2023

CAPSTONE PROJECT

Examination of Malaria prevalence and prevention strategies under NVBDCP: A Case Study of Community Health Centre Govindgarh, Rajasthan

NILANJAN BHOR

MPHIS – 1 COHORT
INSTITUTE OF HEALTH MANAGEMENT RESEARCH

10 June 2023

Acknowledgments

I acknowledge the advice and guidance received from my advisor Dr. Seema Mehta. I would like to thank her providing her valuable time for reviewing my project report and providing approval.

I also would like to than Dr. Vinod Kumar for providing overall guidance and train me in understanding the tools.

I also would like to thank support and guidance at the field received from Mr. Haider Ali and facilitating the observation and data collection during my four days of field visit to the Community Health Centre Govindgarh, Rajasthan.

Table of Contents

1. Background

In 2003-04, the Vector Borne Diseases Control Program (Kishore, 2020) was implemented by merging National Anti-Malaria Control Programme (NAMP), National Filaria Control Programme and Kala Azar Control Programmes. The NAMP Directorate was nodal for the prevention and control of major Vector Borne Diseases. The National Malaria Eradication Program was being implemented in 1958, then reviewed in 1977 and revised guidelines for Modified Plan of Operation were issued to all States and Union Territories (UTs). Afterwards, occurrences of outbreaks in India, malaria situation was assessed in 1994 and an operation manual for Malaria Action Programme was brought out in 1995. By converging Dengue/Dengue Haemorrhagic fever and Japanese Encephalitis with the three on-going programs, an integrated scheme was developed and named as National Vector Borne Disease Control Program (NVBDCP) from December 2003. Emergence of Chikungunya in 2006 brought it under the umbrella of NVBDCP. The NVBDCP is an integral component of and implemented under National Health Mission.

Box. 1

Six Vector Borne Diseases

under the Umbrella of NVBDCP

Malaria

Dengue

Chikungunya

Japanese Encephalitis

Kala-Azar

Lymphatic Filariasis

Vision of NVBDCP: A well informed and self-sustained healthy India free from Vector Borne Diseases with equitable access to quality healthcare.

Mission of NVBDCP: An integrated and accelerated action towards reducing mortality on account of malaria, dengue and Japanese encephalitis by half and elimination of Kala-Azar by 2010 and elimination of Lymphatic Filariasis by 2015.

Strategies for prevention and control are (i) Disease management (ii) Integrated vector management (IVM) (iii) Mass Drug Administration annually only for lymphatic filariasis (iv) Vaccination: for Japanese Encephalitis and (v) Supporting interventions include behaviour change communication (BCC), intersectoral convergence, human resource development, public-private partnership, operational research, monitoring, and evaluation.

1.1 Malaria and its related program

India has started working on reducing the burden of Malaria from 1953, and programme strategies were revised many times based on the expert committee recommendations based on reviewing the malaria situation in the country and other social consequences like urbanization and population growth.

1.1.1 National Strategic Plan (NSP) for Malaria (2017 – 2022)

Vision: The NSP 2017-2022 focuses on strategic policies to provide universal intervention package, paving the way for malaria elimination by 2030.

Goal:

- Eliminate malaria by 2022 in all districts of 22 states/UTs of existing category 1 & 2, and in districts having API<1 of category 3 states.
- All remaining districts (having API>2) to be brought into elimination & pre-elimination phase.
- Maintain malaria free status in areas where malaria transmission has been interrupted and prevent reintroduction of malaria by strengthening surveillance.

Objectives: The overall objective is to consolidate the achievements of the previous NSP 2012-2017 and sustain its impacts. Specific objectives are,

- Achieve universal coverage of case detection and treatment services in endemic districts to ensure 100% parasitological diagnosis of all malaria cases, and complete treatment of all confirmed cases.
- Strengthen surveillance system to detect, notify, investigate, classify, and respond to all cases.
- Near universal coverage of population at risk of malaria, by appropriate vector control intervention and by appropriate BCC activities.
- Effective program management and coordination at all levels to deliver a combination of targeted interventions for malaria elimination.

Strategies:

(i) Surveillance

Surveillance monitors malaria incidence trends and geographical distribution, and aim to target control interventions to high transmission areas and assessing their impact. It also helps in early detection of outbreaks.

Box. 2

The broader strategies adapted by the NSP:

- Surveillance and epidemic response
- Diagnosis and case management
- Prevention by IVM
- Cross cutting interventions

Active case detection, a type of surveillance, is carried out by multi-purpose health workers (MPW, male) during fort-nightly home visits under primary healthcare system, mainly to avoid large number of secondary visits considering the incubation period and interval. The activities conducted includes, (i)

identification of fever cases or who had fever (ii) collection of blood smear from such cases, and (iii) providing treatment through appropriate anti-malarial.

Passive case detection (PCD) is carried out at the dispensaries, by screening and giving presumptive treatment to the fever cases attending the hospital. It is also carried out at the local level by local volunteers/ anganwadi workers or private practitioners. A mapping of private clinics, that could function as a PCD centre, has been conducted by the District Malaria Officer and supported by the PHC staff.

(ii) Epidemic response

In coordination with Integrated Disease Surveillance Program (IDSP) and rapid response team in each district, the program established an early warning system for detection of malaria epidemic. The early warning signals communicated to Medical Officer (MO) at PHC to be attentive to the fever trends on weekly basis. A consolidate report of weekly fever trends are also brought out by the IDSP. On confirmation of an outbreak, Chief Medical Officer/ District Vector Borne Disease Consultant/ District Malaria Officer ensure all measures related to preparedness and control of outbreak/epidemic in the district. The following actions required to be taken.

a) At preparatory phase, conducting rapid fever survey, formation of rapid response team in collaboration with IDSP to support outbreak investigation, and providing technical support, and logistics management of materials, equipment, diagnostics and medicines.
b) Control of the malaria epidemic is carried out by defining the area and estimating of the population involved and measuring for the liquidation of the foci.
c) Follow up actions is carried out by continued surveillance and strengthening case detection and treatment services.

(iii) Diagnosis and case management

Early diagnosis and management of malaria cases is done systematically following the prescribed guidelines. The guideline documented three ways to diagnose and malaria case management: those are, (1) availability of microscopy result within 24 hours (2) non-availability of microscopy result within 24 hours and monovalent RDT is used, and (3) non-availability of microscopy result within 24 hours and bivalent RDT is used. The systematic procedure for where microscopy result is available within 24 hours is described (given the study CHC has similar feature). The procedure listed step by step activities to be done, are as follows.

Step 1: Once the suspected malaria case is identified, blood smear must be collected using slide and must be sent for microscopic examination.

Step 2: Result of the microscopic examination

Step 3: Treatment

1) Given the result is positive for vivax, prescribe CQ 3days + PQ0.25 mg per kg body weight daily for 14 days.
2) Given the result is positive for falciparum, prescribe ACT-SP for 3 days + PQ single dose on second day.
3) Given the result is positive for mixed infection, prescribe ACT-SP 3 days + Primaquine 0.25 mg per kg body weight daily for 14 days.

(iv) Integrated vector management (IVM)

The measures for vector control and protection includes ITN/LLIN, IRS in selected high-risk areas, space spray, biological control using larvivorous fish, larvicides, larval source management, and effective entomological surveillance.

(5) Cross cutting interventions include advocacy, communication, and community mobilization, program management and coordination, monitoring and evaluation, research & development.

2. Organization of services and Key Tasks

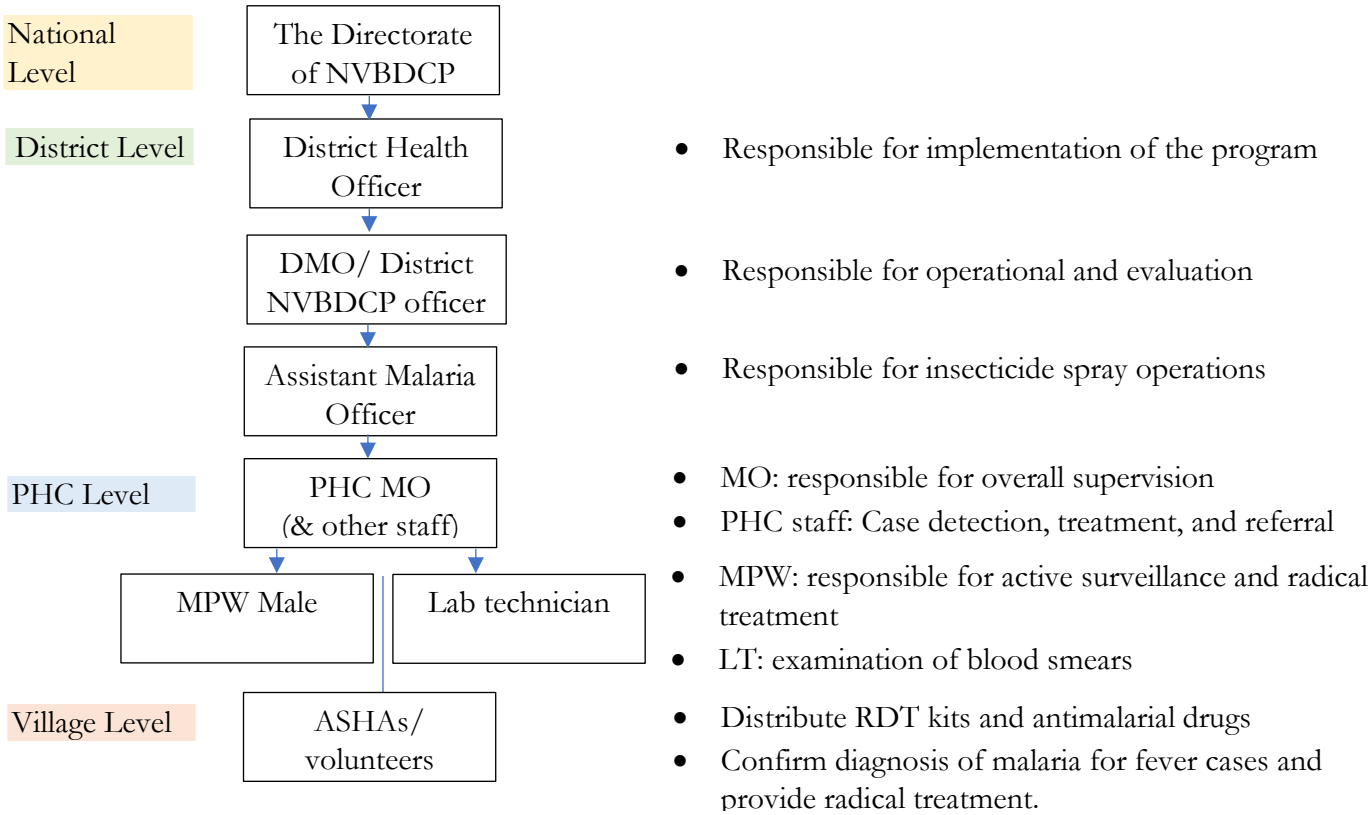

Figure [1] Organization of services

Source: Kishore (2020)

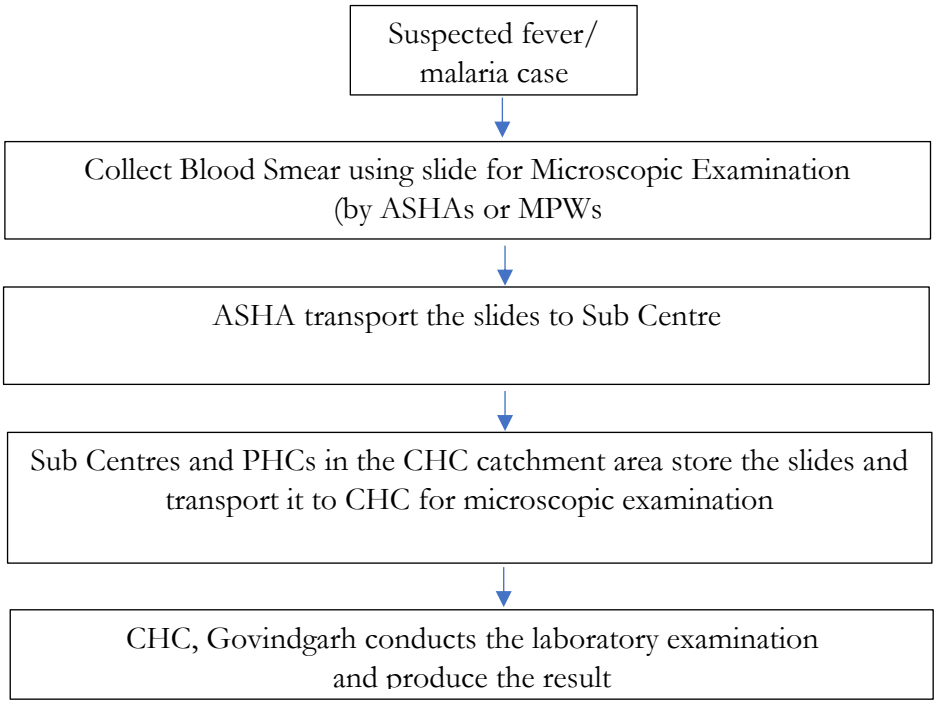

Figure [2] Diagrammatic representation of the malaria program design and service delivery with linkages to all stakeholders in CHC and its catchment area

3. Objectives of the Capstone Project

The capstone work area selected is National Vector Borne Disease Control Program with focus on Malaria prevalence and prevention strategies implementation in Government community health centre in the state of Rajasthan. The objectives of the project were-

(i) To examine the malaria prevalence and related service delivery statistics from 2020 to 2022 in the catchment area of Community Health Centre, Govindgarh, Rajasthan

(ii) To find the prevention strategies at present functional in the catchment area of CHC Govindgarh, Rajasthan

(iii) To identify enablers and problems in implementing the prevention strategies in the catchment area of CHC Govindgarh, Rajasthan

(iv) To suggest actions for prioritize problems in implementing the prevention strategies in the catchment area of CHC Govindgarh, Rajasthan

4. Methodology

4.1 Setting

The site of the capstone was the Government Community Health Center (CHC), Govindgarh, a rural block of Jaipur district of Rajasthan, and the Dhoblai sub-center (currently upgraded to health & wellness centre) in its catchment area. The CHC has total 5 sub-centres in its catchment area: (i) Dhoblai sub-center (currently upgraded to health & wellness centre) (ii) Malikpur health & Wellness centre (iii) Narsingpura Health & Wellness Centre (iv) Shyaoo Sub-Centre (v) Kannipura Sub-Centre and (vi) Sitarampura Sub-Centre.

4.2 Study design

The study design used for the project was mixed method. Quantitative and qualitative data was collected for the study. The data was collected using pre-designed checklist and interview guide. Quantitative data is collected on services related to Malaria and Dengue using defined indicators of mortality, morbidity, and diagnosis. Qualitative data is collected through review of literature, in-depth interviews and observations from participants are focused on understanding about the program, their roles and responsibilities in the program, and challenges faced in executing the services. Observation was made using the pre-defined indicators in the observation checklist, and covered areas of doctor's room in the out-patient area, IEC materials displayed in the out-patient waiting area, laboratory, and pharmacy.

4.3 Participants

Total 3 in-depth interviews are conducted. Data was collected from 1 medical officer (program in-charge) at CHC, 2 Auxiliary Nurse Midwife (ANM) [1 at CHC and 1 at SC], and 1 Accredited Social Health Activists (ASHAs) at SC.

4.4 Ethical guidelines

Ethical approval from Institutional Review Board was not obtained. Permission was obtained from the in-charge of the National Health Mission, Rajasthan and the CHC Govindgarh which was selected for the capstone project. For data collection, informed consent was obtained from the participants recruited for in-depth interviews.

4.5 Data Collection - Field visit

A total 4 visits have been made to the Community Health Center, Govindgarh. I was accompanied with a team consisting of five members (including me).

On the very first day, after an introductory discussion with the MO in-charge of NVBDCP, observations were performed in and around the CHC. Then we have been directed by the MO to the laboratory. In the laboratory, the team was interacted with the lab in-charge and lab assistant, made observations in the

lab and reviewed lab registers related to malaria and dengue. After that a CHO was appointed by the MO to coordinate our visit to a nearest sub-centre (Dhoblai Sub-Center) to observe the Maternal and Child Health Day. In the sub-centre, the team interacted with the CHO, ANM and one ASHA. Observations were made in and around the sub-centre, and specifically stock of medicines, kits, and collection of blood smear from patient and its storage. Interview with the ANM and ASHA was also conducted. The overall service statistics (data from laboratory) related to malaria and dengue is collected by using a pre-designed format containing specific indicators from the MO in-charge. Overall, it was an introductory visit.

In our second visit, the team has encountered doctor's strike due to the Right to Health Bill, and the CHC was functional with only one emergency paediatric doctor, which affected and reduced patients visit to the hospital. This situation affected the execution of the plan for the day. To continue our observation, the team has initiated assessment and clarifications of the service statistics collected in the last visit with the lab in-charge and lab assistant and requested to provide the statistics from HMIS. The team has also conducted observation and organization of services in the lab, OPD and in pharmacy.

In our last visit, the team has conducted interview with the doctor (in-charge of the program), and an ANM. We have also collected the HMIS statistics. A repeat visit was conducted to complete the doctor's interview.

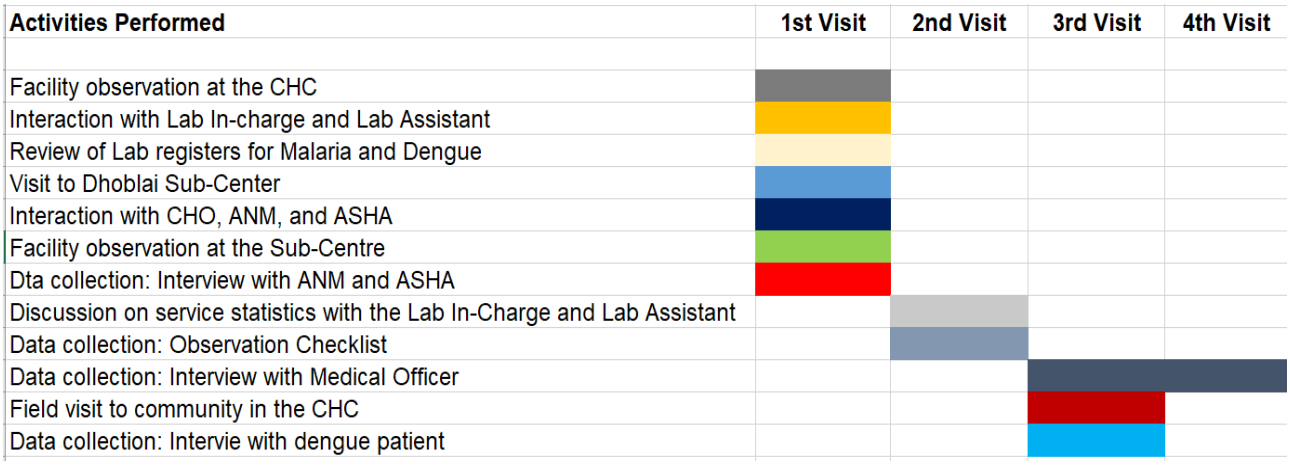

Figure [3] Gantt Chart showing day wise activities performed during visit to the CHC Govindgarh

5. Findings:

5.1 Malaria prevalence in India and Rajasthan

According to the MoHFW (2020), in 2019, there was incidence of Malaria in 31 states/UTs: those are, Andhra Pradesh, Arunachal Pradesh, Assam, Chhattisgarh, Goa, Gujarat, Haryana, Himachal Pradesh,

Jammu & Kashmir, Jharkhand, Karnataka, Kerala, Madhya Pradesh, Manipur, Mizoram, Nagaland, Odisha, Punjab, Rajasthan, Sikkim, Tamil Nadu, Telangana, Tripura Uttar Pradesh, Uttarakhand, West Bengal, Pudducherry, Chandigarh, Daman & Diu, D&N Haveli and Lakshadweep.

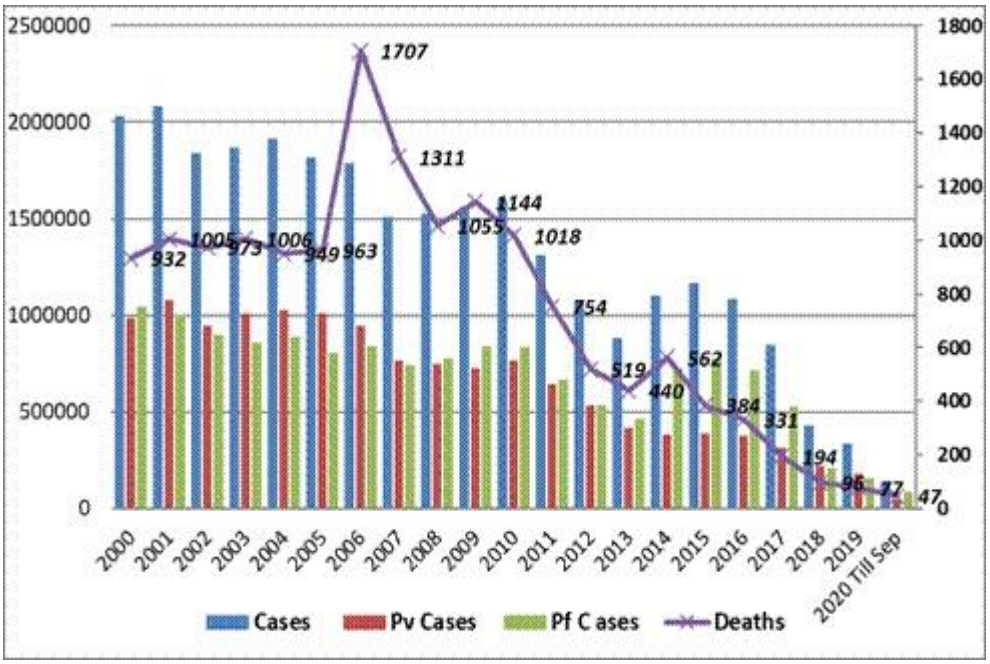

Figure [4] Malaria trend in India (2000-2019) Pv-Plasmodium Vivax & pf-Plasmodium Falciparum

Source: World Malaria Report 2020

In February 2019, the number of malaria and dengue cases were high, about 782 malaria cases and 555 dengue cases since between January and August, in Rajasthan compared to the other states in India (Kalra, 2020). To control the rise in malaria and dengue in the state, the Government of Rajasthan has taken the following steps (Kalra, 2020).

- Establishing control rooms
- Formation of rapid response teams
- Provision of free blood tests
- Carrying out anti-larval activities
- House-to-house surveys
- Fogging

Further, as per the data of the NVBDCP, there was a significant decrease in malaria cases from 54 thousand to less than thousand, and reduced deaths from 45 to nil between 2011 to 2021 in Rajasthan. (MoHFW, 2021) Overall, it was observed a significant decline in malaria cases in India especially in high endemic states. There were about 40% decline in malaria cases in Odisha between 2018 and 2019.

Similarly, other states such as Meghalaya experienced 59.10%, Jharkhand 34.96%, Madhya Pradesh 36.50% and Chhattisgarh 23.20%. (MoHFW, 2020) A significant decline was gained due to the implementation of WHO's the High Burden to High Impact (HBHI) initiative in 2018: overall cases reduced by 18% and death reduced by 20% respectively, in last 2 years. (MoHFW, 2020)

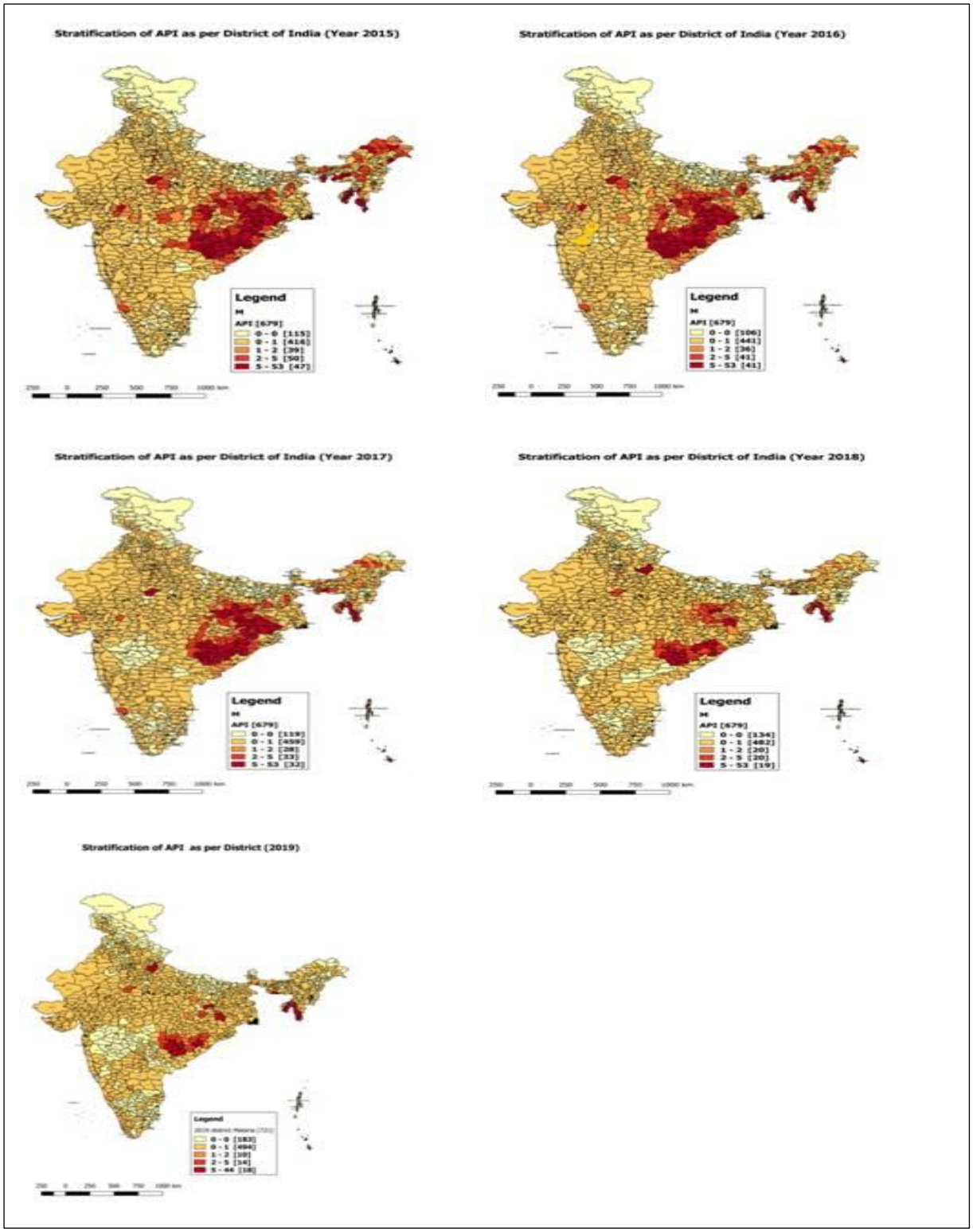

Figure [5] Shrinking malaria endemicity (District level) from 2015 to 2019

Source: World Malaria Report 2020

The malaria situation was almost unchanged between 2020 to 2022 in Rajasthan, as shown in table 1. Positive cases reported 0.01% of which 10% were Plasmodium Falciparam (Pf) cases and the rest 90% were Plasmodium Vivax (Pv) cases, and no death cases were reported during this period. These reported cases and deaths were much lower than the national average.

Table [1] Malaria cases in Rajasthan (2020-2022)

Year	State/ Country	Blood Slide Examination	Positive Cases %	PF Cases	PF%	Slide Positivity Rate %	Slide Falciparum Rate	Deaths
2020	Rajasthan	4778346	0.02	106	10.1	0.02	0	0
2020	**India**	**90951598**	0.20	**115142**	**63.32**	**0.2**	**0.13**	**63**
2021	Rajasthan	6632314	0.01	119	12.86	0.01	0	0
2021	**India**	**114391977**	0.14	**101566**	**62.79**	**0.14**	**0.09**	**90**
2022	Rajasthan	10250383	0.01	104	10.14	0.01	0	0
2022	**India**	**139672021**	0.12	**99849**	**57.39**	**0.12**	**0.07**	**64**

Source: Ministry of Health & Family Welfare, Government of India

5.1.1 Diagnostic test statistics at the CHC Govindgarh, Rajasthan

Table A1 shows year-wise statistics of Malaria prevalence and related services between 2020 to 2022 collected from CHC Govindgarh. The statistics likely reveal a similar pattern of malaria morbidity and mortality with the state-level statistics (as shown in table 2). The pattern emerges from the CHC service statistics is explained below.

(i) The testing of blood smear examination is increased by 2476 tests between 2020 and 2022. Blood smear examination in 2020 and 2021 could have been affected, as reported by CHC, due to the pandemic. But, of total 4636 blood examinations conducted in 2022, zero number of Pv and Pf cases is unsatisfactory, indicate error in data reporting.

(ii) RDT conducted for malaria is much lesser than the blood smear examination performed. Though conducting RDT for malaria increased between 2020 and 2021, a drastic decrease in number of Pv cases have been reported in 2022 compared to 2020 and 2021. Only two cases of 19 RDTs conducted have been reported in 2022 compared to 16 cases of 202 RDTs conducted in 2021. The reason for the decrease in using RDT for malaria was, as said by the doctor-in-charge of the program at CHC during the time of interview, "increased number of *microscopies is conducted during the outbreak mostly between July to October. Other times RDTs are used, or else fever cases are kept under observation. If not cured within 3 days of observation, microscopy is mostly preferred for diagnosis. There are very less number of fever cases have been reported during December to June,*

so the use of RDTs deresed." But a high number of RDTs are used for dengue diagnosis during the same period.

(iii) Almost all malaria positive cases have been treated as out-patient, and no death cases were reported between 2020 to 2022.

5.2 Malaria prevention strategies

National Malaria Control Strategy documented five strategies for Malaria prevention as depicted in figure 6. Those are: surveillance, intensified vector management, supportive intervention, environmental management and source reduction, and program monitoring & evaluation.

Figure [6]. Malaria Prevention Strategies

Further analysis is being conducted to review the program services by considering the malaria prevention strategies.

5.2.1 Surveillance system in the CHC and its catchment area

At CHC Govindgarh, data is being reported through the surveillance system. Malaria surveillance is a core intervention (Fountain et.al. 2022) to control and eliminate the spread of malaria as emphasized in the WHO Global Technical Strategy for Malaria 2016–2030. Early case detection & treatment is important to reduce the spread of malaria in the community.

The activities conducted for the early case detection are;

(i) Fortnightly domiciliary visits: Given the shortage of MPWs, ASHAs made fortnightly house to house visit. Whereas in the National Malaria Control Strategy, MPWs (male) is assigned with this task. The three main tasks conducted by ASHAs during the visit are: (a) detection of fever/symptomatic to fever cases (b) collection of blood smear from those identified cases and (c) administration of appropriate anti-malarial drugs.

(ii) Rapid fever survey: It is done by house-to-house visit during malaria outbreak in the suspected epidemic areas. A similar activity is conducted like domiciliary visits.

(iii) Passive case detection: Malaria clinics are established in the hospitals for the fever cases, they are screened, and given presumptive treatment if diagnosed with malaria. Fever treatment depots were not established in the community.

(iv) Blood smear collection: A timely collection of blood smear from the symptomatic cases and its examination are very essential. In CHC, during surveillance and epidemic outbreak, laboratory data especially the result of the microscopic investigation is considered for estimating the incidence of malaria.

In addition to early detection, surveillance also strengthen the referral system, and especially in case of outbreak, a rapid response team is formed to respond to the outbreak. The malaria surveillance system followed by the CHC and its catchment area is depicted in figure 7.

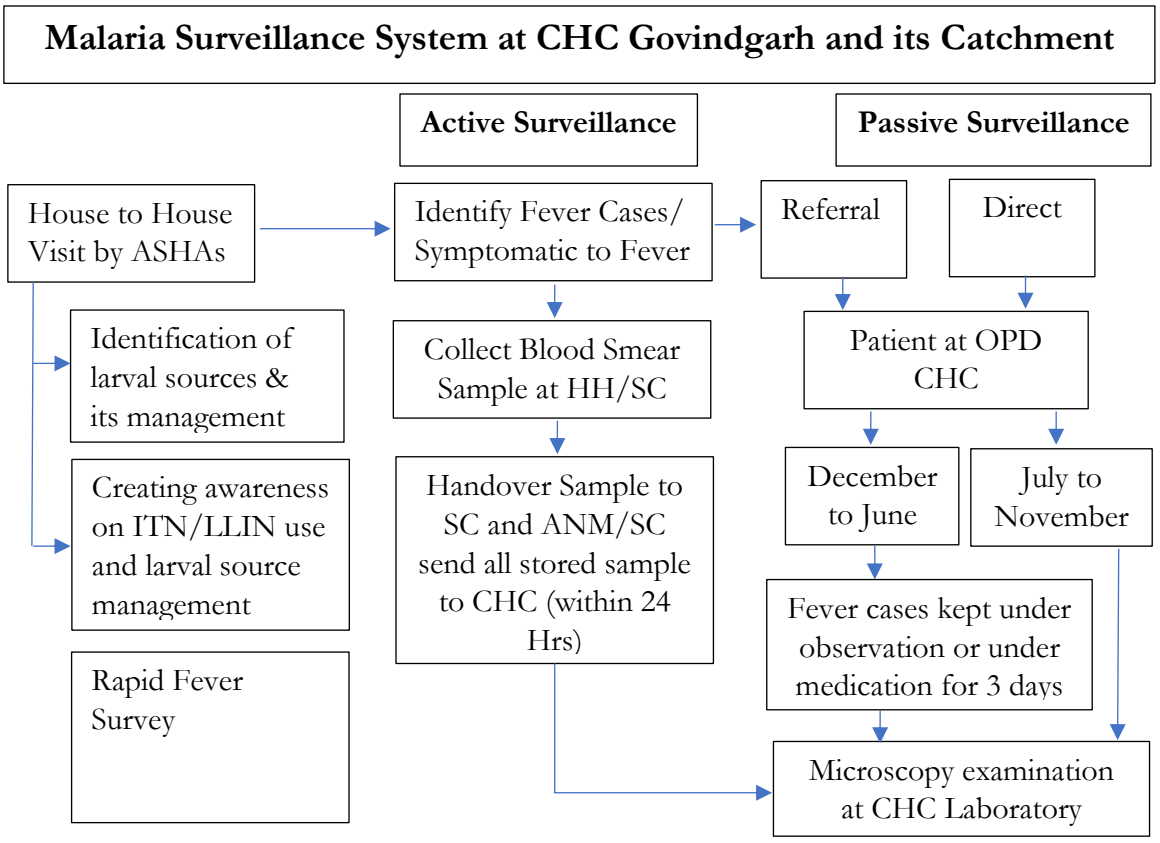

Figure [7] Malaria Surveillance system at CHC Govindgarh and its catchment area

5.2.2 Resource availability in the CHC OPD, Laboratory and Pharmacy

To successfully carryout the surveillance, it is important to assess availability of services and resources at the CHC to deliver malaria services. The services and resources available at OPD, Laboratory and Pharmacy are assessed and analysis of those indicators are described below (refer table A2).

(i) OPD services

The OPD at the CHC has eight doctor's room. All fever cases are consulted in the OPD. There is no Malaria-specific clinic (during the assessment probably due to the time was non-seasonal). There was no recording or reporting of the fever cases are done in the patient records by the doctors. While fever patients visit the OPD, doctor consulted the patients and prescribe medicines as observed during the assessment. During seasonal months (July to November), if the fever patients are undergone microscopy, then the fever cases are recorded in the lab register including the result of the microscopy. This may be because doctors are unaware or not following treatment guidelines. Treatment guidelines are also not displayed in the doctor's room. But there is provision of thermometer with the doctor which is used to measure temperature of the fever patients. During the assessment, it was observed that temperature is being measured only for the children and not adults. There is one poster for malaria is hanged on the wall of waiting room of the OPD.

(ii) Laboratory services

The patients are reported in the lab for undergoing microscopy. Blood smear is being collected using glass slides. Then the slides are prepared for the blood microscopy for malaria using reagents, lancets etc. Microscope is available in the lab but as opined by the lab technician during the assessment "*the microscope is too old but it is functional. There is only 1 microscope which has load of approximatelt 20 patients per day*". Further lab report generation is also delayed which increases waiting time or patients has to visit the next day for the lab report and consultation for diagnosis. OPD sample reports are generated within 6 hours and field samples takes about 12 hours. In case of field samples, the quality of the sample may be questionable as the sample is stored and sent from the sub-center within 24 hours to the CHC laboratory, and then again it takes about 2 to 3 hours to conduct the microscopy. Alternatively, benevolent RDTs (for both Pf and Pv cases) are also being used for the malaria diagnosis and there are stocks available.

Further, the assessment showed that the lab personnel are available during OPD hours and trained on the NVBDCP and laboratory guidelines.

(iii) Pharmacy Services

The fever patients diagnosed with malaria are treated in the OPD, and mostly treated with the chloroquine tablets prescribed for 14 days. In addition, artesunate combination therapy and quinine injection are also used for the treatment.

5.2.3 Intensified Vector Management (IVM)

The IVM strategies are used for the Malaria prevention in the CHC is displayed in table [ ]. During the interview ASHA said that she has not conducted any biological control. In addition, she has also mentioned about chemical control measures such as spray have been performed by her but she couldn't able to explain how and when she has carried out those measures. In terms of personal protection, she has mentioned about creating awareness on personal protective clothing, usage of ITNs/LLINs, mats, coils etc.

IVM Strategies	Performance
Chemical control	
Indoor Residual Spray (IRS)	Yes conducted
Use of chemical larvicides	Yes conducted
Aerosol space spray during daytime	Yes conducted
Malathion fogging during outbreaks	Yes conducted
Biological control	
Use of larvivorous fish in ornamental tanks, fountains etc.	Not conducted
Use of biocides	Not conducted
Personal prophylactic measures	
Use of mosquito repellent creams, coils, mats etc.	Awareness created during house visits
Screening of the houses with wire mesh	Not conducted
Use of bed nets treated with insecticide	Awareness created during hose visits
Wearing clothes that cover maximum surface of the body	Awareness created during hose visits

5.2.4 Supporting interventions

The supporting intervention strategies are used for the Malaria prevention in the CHC is displayed in below table.

Supporting intervention strategies	
Community participation by sensitizing and involving community for detection of anopheles breeding places, and their elimination	Not conducted

5.2.5 Environmental management and source reduction

The environmental management and source reduction strategies are used for the Malaria prevention in the CHC is displayed in below table. The activities carried out by ASHA for source reductions are, as said by ASHA during the interview, "*I create awareness on improved water storage facility such as for drinking water, water tanks, wells, solid waste disposal, and other mosquito breeding places related to drainage system, which facilitates breeding place for mosquitos.*"

Environmental management and source reduction strategies	
Filling up of the breeding places	Yes conducted
Proper covering of stored water	Yes, create awareness during house visit
Channelization of breeding source	Not conducted

5.2.6 Monitoring & evaluation (M&E)

The M&E strategies are used for the Malaria prevention in the CHC is displayed in below table.

Monitoring & evaluation strategies	
Monthly Computerized management information system	Yes conducted
Field visits by state/national program officers	Yes conducted

6. Enablers & problems in malaria prevention program implementation at CHC Govindgarh, Rajasthan

The following priority enablers (refer table A3) found fundamental in strengthening the NVBDCP program and malaria prevention.

(i) Integrated intervention for Malaria, Dengue and other vector borne diseases

Integrating all six diseases under the umbrella of one program was found beneficial by the healthcare providers involved in the NVBDCP program. The doctor in-charge said during the interview "*integration made it cost-effective, and smoothen logistics and effective allocation of resources and its management in my*

hospital [at CHC]." ASHA said "*it reduces our work burden somewhat, but still, I have to manage many other program responsibilities."* ANM said "*it is a good initiate by the government."*

(ii) Active involvement by the gram panchayat

The front-line workers of the Dhoblai Sub-Center has active interaction with the gram panchayat. The bottlenecks in the prevention strategies identified by the ASHAs, ANM or Community Health Officer during field visit are being reported to the gram panchayat to act. The ASHAs, ANM or Community Health Officer said during the interview "*all problems we get like potholes in the road, water logging, unhygienic environment in the villages, we report to panchayat and it is being discussed in the monthly meeting, and actions are taken."*

(iii) Rapid fever survey

Rapid fever survey is conducted for early detection of symptomatic cases especially during the outbreak. The doctor in-charge claimed during the interview that smaller number of malaria cases in the CHC catchment is especially due to the effective implementation of the rapid fever survey. The doctor said "*rapid fever survey is very beneficial in early detection and good intervention for malaria surveillance."* Doctor also added "*this survey especially carried out during outbreak, but it was continued due to the COVID-19 pandemic since 2020."*

(iv) Availability of laboratory facility at CHC

As observed during field visit, laboratory facility available at the CHC and equipped with adequate infrastructure, equipment, stock of diagnostics, and lab specialists. Doctor in-charge said during the interview, "*Though it is not much spacious, we have good lab infrastructure, materials and equipment, but still it needs to be strengthened. There is huge load on the laboratory as all testing of the patients visit OPD and samples from the field are being tested here."*

(v) Good leadership by the rapid response team

Every year before the outbreak since 2020, a rapid response team is formed to effectively respond to the outbreak at the district level. The technical support provided by the team to the district level monitoring team led to prevent and control the disease at CHC catchment area. While asked doctor in-charge about the composition of the rapid response team, replied "*This is a 5 to 6 member team. Our deputy chief medical officer (MOH) and divisional CMOHs are part of the team. In addition, there are physician and microbiologists/pathologists from district hospital."*

7. Problems in Malaria prevention strategies implementation at CHC and its catchment area

The problems as emerged in-depth discussion were listed (refer table A4), that are hindering the program service delivery, are as follows.

(i) Availability of quality data/no documentation of data/unreported-underreported data
(ii) Less community involvement
(iii) Less attention to the NVBDCP program henceforth inadequate number/no MPWs for surveillance led to ASHAs burdensome
(iv) Few vector borne disease prevention training for doctors, ASHAs, and ANMs regarding their responsibility under the NVBDCP program

7.1 Suggestive actions

For proposing actions, identified problem areas were prioritized **using feasibility and priority matrix. Each** action area is prioritized based on pre-designed criteria. The criteria used to label feasible and priority actions is described below.

(i) **Criteria used to identify feasible actions**

The feasibility grades are categorized into 3 categories, and the definition followed to categorize the feasibility is: (1) Category 1-Swift: Readily doable in terms of financial and field implementation and possible to execute in less than a year. (2) Category 2-Challenging: Doable but expected to require serious efforts and support from Stakeholders. (3) Category 3-Difficult: Perceived difficulty in approvals /funding, may require sustained advocacy for convincing the Key Stakeholders / Government and may require a long time to implement.

(ii) **Criteria used for prioritization of actions**

The prioritization of the actions was done by the following colour coding: (1) Red (Top Priority) for those which are expected to be more effective in removing the bottlenecks even if they are Challenging. (2) Yellow colour (Intermediate Priority) depicts those which should be taken up and are considered to improve the functioning although to a lesser extent than the grey ones. (3) Grey (Low Priority) which the group considers will take lot of efforts and /or yield minimal results.

Table 2 shows the listing of the problems, suggestive actions for those problems and an assessment of the feasibility and prioritization of the actions.

Table [2] Identification of feasible and priority actions using feasibility and priority matrix

Problems	Suggestive Actions	Feasibility	Priority
Inaccuracy in data recording and reporting from lab report to HMIS (and under-reporting of cases)	Periodic monitoring of the data reported to HMIS	Swift	Top priority
	Auditing of the data reported to HMIS	Difficult	Intermediate priority
No/less involvement of community in detection of mosquitos, and their elimination	Awareness creation on malaria prevention in the community by service providers (through house visits, miking, celebrating health days etc.)	Swift	Top priority
	Create and engage community volunteers	Challenging	Top priority
Inadequate number/ no MPWs for surveillance led to ASHAs burdensome	Filling up of the vacant MPW posts	Difficult	Intermediate priority
	Filling up of the vacant ASHA posts	Difficult	Intermediate priority
No documentation/ records of the prevention strategies executed in past years (less importance to prevention)	Creating indicators of specific prevention strategies/activities in HMIS	Swift	Top priority
	Evaluation of the intervention strategies implemented	Swift	Low priority
	Establishing Standard Operating Procedures (SOPs) for prevention	Swift	Top priority
Lack of training of doctors, ASHAs, and ANMs regarding their responsibility under the NVBDCP program	Conducting periodic training	Swift	Intermediate priority
	Effective supervision	Swift	Top priority

8. Recommendation for actions

The analysis identified 7 actions, of total 11, that could be addressed immediately as it is readily doable and possible to execute within 2 years: those actions are (i) HMIS data monitoring (ii) awareness creation for malaria prevention (iii) inclusion of prevention specific indicators in HMIS (iv) evaluation of intervention strategies (v) establishing SOPs for prevention (vi) conducting periodic training and (vii) supervision. Of these actions, 5 actions, except the evaluation of the intervention strategies and periodic training, are identified as top priority i.e., these actions are more effective in removing the bottlenecks. Therefore, these 5 actions are required to address immediately to improve the malaria prevention strategies in CHC and its catchment area.

9. References

Kalra S. (2020) Common Mosquito-Borne Diseases in Rajasthan. Accessed from https://ckbirlahospitals.com/rbh/blog/common-mosquito-borne-diseases-in-rajasthan

Kishore J. (2022) National Health Programs of India. Century publications. New Delhi.

Malaria situation in India. 2021. National Centre for Vector Borne Diseases, Ministry of Health and Family Welfare. https://nvbdcp.gov.in/WriteReadData/l892s/95833279891 65580 5683.pdf

MoHFW, 2020, https://www.pib.gov.in/PressReleasePage.aspx?PRID=1677601

10. Annexures

Table [A1] Malaria prevalence and diagnostic tests statistics

	2020	2021	2022	Remarks
I. Malaria				
A. Microscopy				
1. Total Blood Smear Examined for Malaria	**2160**	**3693**	**4636**	Though testing of blood smear is increased between 2020 to 2022, there are zero +ve cases reported, which shows a contrary pattern with the MoHFW data for Rajasthan.
2. Malaria (Microscopy -P Vivax Test +ve)	**0**	**0**	**0**	
3. Malaria (Microscopy -P Falciparum Test +ve)	**0**	**0**	**0**	
B. Malaria RDT				
4. RDT conducted for Malaria	**146**	**202**	**19**	There was an increase in RDT tests by 56 between 2020
5. Malaria RDT Conducted P Vivax Test +ve)	**3**	**16**	**2**	

6. Malaria RDT Conducted (P Falciparum Test +ve)	**0**	**0**	**0**	and 2021. But drastic reduction of RDT tests happened in 2022. RDT testing data is unavailable from MoHFW
7. Patients Treated on Outpatient Basis for Malaria	**3**	**16**	**2**	
8. Patients admitted with Malaria	**0**	**0**	**0**	
9. Deaths Due to Malaria	**0**	**0**	**0**	It shows similar pattern as MoHFW data for the last 8 years.
II. Dengue				
1. Tests conducted	**28**	**704**	**234**	Between 2021 and 2022, the pattern shows that 97% and 86% respectively were RDT +ve of the total tests conducted for dengue, indicate that the CHC could not able to efficiently and effectively respond to the outbreak in its catchment area.
2. RDT Test +ve	**1**	**684**	**202**	
3. Elisa Test +Ve	**0**	**0**	**0**	ELISA test service is not available at the CHC.
4. Patients Treated for Dengue as outpatients	**1**	**300**	**190**	In 2021, given the limited capacity of human resources and beds at CHC, it is very difficult to manage 300 patients in OPD and 384 admissions. Gradually in 2022, the number of treated outpatients and admissions decreased.
5. Patients Admitted for Dengue	**1**	**384**	**22**	
6. Deaths due to Dengue	**0**	**0**	**0**	It shows similar pattern as MoHFW data for the last 8 years.

Table [A2] Provisions and organization of services related to malaria at the CHC

A	**Laboratory**	
1	Lab Technician Availability	Partial
2	Blood Microscopy for Malaria	Being done
3	Maximum Testing Load for Malaria (Per Day)	Approximate 20 per day
4	Reporting of Blood Test for Malaria	
	a) Usual Time taken to give report (Ask the technician)	
	i) OPD Samples	6 hours
	ii) Field Samples	12 hours
	b) Documentation (Check the register for few reported cases for time taken	
	i) OPD Samples	Documented in register
	ii) Field Samples	Documented in register
5	RDT for Malaria (Antigen)	Bivalent (Pf and Pv cases)
6	RDT for Dengue (Antigen)	
7	Training of LTs in past five years	Yes, trained within 2 years
8	Resource Availability	
	a) Functional Microscope	Yes
	b) Reagents	Yes
	c) Glass Slides	Yes
	d) Lancets	Yes
	e) Hollow/Injection Needles used for Finger Prick	Yes
	f) RDTs for Malaria	Yes
	f) RDTs for Dengue	Yes
9	There is arrangement for segregation of BMW at the session site.	Yes
B	**OPD and Service Provision Area**	
1	IEC Related to NVDCP displayed in Facility	Yes

2	Display of treatment guidelines for Malaria	No
3	Provision for temperature measurement of Fever Cases	
	a) Thermometer	Yes
	b) Temperature being Measured	Yes
C	**Drug Dispensing**	
1	Drug Availability	
	a) Chloroquine Tablets	Yes (Available, no supply issues/stockouts in past) 500 tab till Apr 2022 200 used till Mar 2023
	b) Artesunate Combination Therapy	Yes (Available, no supply issues/stockouts in past)
	c) Injection Artesunate	No
	d) Quinine Tablets	No
	e) Quinine Injection	Yes (Available, no supply issues/stockouts in past)

Table [A3] Enablers and Challenges in prevention of malaria

Enablers	Challenges
• Availability of adequate staff such as doctors, lab technicians, and front-line workers. • Availability of logistics and resources such as slides, chemicals, medicines etc. • Common intervention for malaria and dengue • Rapid fever survey is conducted last three years before the seasonal outbreak • Patient satisfied on the services provided	• Availability of quality data • Data for dengue is not maintained systematically • HMIS data is not matching with laboratory data • ELISA test is not available for dengue • HCWs are overburdened at CHC • Lack of trained manpower and infrastructure at grass root level • Fogging machine was unfunctional in 2022 • Less attention to the NVBDCP

• Panchayat's active involvement in solving issues proposed by the sub-centre • Availability of laboratory facility at CHC • Good leadership by the rapid response team	• No clear programme specific responsibilities of doctor/LTs/ANMs • Few vector borne disease prevention measures • Funding • Weak surveillance system

Table [A4] Prioritization of Enablers and Challenges

Enablers	Challenges
• Common intervention for malaria and dengue • Rapid fever survey is conducted last three years before the seasonal outbreak • Panchayat's active involvement in solving issues proposed by the sub-centre • Availability of laboratory facility at CHC • Good leadership by the rapid response team	• Unavailability of quality data • Lack of trained manpower and infrastructure at grass root level • Less attention to the NVBDCP • Few vector borne disease prevention measures • Weak surveillance system

****