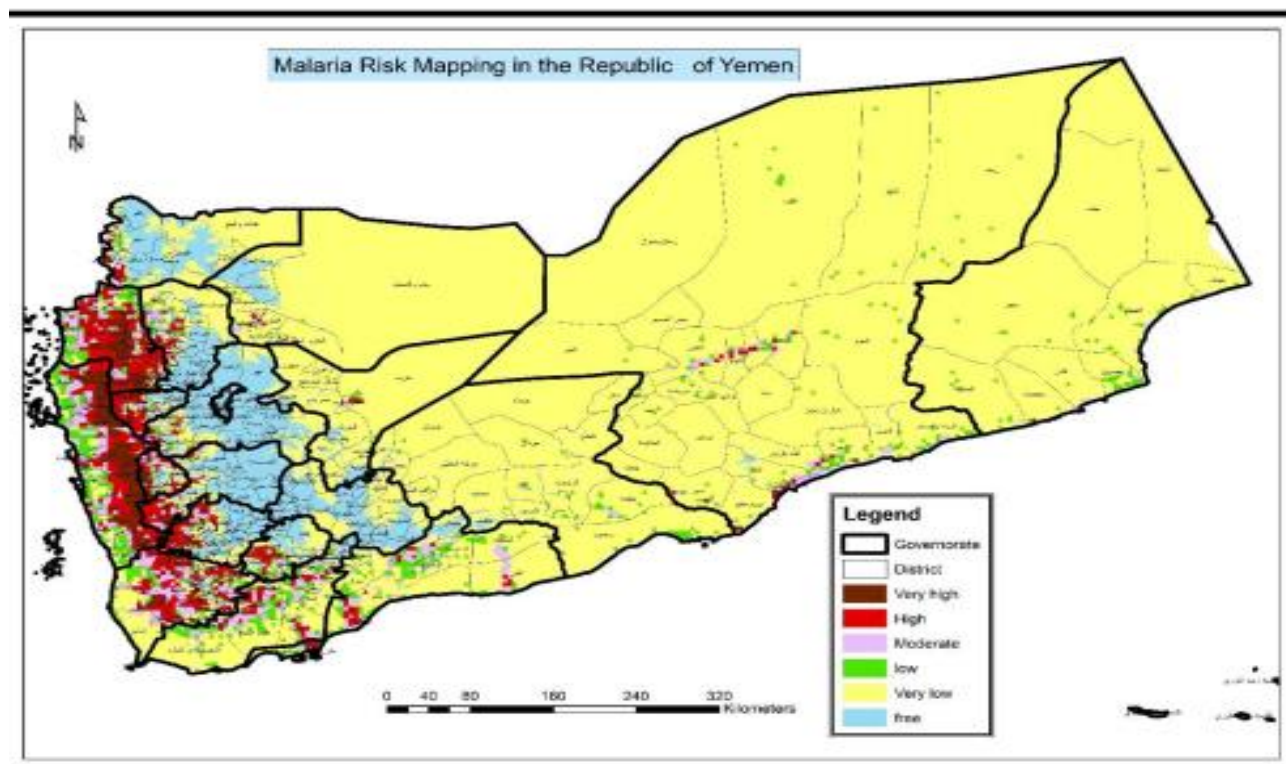


Figure 7: The Feasibility Intervention Framework CCMm.

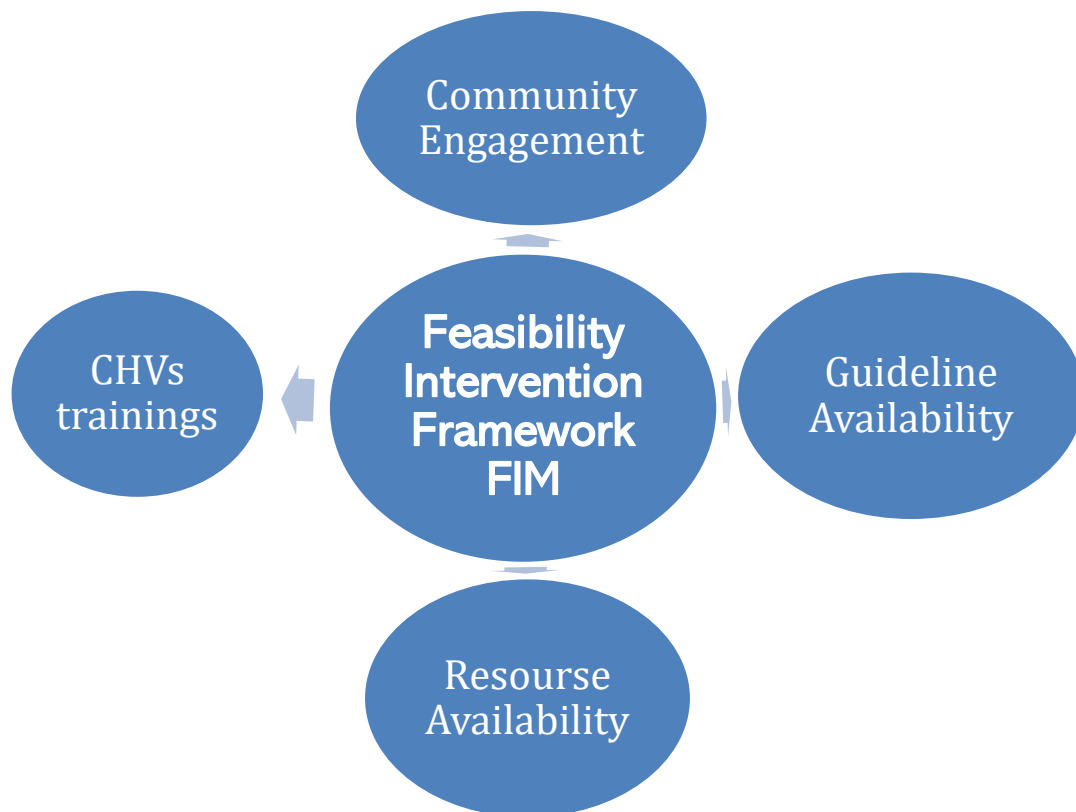
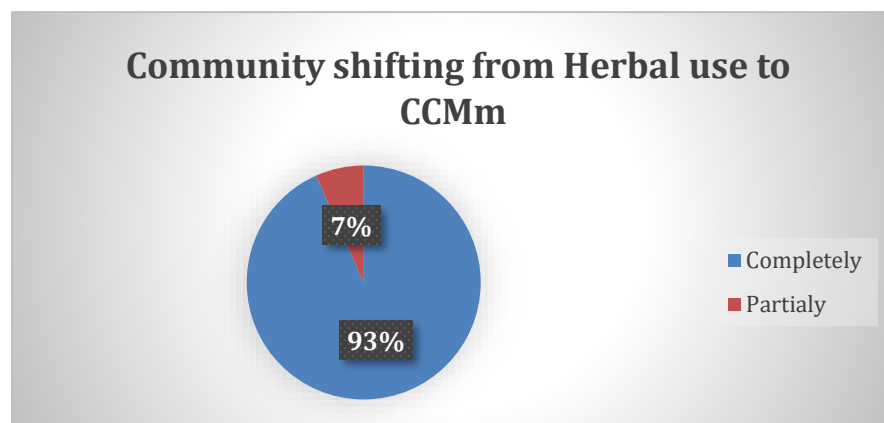


Figure 9: The indicators of Community Case Management of Malaria from Malaria Control Program.

Indicators	2020	2021	2022	2023
No of CHVs	175	325	425	425
Suspected Malaria cases	6593	13548	18965	15350
Tested Malaria Cases	6593	13544	18965	15033
Postive Malaria Cases	61	429	840	408
referred cases by CHW (Under 5 or pregnant women)	0	0	0	0
severe Malaria cases	0	0	0	0
training conducted to CHW	150 CHVs	100 CHVs	Biannual meeting	Biannual meeting
Male Postive	-	-	344	156
Female Postive	-	-	496	252
<5 Postive	-	-	140	103
>5 Postive	-	-	700	305
positive cases treated with ACT	61	429	840	408
ACT & RDT stock out	0	0	0	0
Mortality cases	0	0	0	0
RDT distributed to CHW	-	-	-	-
RDT Used / Expired	-	-	-	-

Figure 10: Pie chart showing the attitude of the community.





Date: 23rd January 2024

Research and Ethics Committee

To: Dr. Ameera Zain Ba-Fadhel

Dear Dr. Ameera,

We are pleased to inform you that the Research and Ethics Committee had granted you the approval to carry out the research project:

Research Title: "Assessing the Effectiveness of Implementing the Integrated Community Case Management in Malaria Control Program, Yemen"

Research Code: REC-184-2024.

With reference to the above, the Research and Ethics Committee have approved the research proposal and found it in compliance with the International Conference of Harmonization (ICH) – Good Clinical Practice Guidelines. Please submit your Final Report upon completion of the research to the Research and Ethics Committee Secretariat.

Sincerely yours,



Prof. Dr. Iman Ali Ba-Saddik, PhD
Vice Dean for Postgraduate Studies and Scientific Research
Faculty of Medicine and Health Sciences
University of Aden, Yemen
Phone: 00967 2 231767/ 232997
Mobile: 00967 7777232997
Email: iman.ali.med@aden-univ.net
imanmakki@gmail.com

كلية الطب و العلوم الصحية - جامعة عدن - ص.ب: 878 كريتير - عدن - الجمهورية اليمنية

تلفون 236625 / 231763 - فاكس 236621

Faculty of Medicine & Health Sciences. P.O. Box :878 Crater – Aden – Yemen

Tel + 967 2 236625 / 231763 , Fax + 967 2 236621

www.adenmedicalfaculty.com Email: info@adenmedicalfaculty.com