

## Health System Response in Dealing Malaria Epidemic in a Hilly State of India

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### ABSTRACT

The state of Mizoram is co-endemic for Plasmodium falciparum and P. vivax malaria. A study comprising of 1760 HHs was conducted during July-August 2014 in high endemic blocks (API>2) across the state to assess promptness in treatment in the state. It was found that prevalence of new fever cases and fever during last 14 days was 6.59 and 22.58 per thousand populations, respectively. Data reveals that 69.4% sought treatment and ASHAs (42%) and Health Worker (19%) were main sources of treatment. 93% of those who sought treatment got blood test done and got the treatment within 3 days. A total of 94 cases (79 Pf and 15 Pv) were found positive. 70% of Pf cases got ACT treatment within 1 day. However, follow-up of the cases by health worker was poor (aggregate 21%, among pregnant women-33%, children below 5 years-12%).

**Key Words:** API, ACT, Health System, Plasmodium vivax, P. Falciparum

### I. INTRODUCTION

In India, P. falciparum and P. vivax are the most common species causing malaria. Plasmodium vivax is more prevalent in the plain areas, while P. falciparum predominates in forested and hilly areas. Infection with P. falciparum is the most deadly form of malaria. Delay in diagnosis and treatment of malaria increases morbidity and mortality both in the community and specifically in preschool children. [1,2] The choice of treatment source was found to be influenced by accessibility, disease type and severity, patient's gender and parents' educational level [3-5] Attitude of users towards health care providers is also an important factor [6] Patients are more

likely to start with self-treatment at home where transport and health facility are the problem. [7-9]

Malaria is still one of the major public health problems and over three billion people live at the risk of acquiring malaria worldwide. [10] The incidence of malaria in India accounted for 58% of cases in the South East Asia Region of WHO. [11] Malaria is endemic in many parts of India, especially in North Eastern states in the country. Malaria transmission is complex due to multi-species co-existence and variable species dominance and biological characteristics. [12]

According to the World Malaria Report 2014, 22% (275.5m) of India's

population live in high transmission (>1 case per 1000 population) areas, 67% (838.9m) live in low transmission (0–1 cases per 1000 population) areas and 11% (137.7m) live in malaria-free (0 cases) areas. In 2013, with 128 million tests being conducted on the suspected cases, with *P. falciparum* causing 53% and *P. vivax* causing 47% of the infections.<sup>[13]</sup> The proportion of *P. falciparum* and *P. vivax*, however, varied greatly inter alia from one ecotype to another due to climate variability and malaria control interventions.<sup>[14,15]</sup> Official figures for malaria in India, available at NVBDCP indicate 0.7–1.6 million confirmed cases and 400-1,000 deaths annually.<sup>[16]</sup> The proportion of *P. vivax* and *P. falciparum* varies in different parts of India; *P. falciparum* accounts for 30–90% of the infections in the forested areas inhabited by ethnic tribes and <10% of malaria cases in mostly indo-gangetic plains and northern hilly states, northwestern India, and southern Tamil Nadu.<sup>[13]</sup> North Eastern states of India are co-endemic for both *Plasmodium falciparum* and *P. vivax* malaria, and in the past contributed 10 per cent of cases and 20 per cent malaria-attributable deaths in India.<sup>[17]</sup> Studies have revealed that northeast region is an established route for migration and spread of drug-resistant *P. falciparum* malaria to rest of the country.<sup>[18]</sup>

The state of Mizoram is one of the high endemic States in North Eastern Region in the country. During 2013-2014, approximately 10 in 1000 population were found positive. In the year 2009, the total deaths reported from malaria were 119 which further reduced to 31 in 2010, 30 in 2011, 25 in 2012 and 21 in 2013 and 31 in 2014 i.e. almost 84% reduction in deaths due to malaria over the 5 years duration. It further reduced to 1 & 3 in 2015 & 2016, respectively.<sup>[19]</sup>

The National Vector Borne Disease Control Programme (NVBDCP) was launched in 2003-04.<sup>[20]</sup> In Mizoram, some far away districts and those bordering with Tripura, Bangladesh and Myanmar, are still

having higher API. The GFATM Round 9, IMCP- II project is implemented in high API districts in Mizoram with the objectives of prompt and effective treatment (using ACT) besides many promotive and preventive services.<sup>[21]</sup>

The present study was conducted in the high prevalence districts in the state of Mizoram to assess (i) epidemiological situation and (ii) promptness in seeking treatment particularly amongst pregnant women and children under five.

## II. MATERIALS AND METHODS

### Sampling Design and Sample Size

A two stage sampling technique for selection of blocks and villages within the State was followed. At the first stage, 10 endemic Blocks (Sub-districts) were selected from the list using the PPS sampling technique. In each of the selected Block, all the Sub-centres with API >2 in the last three years (2010-12) were listed alphabetically. Then all the villages under those Sub-centres were listed along with their population and 8 villages were selected by PPS method, giving a total of 8 villages per Block. A randomly selected sample of 11 households per village from 80 selected villages was included to study treatment seeking behaviour. An another sample of 11 old fever cases during last 14 day was selected by systematic random sampling from the list of old fever cases prepared during house listing. Thus, the total sample size was 1760 HHs for the State.

### Reference Period for Data Collection

This report contains the findings of household survey for malaria in endemic districts of Mizoram State carried out during peak season during July-August 2014.

### Tools used for the Survey

The present survey utilized (i) Household listing schedule a day prior to survey (ii) Fever/chills in last 14 days of visit (iii) Fever/chills on the day of visit. Besides, information available on the website of state health department was also analysed.

**Data Collection and Analysis**

A survey team, consisting of 5 well trained members (1 Supervisor + 4 Field investigators), was responsible for survey in each village for 2 days. For each selected Block, there were two such teams and each team covered 4 villages in 8 days. The collected data was analyzed using Excel and SPSS ver21.0.

**Ethical Clearance**

The study was approved by the Ethics Committee of the Institute. Due informed consent was taken from all the households under survey.

**Quality Assurance**

The supervisor of local evaluation/survey team verified at least 10% of the completed interview schedule of new and old fever cases in last 2 weeks.

**Study Limitations:** The study considered Sub-centres with API <2 were excluded

from the study which deprived to assess and compare health systems response in those areas.

**III. RESULTS**

**3.1 Profile of Respondents**

Majority of the households (45%) belonged to the age group 30-39 years, were males (73%) and literate (87%), were Christians (96%) and Schedule Tribes (98%). Occupation wise 54% were engaged in agriculture and 16% were in government/private job.

**3.2 Awareness about Malaria in Community**

The study found that more than 70% respondents were aware about malaria, and its prevention. The awareness in endemic faraway districts like Logtlai and Lunglei was low compared to other Districts/Blocks (Table 1).

**Table 1. Awareness on Malaria and its Prevention by District and Block**

District	Aizawl East	Aizawl West	Kolasib			Mamit	Champhai	Lunglei	Lawngtlai	Saihya	
Block	Phullen (n=88)	Aibawk (n=95)	Kolasib (n=11)	Bikhawthir (n=57)	Thingdowl (n=11)	Zamang (n=89)	Ngopa (n=88)	Lunglei (n=202)	Lawngtlai (n=176)	Tui pang (n=88)	Total (n=905)
How a person gets Malaria	70.5	95.8	100.0	96.5	90.9	92.1	83.0	69.3	60.2	75.0	76.9
How to know Malaria fever	69.3	80.0	81.8	80.7	72.7	91.0	88.6	50.0	55.7	83.0	69.7
How to prevent Malaria	67.0	93.7	100.0	91.2	90.9	88.8	95.5	65.8	59.7	87.5	77.2

However, awareness was low among schedule caste, villages where LLINs were distributed and BPL population (Table 2).

**Table 2: Awareness on Malaria and its Prevention among the Community**

Categories	SC (n=7)	ST (n=886)	OBC (n=5)	OTHERS (n=7)	LLIN (n=718)	Non LLIN (n= 187)	BPL (n=382)	Non BPL (n=523)	Total (n=905)
How a person gets Malaria	71.4	77.2	80.6	42.9	77.4	74.9	76.2	77.4	76.9
How to know Malaria fever	57.1	70.0	100.0	28.6	67.7	77.5	68.3	70.0	69.7
How to prevent Malaria	71.4	77.5	80.0	42.9	75.6	83.4	73.8	79.7	77.2

**3.3 Prevalence of Old Fever/Chills Cases during Last 14 Days and Same Day Fever/Chills Cases in selected Districts/Blocks**

Our analysis revealed that prevalence rate (per thousand populations) for same day fever cases was 6.59 and for

old fever cases during last 14 days was 22.58. Among SC/ST/OBC population, prevalence rate for old fever cases during last 14 days (29.56) and same day fever cases (7.18) were quite high compared to aggregate prevalence rate for the State (Table 3).

**Table 3.** Point Prevalence Rate (per 1000 Population) of New Fever/Chills on the Day of Survey and Period Prevalence Rate of Old Fever Cases during last 14 Days of Survey

Districts	Aizawl East	Aizawl West	Kolasib			Mamit	Champhai	Lunglei	Lawngtlai	Saiha	Total
Blocks	Phullen	Aibawk	Kolasib	Bikhawthir	Thingdowl	Zanuang	Ngopa	Lunglei	Lawngtlai	Tuipang	
1	<b>Point Prevalence of New Fever/Chill Cases on the day of Survey</b>										
	1.87	0.00	0.00	1.56	6.32	1.85	1.37	9.75	20.45	0.00	6.59
2	<b>Prevalence of Old Fever/Chill Cases during last 14 days from the date of survey</b>										
	6.32	2.43	0.00	5.91	0.00	10.46	4.49	30.46	69.80	2.23	22.58
3	<b>Point Prevalence of New Fever/Chill Cases among BPL card holders on the day of Survey</b>										
	3.12	0	0.00	2.62	7.81	1.65	26.32	24.42	31.66	0.00	11.76
4	<b>Prevalence of Old Fever/Chill Cases during last 14 days from date of Survey among BPLs</b>										
	9.35	2.88	0.00	7.87	0.00	12.41	5.01	25.58	85.63	1.48	20.21
5	<b>Point Prevalence of New Fever/Chill Cases among Non-BPL card holders on the day of Survey</b>										
	1.51	0.00	0.00	0.00	0.00	2.15	1.24	10.38	38.79	0.00	10.07
6	<b>Prevalence of Old Fever/Chill Cases among Non BPL Card Holders during last 14 day from date of Survey</b>										
	5.44	0.00	0.00	3.91	0.00	9.96	4.98	22.99	76.51	2.59	22.25
7	<b>Point Prevalence of New Fever/Chill Cases among SC/ST/OBC on the day of Survey</b>										
	1.17	0.00	0.00	2.18	6.32	3.00	0.74	9.50	27.67	0.00	7.18
8	<b>Prevalence of Old Fever/Chill Cases among SC/ST/OBC during last 14 days from date of Survey</b>										
	6.32	2.19	0.00	5.60	0.00	11.14	4.06	22.37	91.35	68.35	29.56
9	<b>Point Prevalence of New Fever/Chill Cases among Others on the day of Survey</b>										
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	54.69	81.63	0.00	6.32
10	<b>Prevalence of Old Fever/Chill Cases among Others in last 14 days from date of Survey</b>										
	0.00	0.00	0.00	0.00	0.00	14.63	0.00	15.63	61.22	0.00	4.74

It is also found that Districts like Aizawl West, Saihya and Kolasib, were low prevalence; Nagopa, Aizawl East were having medium prevalence but other districts like Mamit, Lunglei, Lawngtlai have high prevalence rates.

### 3.4 Blood Test in respect of 14 Days Old Fever/Chills Cases and Treatment Provided

Our findings describes that 69% (261 cases) of old fever cases during last 14 days took treatment from health care provider. This percentage was highest (90%) in respect of pregnant women and lowest (54%) in respect of children less than 5 years (Table 4).

**Table 4.** Treatment status in respect of old fever/chills cases during last 14 days from the date of survey in the community

Age distribution of old fever cases during last 14 days from the date of survey								
Age-Group Total(N=376)								
<5	6-10	11-20	21-30	31-40	41-50	51-60	61-70	71-90
(N=68)	(N=29)	(N=78)	(N=55)	(N=46)	(N=35)	(N=31)	(N=23)	N=11
18.1%	7.7%	20.7%	14.6%	12.2%	9.3%	8.2%	6.1%	2.9%
Patient seek treatment from health care provider								
Sought Treatment	Type of village			Sex		Pregnant Women	Children	Total (N=376)
	Non LLIN (N=38)	LLIN (N=328)	No Information (N=10)	Male (N=194)	Female (N=182)	(N=20)	Less than 5 years (N=68)	
Yes	29	226	6	140	121	18	37	261
	76.3%	68.9%	60.0%	72.2%	66.5%	90.0%	54.40%	69.4%

Study found that out of these, 77% took treatment from government health care provider. It was higher among females (79%), children (78%) but lower in males

(76%) and pregnant women (44%). ASHA (42%) and Health Workers (19%) were first but also major source of advice/treatment (Table 5).

**Table 5. Sources of advice/treatment in respect of old fever/chills cases during last 14 days from the date of survey in the community**

Source of Treatment	Type of village			Sex		Pregnant Women	Children	Total (N=261)
	Non LLIN (N=29)	LLIN (N=226)	No Information (N=6)	Male (N=140)	Female (N=121)	Yes (N=18)	Less than 5 years (N=37)	
ASHA	12 41.4%	95 42.0%	2 33.3%	57 40.7%	52 43.0%	4 22.2%	14 37.8%	109 41.8%
ANM	0 .0%	2 .9%	0 .0%	2 1.4%	0 .0%	0 .0%	0 .0%	2 .8%
AWW	0 .0%	8 3.5%	0 .0%	4 2.9%	4 3.3%	0 .0%	0 .0%	8 3.1%
Health Worker (F)	4 13.8%	43 19.0%	2 33.3%	26 18.6%	23 19.0%	2 11.1%	8 21.6%	49 18.8%
FTD	0 .0%	7 3.1%	0 .0%	5 3.6%	2 1.7%	0 .0%	1 2.7%	7 2.7%
DDC	0 .0%	2 .9%	0 .0%	2 1.4%	0 .0%	0 .0%	0 .0%	2 .8%
CHV	1 3.4%	15 6.6%	1 16.7%	5 3.6%	12 9.9%	0 .0%	5 13.5%	17 6.5%
PHC	3 10.3%	5 2.2%	0 .0%	6 4.3%	2 1.7%	2 11.1%	1 2.7%	8 3.1%
No Response	9 31.0%	49 21.7%	1 16.7%	33 23.6%	26 21.5%	10 55.6%	8 21.6%	59 22.6%

Table 5 also informs that nearly one fourth (23%) who did not respond, probably taken home remedies, or approached local healers or took treatment from private service providers.

**Table 6: Time gap in days between onset of fever and first contact with health care provider**

Time Gap in days	Type of village			Sex		Pregnant Women	Children	Total (N=261)
	Non LLIN (N=29)	LLIN (N=226)	No Information (N=6)	Male (N=140)	Female (N=121)	Yes (N=18)	Less than 5 years (N=37)	
1	14 48.3%	78 34.5%	3 50.0%	50 35.7%	45 37.2%	13 72.2%	16 43.2%	95 36.4%
2	6 20.7%	56 24.8%	1 16.7%	28 20.0%	35 28.9%	2 11.1%	8 21.6%	63 24.1%
3	0 0.0%	46 20.4%	0 0.0%	29 20.7%	17 14.0%	0 0.0%	7 18.9%	46 17.6%
4	3, 6 10.3%	37 16.4%	2 33.3%	26 18.6%	19 15.8%	3 16.7%	4 10.8%	45 17.3%
No response	3 10.3%	9 4.0%	0 0.0%	7 5.0%	5 4.1%	0 0.0%	2 5.4%	12 4.6%

Out of 261 patients who sought advice/treatment, more than one third (36.4%) of them contacted within 1 day of time of onset of fever and 42 % contacted within 2 to 3 days of start of fever. In case of pregnant women 72% contacted within 1 day of start of fever and 11% within 2 to 3 days of start of fever. In case of children 43% contacted within 1 day and 40.5% within 2 to 3 days of start of fever (Table 6). Our analysis in Table 7 indicates that out of 261 patients sought advice/treatment for fever/chills in last 14 days, blood test was done in respect of 93% patients (243 patients); this percentage was higher in males (99%), pregnant women (95%) and children (92%) but less in females (87%).

The time gap between onset of fever and blood test was also analysed. It was found that majority of patients (64%) got the test done within 1 day but it was less in respect of pregnant women (53%) and high (79%) in respect of children less than 5 years. Out of 243 patients, overall 95% (230 patients) of them received the result of blood test and majority (66%) received their blood test report within a day.

Our analysis in table 8 reveals that almost 95% of the old fever cases received their blood test report but in case of pregnant women, it was just 71%. In majority of cases (66%), the report was received within one day but it was lowest in pregnant women (58%). As per the available record with the patients regarding

the blood test report, 34% cases were P. Falciparum, 6.5% were P.Vivax, 10.4% cases could not be ascertained and 49% cases were negative.

**Table7.**Status of blood test done in respect of old fever/chill cases during last 14 days from the date of survey by type of villages, sex, pregnancy status and children

Was blood test done during illness with fever/chills?								
Blood test Done during Illness	Type of village			Sex		Pregnant Women	Children	Total (N=261)
	Non LLIN (N=29)	LLIN (N=226)	No Information (N=6)	Male (N=140)	Female (N=121)	Yes (N=18)	Less than 5 years (N=37)	
Yes	22	215	6	138	105	17	34	243
	75.9%	95.1%	100.0%	98.6%	86.8%	94.5%	91.9%	93.1%
What was the time gap in days between onset of fever/chills and blood test?								
Time gap	Type of village			Sex		Pregnant Women	Age < 5	Total (N=243)
	Non LLIN (N=22)	LLIN (N=215)	No Information (N=6)	Male (N=138)	Female (N=105)	Yes (N=17)	(N=34)	
1 day	11	79	3	48	45	8	16	93
	50.0%	36.7%	50.0%	34.8%	42.9%	47.1%	47.1%	38.3%
2 days	4	53	1	33	25	1	9	58
	18.2%	24.7%	16.7%	23.9%	23.8%	5.9%	26.5%	23.9%
3 days	0	39	0	24	15	1	4	39
	0.0%	18.1%	0.0%	17.4%	14.3%	5.9%	11.8%	16.0%
4 days and above	3	26	2	18	13	3	3	31
	13.6%	12.1	33.3%	12.9%	12.4	17.7	8.7%	12.8
No response	4	18	0	15	7	4	2	22
	18.2%	8.4%	0.0%	10.9%	6.7%	23.5%	5.9%	9.1%

**Table8.** Details of results of blood test done in respect of old fever/chill cases

Was the result of blood test received?								
Result Received	Type of village			Sex		Pregnant Women	Children	Total (N=243)
	Non LLIN (N=22)	LLIN (N=215)	No Information (N=6)	Male (N=138)	Female (N=105)	Yes (N=17)	(N=34)	
Yes	20	204	6	131	91	12	33	230
	90.9%	94.9%	100%	94.9%	94.3%	70.6%	97.1%	94.7%
Time Gap between blood Test and receiving report?								
Delay in Getting Result	Type of village			Sex		Pregnant Women	Children	Total (N=230)
	Non LLIN (N=20)	LLIN (N=204)	No Information (N=6)	Male (N=131)	Female (N=91)	Yes (N=12)	Less than 5 years (N=33)	
0	0	1	0	0	1	0	0	1
	0.0%	0.5%	0.0%	0.0%	1.0%	0.0%	0.0%	0.4%
1 day	14	132	5	85	66	7	27	151
	70.0%	64.7%	83.3%	64.9%	66.7%	58.3%	81.8%	65.7%
2 days	2	5	0	5	2	1	1	7
	10.0%	2.5%	.0%	3.8%	2.0%	8.3%	3.0%	3.0%
3 days and above	0	14	0	7	7	0	0	14
	0.0%	7%	0.0%	5.4%	5%	0.0%	0.0%	6.1%
No response	4	52	1	34	23	4	5	57
	20.0%	25.5%	16.7%	26.0%	23.2%	33.3%	15.2%	24.8%
What was the result of the blood test (confirm from report/prescription if available)?								
Blood Test Result	Type of village			Sex		Pregnant Women	Children	Total (N=230)
	Non LLIN (N=20)	LLIN (N=204)	No Information (N=6)	Male (N=131)	Female (N=91)	Yes (N=12)	Less than 5 years (N=33)	
P. Vivax	0	15	0	10	5	1	3	15
	0.0%	7.4%	0.0%	7.6%	5.1%	8.3%	9.1%	6.5%
P Falciparum	5	73	1	52	27	4	12	79
	25.0%	35.8%	16.7%	39.7%	27.3%	33.3%	36.4%	34.3%
Negative	13	96	3	61	51	6	14	112
	65.0%	47.1%	50%	46.6%	51.5%	50.0%	42.4%	48.7%
Could not specify	1	16	0	7	10	1	3	17
	5.0%	7.8%	0.0%	5.3%	10.1%	8.3%	9.1%	7.4%
No response	1	4	2	1	6	0	1	7
	5.0%	2.0%	33.3%	.8%	6.1%	.0%	3.0%	3.0%



The details of treatment received after blood report is presented in Table 9. After getting the report positive for P. Falciparum, majority (70%) got ACT treatment within 1

day. The 92% children and 50% pregnant women could get ACT treatment within a day. In case of P Vivax, 87% got the treatment within 1 day.

**Table 9.** Treatment initiated after getting results of blood test in respect of old fever/chill cases during last 14 days from the date of survey by type of villages, sex, pregnancy status and children

If positive for P. falciparum, how many days after the first contact with health care provider did she/he get the treatment ACT as per the guidelines?								
Delay in Treatment	Type of village			Sex		Pregnant women	Children	Total (N=79)
	Non LLIN (N=5)	LLIN (N=73)	No Information (N=1)	Male (N=52)	Female (N=27)	Yes (N=4)	Less than 5 years (N=12)	
1 day	1	54	0	33	22	2	11	55
	20.0%	74%	0.0%	63.5%	81.5%	50%	91.7%	69.6%
2 days	1	8	1	7	3	1	0	10
	20.0%	11%	100%	13.5%	11.1%	25%	0.0%	12.7%
3 days	0	1	0	0	1	0	0	1
	0.0%	1.4%	0.0%	0.0%	3.7%	0.0%	0.0%	1.3%
4 days	0	2	0	1	1	0	0	2
	0.0%	2.7%	0.0	1.9%	3.7%	0.0%	0.0%	2.5%
5 days	0	1	0	1	0	0	0	1
	0.0%	1.4%	0.0%	1.9%	0.0%	0.0%	0.0%	1.3%
No response	3	7	0	10	0	1	1	10
	60.0%	9.6%	0.0%	19.2%	0.0%	25.0%	8.3%	12.6%
If positive for P.Vivax, how many days after the first contact with health care provider did she/he get the treatment as per guideline?								
Delay in Treatment	Type of village			Sex		Pregnant Women	Children	Total (N=15)
	Non LLIN (N=0)	LLIN (N=15)	No Information (N=0)	Male (N=10)	Female (N=5)	Yes (N=1)	Less than 5 years (N=3)	
1 day	0	13	0	8	5	1	3	13
	0.0%	86.7%	.0%	80%	100.0%	100.0%	100.0%	86.7%
No response	0	2	0	2	0	0	0	2
	0.0%	13.3%	0.0%	20%	0.0%	0.0%	0.0%	13.3%
If did not receive any blister packet (ACT), was any other drugs(s) given?								
Received other than ACT drug	Type of village			Sex		Pregnant Women	Children	Total (N=79)
	Non LLIN (N=5)	LLIN (N=73)	No Information (N=1)	Male (N=52)	Female (N=27)	Yes (N=4)	Less than 5 years (N=12)	
Yes	0	33	0	23	10	2	6	33
	0.0%	45.2%	0.0%	44.2%	37.0%	50.0%	50%	41.8%

Further, it was found that nearly 42% P. Falciparum cases were provided other than ACT which was almost 50% in case of pregnant women and children but less

among males (44%) and females (37%). It seems quite realistic as most of the places shortages of medicines were reported during rainy season.

**Table 10.** Follow-up visit of old fever/chill cases during last 14 days by the health workers

Did the health worker (male) visit the household any time during this illness?								
Visit of Health Worker	Type of village			Sex		Pregnant Women	Children	Total (N=230)
	Non LLIN (N=20)	LLIN (N=204)	No Information (N=6)	Male (N=131)	Female (N=91)	Yes (N=12)	Less than 5 years (N=33)	
Yes	7	39	2	28	20	4	4	48
	35.0%	19.1%	33.3%	21.4%	20.2%	33.3%	12.1%	20.9%
No	2	100	2	58	46	2	15	104
	10.0%	49.0%	33.3%	44.3%	46.5%	16.7%	45.5%	45.2%
No Response	11	65	2	45	33	6	14	78
	55.0%	31.9%	33.3%	34.4%	33.3%	50.0%	42.4%	33.9%

Study found that in aggregate health worker visited 21% households. However, relatively more pregnant women (33%) and less children (12%) were visited by the health worker (Table 10).

### 3.4 Hospitalization of Old Fever/Chill Cases during Last 14 Days from Date of Survey

A total of 94 cases (79 Pf and 15Pv) were tested to be positive. It was found that

nearly one fifth (21%) of patients were admitted during the illness. Relatively higher cases of hospitalization were found among children (60%) than pregnant women (26%). Primary Health Centers and Government Hospitals admitted nearly 70% of malaria patients and 15% patients were admitted in Private Hospitals. It was found that higher percentages of women (22%) were admitted in private hospitals than men (9%).

Table 11. Status of hospitalization of old fever cases during last 14 days from date of survey by vulnerable groups

Was the patient admitted to hospital?								
Patient Admitted	Type of village			Sex		Pregnant Women	Children	Total (N=94)
	Non LLIN (N=5)	LLIN (N=88)	No Information (N=1)	Male (N=62)	Female (N=32)	Yes (N=5)	Less than 5 Yrs (N=15)	
Yes	3	17	0	11	9	3	4	20
	60%	19.3%	0.0%	17.7%	28.1%	60.0%	26.7%	21.3%
If yes, place of hospitalization								
Place of Admission	Type of village			Sex		Pregnant Women	Children	Total (N=20)
	Non LLIN (N=3)	LLIN (N=17)	No Information (N=0)	Male (N=11)	Female (N=9)	Yes (N=3)	Less than 5 Yrs (N=4)	
PHC	0	3	0	2	1	1	0	3
	0.0%	17.6%	0.0%	18.2%	11.1%	33.3%	0.0%	15.0%
CHC	0	1	0	1	0	0	0	1
	0.0%	5.9%	0.0%	9.1%	0.0%	0.0%	0.0%	5.0%
Govt Hospital	1	10	0	5	6	1	3	11
	33.3%	58.8%	0.0%	45.5%	66.7%	33.3%	75.0%	55.0%
Private hospital	1	2	0	1	2	0	1	3
	33.3%	11.8%	0.0%	9.1%	22.2%	0.0%	25.0%	15.0%
Other	0	1	0	1	0	1	0	1
	0.0%	5.9%	0.0%	9.1%	0.0%	33.3%	0.0%	5.0%
No response	1	0	0	1	0	0	0	1
	33.3%	0.0%	0.0%	9.1%	0.0%	0.0%	0.0%	5.0%

### 3.5 Details of Blood Test done in respect of Same Day Fever/Chills Cases and Treatment Provided

A total of 246 same day fever cases were identified during survey. As per the details in the table 12, the RDT test was done for 70% (171) cases by the government health worker/ASHA etc. The RDT done on same day fever cases was higher among males (72%) than females (67%), high among pregnant women (77%) but less among children (66%).

Results of the test shows that 21% cases were detected as Plasmodium Falciparum and only 4.7% were detected

positive for Plasmodium vivax and 74% cases were negative. The Pf positive were detected more in males (26%) than females (16%) and more in pregnant women (40%) but less (10%) among children. The positive Pv cases were higher among males (6%) compared to females (3.7%) and children (2.6%).

Overall 61% positive cases, 100% pregnant women and 60% children were provided treatment as per guidelines. In case of negative result (127 persons), 28% blood slides were sent for re-examination and patients were treated with Paracetamol.



**Table 12. Services provided to same day fever/chills patients by type of villages, sex, pregnancy status and children**

RDT test and blood slide has been done on the day of survey by health worker/ASHA/other staff							
	Type of village		Sex		If married women, pregnancy	Children	Total (N=246)
	Non LLIN (N=36)	LLIN (210)	Male (N=124)	Female (N=122)	Yes (N=13)	<5 Years age (N=59)	
Yes	25 69.4%	146 69.5%	89 71.8%	82 67.2%	10 76.9%	39 66.1%	171 69.5%
Result of RDT test for Plasmodium falciparum							
	Type of village		Sex		If married women, pregnancy	Children	Total (N=171)
	Non LLIN (N=25)	LLIN (146)	Male (N=89)	Female (N=82)	Yes (N=10)	<5 Years age (N=39)	
Plasmodium falciparum	4 16.00%	32 21.9%	23 25.8%	13 15.9%	4 40.0%	4 10.3%	36 21.1%
Positive for Plasmodium Vivax	0 0.0%	8 5.5%	5 5.6%	3 3.7%	0 0.0%	1 2.6%	8 4.7%
Negative	21 84.00%	106 72.60%	61 68.50%	66 80.50%	6 60.00%	34 87.20%	127 74.30%
If RDT positive, treatment given as per guidelines							
Yes	N=4	N=40	N=28	N=16	N=4	N=5	(N=44)
	3 75.00%	25 59.50%	18 64.30%	10 55.60%	4 100.00%	3 60.00%	28 60.90%
If RDT is negative, whether blood slide has been sent for examination and treated with Paracetamol							
Yes	N=21	N=106	N=61	N=66	N=6	N=34	N=127
	12 57.10%	23 21.70%	17 27.90%	18 27.30%	3 50.00%	7 20.60%	35 27.60%
Did you sleep under the bed nets (LLIN or ordinary bed net) last night?							
Yes	27	160	97	90	9	46	187
	75.0%	76.2%	78.2%	73.8%	69.2%	78.0%	76.0%

#### IV. DISCUSSION

The state topography poses many challenges in implementation of vector borne diseases control programme. Areas bordering with Bangladesh had high API and high malarial deaths due to geo-climatic conditions. Under the State Vector Borne Disease Control Programme (SVBDCP), Awareness about preventive measures and compulsory blood test and starting treatment for malaria within 24 hours were key strategies. [22]

Our study found high level of awareness regarding various aspects of malaria viz., causes, symptoms, prevention etc ranging from 70 to 77% but was relatively less in faraway high endemic districts (55 to 60%). In spite of awareness activities carried out by the State, [22] awareness among BPL and SC population was relatively low.

Blood test was done in 93% patients and majority (95%) got their blood test report. This high percentage was due to adequate training and supply of rapid test kits (RDTs) to ASHA workers. However, probably due to decrease in malaria prevalence rate, screening cases of blood

samples collected decreased to 43% during 2009 to 2012. However, it increased to 2635 in 2013. The number of Pf cases was 18 in 2009 but in 2010, no Pf cases were reported. However, number of Pf cases was 2 in 2011, 4 in 2012 and were 8 in 2013. [22]

The study reveals that for the treatment of old fever cases, 60% household sought treatment, but it was less in females (66.5%) than males (72.2%). Very high percentage (90.8%) of pregnant women sought treatment but unfortunately it was around half (54%) among children (<5 years). Due to landslide etc during rainy season, merely 3% reported to have visited Primary Health Center. More than one third (36%) old fever cases contacted health provider mainly ASHA workers within a day and nearly four fifth (78%) contacted health care provider with 3 days, may be initially having some home remedies, or self-medication. It appear that due to active role of ASHA workers, very high percentage of pregnant women (72%) contacted health service provider within a day but for children, it was less than half (42%). Only one fifth (21%) of patients were visited by the health worker.

It was due to coordination and assistance provided by the ASHA/Health workers that 60% of pregnant women and 27% of sick children were hospitalized in PHCs/CHCs. More or less similar findings emerged in case of same day (new) fever cases as 70% were tested by the Rapid Test Kit (RDT) by the ASHA or local health workers though this figure was high among pregnant women (77%) but relatively less (66%) among children. Majority of tested positive were for Plasmodium Falciparum and just 5% were tested positive for Plasmodium Vivax. All positive tested cases were given medicines mainly by the Auxiliary Nurse Midwives (ANMs) as per the programme guidelines.

Because of difficult terrain and landslide, bad road conditions especially during peak malaria season people in faraway & backward districts faced tremendous difficulty while travelling to PHC or CHC for treatment of malaria. Distance to health facility, cost of anti-malarial treatment and the decision made by the caretakers at home all determine the health care seeking. [23] Household headship, education level and income are also associated with health care seeking. [24] For the effective management of malaria in the community, it is important to advise properly by the health workers on one hand and to take full treatment by the patients. [25] The WHO [26] recommends a multi-pronged strategy to control and eliminate malaria. In the North-Eastern states due to reports of late treatment failures to the current combination of AS+SP in *P. falciparum* malaria, the presently recommended ACT in national drug policy is fixed dose combination (FDC) of Artemether-lumefantrine (AL). [27]

A study conducted in highly malaria-endemic Kolasib District, in Mizoram found that approximately one-third of the 540 fever patients interviewed sought initial treatment from public health facilities, whilst the majority either took self-treatment or purchased medicines from private pharmacies. Approximately 20% of

patients sought treatment after 48 hrs of fever onset. [28] Another study conducted in rural parts of Rajasthan by Yadav et al [29] found that higher utilization of health facility was linked with the age of the child being younger (<24 months of age), mothers being primary educated or above and having moderate to high income. A study in Philippines revealed different types of treatment choices viz., public health institutions, private health practitioners, traditional healers and self-treatment. [30]

At present, Sri Lanka is the only country in South Asia which has almost accomplished the elimination of indigenous *P. falciparum* malaria by year 2012, elimination of indigenous *P. vivax* malaria by 2014, maintenance of a zero mortality of malaria cases and prevention of re-introduction of malaria into the country. [31]

## V. CONCLUSIONS AND RECOMMENDATIONS

There has been considerable decline in malarial morbidity in the state of Mizoram during 2009 onwards due to availability of prompt treatment and case management at the community level besides many preventive measures. Due to reduced mortality, tendency of complacency also cropped up in some of the relatively better off districts.

Poor follow-up of malaria cases among pregnant mothers and children need to be improved. Admission facilities for treatment of malaria may be strengthened at PHC level. Opening of government treatment facilities on Sunday during malaria peak season is recommended. Besides, pre-monsoon stocking of anti-malaria drugs and IEC material in remote and inaccessible districts, improved surveillance, monitoring and evaluation, strengthening and retaining trained human resources are pre-requisite to meet the GOI Strategy of eliminating Malaria by 2030.

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