

## Investigation of Asymptomatic Malaria Transmission through Mass Surveillance Campaign in Gadchiroli, Maharashtra.

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### Abstract

Gadchiroli district is majorly covered with forest, and most of the population is tribal, living in the vicinity of the forest. The district is located on the eastern side of Maharashtra. As per the 2011 India census, Gadchiroli recorded a total population of 10,71,795. Males constituted 51% of the population and females 49%. Approximately 11% of the population of Gadchiroli was under six years of age, and almost 90% of the child population stays in the rural part of Gadchiroli. Annual rainfall for the Gadchiroli district is approximately 1,000 mm in the monsoon season from June to September. Gadchiroli is a hotspot for malaria disease in Maharashtra. More than 50% of malaria cases in Maharashtra are observed in Gadchiroli. A special malaria campaign of mass survey for identification of active transmission is carried out in 15 malaria-sensitive PHCs in Gadchiroli from mid of February 2021 to the end of March 2021. About 76% population was tested by microscopic, and 11 % population was screened by Rapid Diagnostic Kit. A total of 164 asymptomatic malaria carriers were identified with 25% gametocytes. Identifying these asymptomatic transmissions followed by complete radical treatment towards malaria elimination is suggested.

**Keywords:** malaria, mass surveillance, gametocytes, asymptomatic transmission

### Introduction

Gadchiroli is an administrative district in the Maharashtra state of India. It is located on the eastern side of Maharashtra. Gadchiroli is surrounded by Gondia district in the north, Chandrapur district in the west, Chhattisgarh state in the east, and Telangana state in the south.

Gadchiroli district is majorly covered with forest, and most of the population is tribal living in the vicinity of the forest. Environmental and social condition like high vegetation, hilly geography of the land, poor housing conditions, lack of health awareness, low development, and the district being a red corridor contributes to overall deprived development, including difficulties in reaching health facilities, providing efficient treatment, support of local communities due to lack of awareness<sup>(1,2)</sup>.

Vector-borne diseases like malaria, Japanese encephalitis, Filariasis, are very common diseases contributing to the major health risk of the district<sup>(3)</sup>. Gadchiroli is highly endemic district for malaria in Maharashtra. More than 50% of malaria cases of Maharashtra are observed in Gadchiroli<sup>(2)</sup>. In this research paper, we are focusing on the situation of malaria in the Gadchiroli district. The objective of the study was to identify the asymptomatic transmission of malaria in Gadchiroli district.

### Materials and Methods

The present study is a cross-sectional survey carried out in the Gadchiroli district across 15 sensitive Primary Health Centres (PHCs), conducted during mid of February 2021 to the end of March 2021.

### Study settings

The geographical location coordinates for Gadchiroli are at 20.10°N 80.0°E. The region is hilly and occupied with deep forests (76% of the geographical area of the district). The district is categorized as tribal and undeveloped district and most of the land is covered with forest and hills<sup>(4)</sup>.

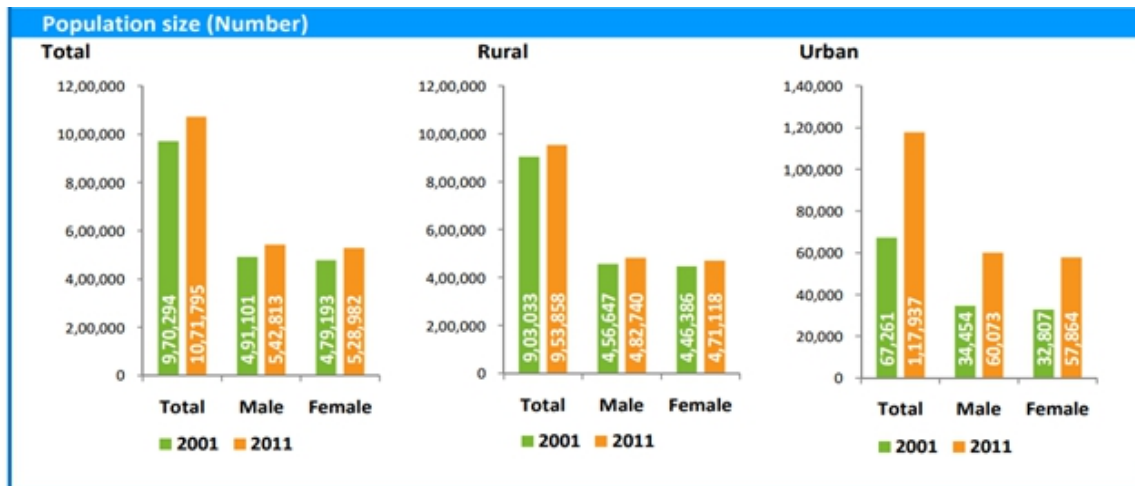
A large part of the population of Gadchiroli stays in a rural area and is dependent on forests and farming for a living. Almost 32% of the population has livable houses made up of mud and hay stacks. Forest areas, Bamboo trees, paddy fields, and these type of *kuccha* houses are major contributors to vector-borne communicable diseases<sup>(5,6)</sup>.

The district is divided into six Sub-Divisions, i.e., Gadchiroli, Chamorshi, Aheri, Etapalli, Desaiganj, and Kurkheda, respectively, and each sub-division has two talukas. There are a total of 457 Gram Panchayats and 1688 Revenue Villages. Gadchiroli has a District Hospital (DH), a Women's Hospital

(WH), three Sub District Hospitals (SDH), nine Rural Hospitals (RH), and 47 PHCs.

Conferring to the 2011 India census, Gadchiroli recorded a total population of 10,71,795. Males constituted 51% of the population and females 49%. Female population number as compared to male population number is slightly low Gadchiroli. Almost 88% of Gadchiroli resides in the rural area. The Tribal Community population that lives in the district is 38.17%<sup>(6,7)</sup>.

Children under six years of age are an important part of the population, as they are more prone to get infected with diseases due to weak immunity. Approximately 11% of the population of Gadchiroli was under six years of age, and almost 90% of the child population stays in a rural part of Gadchiroli. Change in population size and residence between census 2001 and Census 2011 is given in Figure 1.



**Figure 1 : Change in population size and residence as per Census 2001 and 2011, Gadchiroli, India. (Source: Census 2001 and Census 2011, India)**

#### Data sources

##### a) Malaria Register

An SF1 register is regularly used to capture details of each individual of the house in the village.

##### b) Special Malaria Campaign

In the year 2020, a total of 6485 cases with five deaths were reported from Gadchiroli. Therefore, a special malaria campaign for the Gadchiroli district was planned, and a village-wise micro-action plan was prepared<sup>(8)</sup>.

In addition to information from SF1 register, information of the details of fever and other symptoms of malaria if observed were also noted through the special campaign.

#### Study area

Gadchiroli district comprises 47 PHCs, out of which 15 sensitive PHCs for malaria were identified, and a special malaria campaign was planned for these 15 PHCs<sup>(9)</sup>.

#### Micro planning

A micro action plan was developed for 15 sensitive PHCs with a population of 3,13,627. Apart from the regular staff, additional manpower was provided to these 15 PHCs to carry out this special malaria campaign. The state has formed a team of state supervisors comprising almost 60 people; in a

span of 45 days targeted to cover 70% of the population under malaria testing and treatment. A total of 15 senior-level officers from the state had been appointed for these 15 PHCs for improved monitoring and management. The state malaria office has planned a micro action plan and provided additional human resources, laboratory consumables, drug stock management, transportation, Long-Lasting Insecticidal Nets (LLIN) stock management, and overall supervision and monitoring for this special campaign.

Distribution of manpower and allocation of role and responsibilities at each PHC were as follows -

- 1 Radical Treatment (RT) worker/per 1000 population - for Blood Smear (BS) collection
- 1 RT worker- to implement biological control measures under which RT worker should identify breeding sites and eliminate them by introducing Guppy fishes as a biological control
- 1 RT worker – to transport collected blood smear slides to a nearby testing laboratory.
- 1 RT worker - staining of blood smear slide collected.
- Every staff member's role in this campaign was pre-assigned effectively, especially the involvement of Accredited Social Health Activist (ASHA) in the malaria

campaign was observed to be very operative. Health workers (HW) were assigned for BS collection along with RT workers. Health assistants (HA) were assigned to provide radical treatment to malaria-positive patients and follow-up patients on the seventh, 14<sup>th</sup>, 21<sup>st</sup>, and 28<sup>th</sup> days of infection identification.

### Data Collection

This campaign was a mass survey for identification of active transmission, thorough testing in a mass population, and immediate radical treatment for malaria-positive patients. Malaria blood sample slides were collected. ASHAs were allotted to immediately provide medicines/radical treatment. If any house was left in the mass survey, ASHAs were assigned to mop up the survey. The target for blood smear examination was 70 BS/day to cover 1750 BS examination/ Lab Scientific Officer (LSO) in 25 days.

### Monitoring

A state senior officer, a supervisor and a health worker were assigned to for each of 15 PHCs. Malaria technical

supervisors are allotted to monitor RTW, HW, HA, SFW, and LSO work. Medical Officers were enrolled to manage and supervise the entire activities of their PHC. Taluka Health Officers (THO) were assigned to visit all the PHCs under their block and supervise the campaign in their area. However, the district malaria officer (DMO) considered micro-planning, fulfilling physical and financial requirements, and monitoring and analyzing campaign activities for proper implementation.

### Reporting

All the 15 PHCs were provided with a reporting format to report their daily activities to the state. This reporting format compiling data for 15 PHCs is shared below, focusing on PHC-wise population, RTW allotment, and BS. Collection, BS examined, RDK, Total positive identified, Gametocyte%, RT Given, breeding sites identified and eliminated, and LLIN distribution to cover maximum aspects for malaria prevention and control (Table 1).

**Table 1: Reporting format developed to collect information during mass campaign across selected 15 PHCs.**

Daily Reporting Gadchiroli campaign										Date -	
Name of PHC	Population	No. of BS Collected	No. of RDK	No. of BS Examined	Total Positive	No. of positives with gametocytes	RT Given	No. of breeding places enumerated	No. of breeding places eliminated	LLIN distribution target	LLIN distribution achieved
Abbreviations: RDK: Rapid Diagnostic Kit, BS: Blood Smear, LLIN: Long-Lasting Insecticidal Net											

### Result and Discussion

In this malaria campaign, around 83% population of 15 sensitive PHCs was covered to identify symptomatic and

asymptomatic malaria positives and prevent the active transmission of malaria by providing radical treatment for 14 days (Table 2).

**Table 2: Details of testing and diagnosis across 15 sensitive PHCs**

Name of PHC	Population	BS Collection	RDK examination	B.S.+RDK	B.S. examination	Positive found
Botekasa	36151	13910	4555	18465	12237	0
Kotgul	10394	6058	661	6719	4947	23
Deulgaon	58818	22687	8960	31647	16319	3
Godalwahi	22269	11623	1523	13146	9532	7
Pendhari	14875	7531	2461	9992	2973	4
Murumgaon	22633	10828	1076	11904	6565	2
Potegaon	19103	9857	4647	14504	5843	0
Todsa	22261	12703	0	12703	7528	2
Burgi	14282	11853	15	11868	7962	1

To be cont...

Table 2: Details of testing and diagnosis across 15 sensitive PHCs

Name of PHC	Population	BS Collection	RDK examination	B.S.+RDK	B.S. examination	Positive found
Kasansur	31384	18009	3284	21293	7125	8
Gutta	16421	14246	0	14246	8410	23
Arewada	19126	14386	133	14519	10072	9
Mannerajaram	8888	7440	310	7750	4665	8
Laheri	10316	8818	13	8831	5890	47
Permili	10864	8398	711	9109	5952	11
Total	317785	178347	28349	206696	116020	148

At all the 15 PHCs, Malaria diagnosis was carried out using microscopy and Rapid Diagnosis Kit (RDK) methods. The RDK method was used in core forest areas and at difficult geographical locations. Mass blood smear collection was carried out in the villages under each PHC not to miss a single

house and covered the maximum population. Blood smear samples were collected from individuals with and without malaria symptoms to identify if there was any asymptomatic transmission in the community (Figure 2).

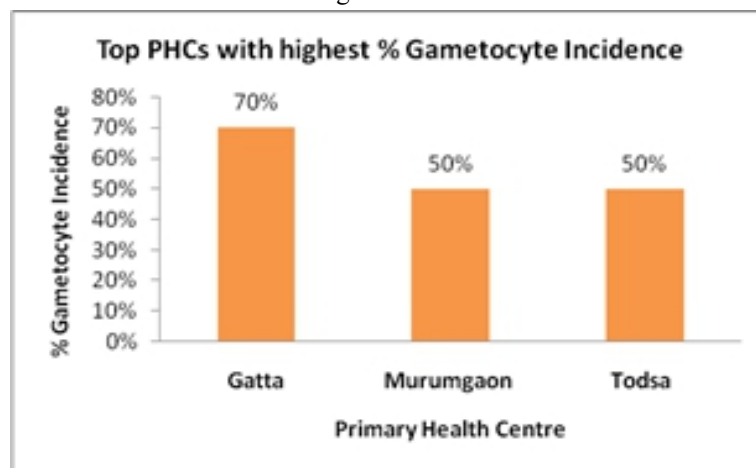


Figure 2: PHC wise malarial parasite transmission to vector

Briefly, 76% of the population was tested by collecting blood smears and microscopic methods. Blood smear collection range across all the 15 malaria-sensitive PHCs was reported to be 57% to 87%. Maximum blood smear collection was observed at Gatta PHC with 87%, followed by Laheri and Mannerajaram with 85% and 84%, respectively. Deulgaon PHC had the least blood smear collection of 69%. 11% population was tested using the RDK kit. So total malaria testing using both microscopy and RDK was approximately 87%.

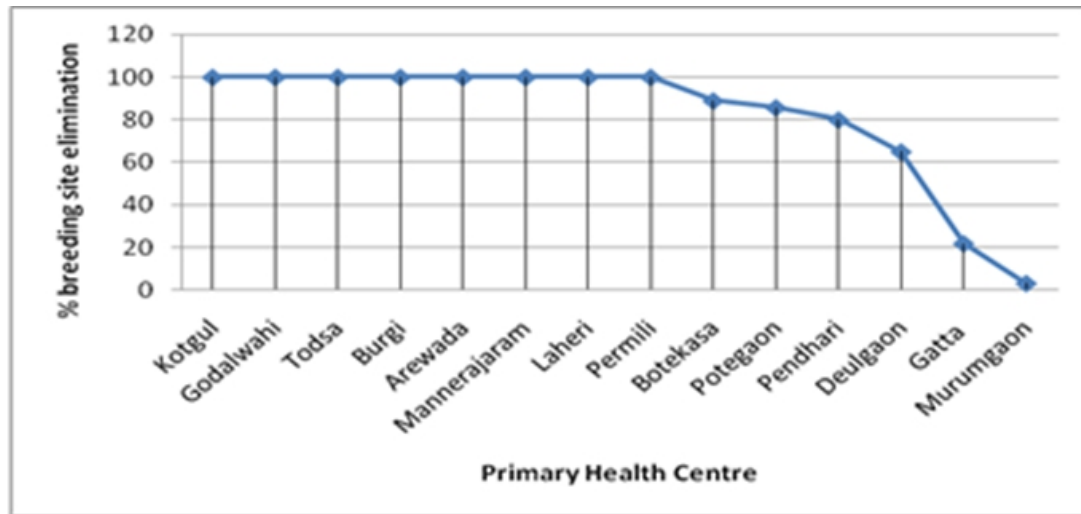
Furthermore, to understand if any asymptomatic transmission exists in the Gadchiroli district, especially in these selected sensitive PHCs, individuals with no malaria symptoms were also screened by collecting blood smears and diagnosing by microscopy. Individuals with no malaria symptoms but were diagnosed malaria positive by gold standard diagnosis method microscopy were considered asymptomatic malaria patients. It is less likely for these asymptomatic patients to visit and seek medical help and also

to get noticed in regular fever surveys carried out by the public health department. However, asymptomatic patients have equal potential to transmit disease compared to symptomatic patients. In our present study, 164 asymptomatic positive malaria cases were identified, and all were given radical treatment for 14 days.

Gametocytes are the only form of both *Plasmodium vivax* and *falciparum* parasite development transmissible to mosquito vectors<sup>(10)</sup>. Along with classical malaria control methods in routine practice, cessation of malarial parasite transmission is an equally important criterion in malaria elimination<sup>(11)</sup>. Thus for the transmission control, gametocyte count was taken from asymptomatic malaria-positive patients using their blood smear slide stained with Jaswant Singh–Bhattacharji stain (JSB stain), which is a rapid staining method for malaria detection and in regular use by the public health department, the government of Maharashtra, India<sup>(12)</sup>. A blood smear was examined using a binocular microscope with oil immersion under 100X magnification. The percentage of gametocytes in

the tested asymptomatic population was counted.

Gametocyte transmission was 25% in the blood smear examined population (Figure 3).



**Figure 3: Breeding site enumeration and their elimination across sensitive PHCs in Gadchiroli**

The highest gametocyte transmission was observed at Gatta PHC with 70% gametocytes, followed by Murumgaon and Todsa PHCs with 50% gametocytes, respectively. These PHCs with a higher rate of asymptomatic patients provided complete radical treatment to break the further malarial parasite transmission in the community. Along with treatment, entomological surveillance was strengthened simultaneously.

#### Prevention and Control measures applied

As one of the preliminary yet important steps in control and prevention is the identification of temporary and permanent breeding sites in the selected 15 PHCs. An RT Worker was allotted to each PHC, especially for breeding site enumeration and elimination. More than 1000 breeding sites were enumerated in this sensitive region, and 79% of breeding sites were eliminated. Some breeding sites were destroyed, and at some breeding sites, especially permanent breeding sites, biological control measures such as Guppy fishes (*Poecilia reticulata*)<sup>(13-15)</sup> and (*Gambusia affinis*) were introduced<sup>(16-18)</sup>. Out of 15 sensitive PHCs, in the 11 PHCs, more than 80% of enumerated breeding sites were eliminated. However, Gatta and Murumgaon PHC's performance concerning breeding site elimination was unsatisfactory. Data for Kasansur PHC was not available, so it was not considered further.

Using LLINs is one of the effective prevention measures against malaria and other vector-borne diseases<sup>(18-22)</sup>. The distribution of LLINs as a protective and preventive measure for malaria transmission was included in a micro action plan for the special malaria campaign in Gadchiroli across 15 sensitive PHCs. For each PHC, according to population, a target LLIN distribution was set up. All together average of

90% of LLINs were distributed of the given target across 15 selected PHCs. Multi-Purpose Workers and RT workers were allotted for LLIN distribution in their respective PHCs. Out of 15, ten PHCs achieved 100% of the target LLIN distribution, and 14 PHCs were observed to achieve more than 70% LLIN distribution. Only Todsa PHC achieved less than 60% LLIN distribution.

#### Conclusion

The present study was a special malaria mass campaign to identify asymptomatic malarial transmission existing across highly sensitive 15 PHCs in Gadchiroli. Around 87% population was screened, and 164 malaria-positive patients were identified with 25% of gametocytes. Identifying asymptomatic malaria patients and their complete radical treatment along with implementing preventive control measures is a major step towards malaria elimination.

**Conflict of Interest:** Nil

**Source of Support:** Nil

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