Evaluation of malaria control programme in three selected districts of Assam, India

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Abstract

Background & objectives: To ensure that the activities of Malaria Control Programme were taking place in effective and judicious manner, an intensive monitoring and supervision of various activities of the programme were carried out in Karbi-Anglong, Cachar and Nagaon districts of Assam, India during July–October 2007.

Methods: Questionnaire-based protocol prepared by the National Vector Borne Disease Control Programme was used to evaluate the activities. Sixteen villages belonging to five different Primary Health Centres (PHCs) of three districts were selected for investigations.

Results: Results of monitoring of indoor residual spraying (IRS) revealed inadequate spraying coverage. Although recorded to be about 69–99%, but apparently it was 17–43% in the districts investigated. Cross-examination of 180 blood smears (90 positive and negative each) in the laboratories of the study PHCs, revealed discrepancy in the results of 67 blood smears. Maximum (44%) discrepancy was observed in positive blood smears and 30% in negative blood smears. Out of 22 Accredited Social Health Activists (ASHA) interrogated, none was found involved in antimalaria activities. However, out of 13 fever treatment depots monitored, one was found partially functional. Criteria laid down for preparation of micro action plan were not followed properly in any of the districts sruveyed. Various important components of the programme like constitution of Village Health Sanitation Committee, information education communication (IEC) activities, capacity building, use of larvivorous fishes, supervision, etc. were not exercised properly. However, 100% community acceptance was recorded for insecticide-treated bed nets in the villages surveyed. Indiscriminate use of rapid diagnostic test kits yielded poor and unsatisfactory response. Declining trend of malaria was observed during 2002–06 in Districts Nagaon and Karbi-Anglong (up to 2005). In District Cachar, however, a little increasing trend was observed during 2002–04.

Conclusion: The results of this investigation revealed that the malaria control programme had been jeopardized seriously due to improper implementation of vector control measures, lack of adequate professional support and varied commitment on the part of the State Government. It can be concluded that long-term malaria control strategy should be based on generation of increased awareness on the disease and various methods of its control, health care access and administrative commitment for increased prosperity in resource-poor settings. The observation also necessitates further in-depth evaluation with appropriate regular active surveillance round the year with prompt detection and treatment facilities in order to control malaria effectively in these districts.

Key words ASHA – evaluvation – IEC – IRS – insecticide coverage – RDKs

Introduction

Malaria is one of the major public health problems in north-eastern region of India. Various methods to control malaria in this region have been adopted including integrated vector control through selective spraying of residual insecticides to interrupt transmission by reducing vector longevity and the use of in-

secticide-impregnated bed nets, the efforts to implement improved diagnosis and prophylactic chemotherapy and information education and communication (IEC) activities in the villages to make the public aware of the disease; various methods of its control and importance of their participation in the programme. In spite of this, the magnitude of present malaria problem in the region particularly in Assam has become serious because almost all the districts of Assam report malaria attributable morbidity and mortality annually, and are vulnerable to focal outbreaks of the disease. Both *Plasmodium falciparum* and *P. vivax* occur in abundance in the state but *P. falciparum* (the killer parasite) accounts for 58–68% of the cases and the remaining cases are due to *P. vivax*[1,2]. The state alone contributes >5% malaria cases and 20% of all the malaria attributable deaths reported in the country annually.

During the years 2000–07 malaria attributable mortality was documented between 43 and 300 with highest being 300 deaths in the year 2006[3]. The present malaria situation has also been found deterring the social, cultural and economic progress of the state. Considering the havoc caused by malaria in the state and to that of the country, it was decided to evaluate the present malaria control activities in high-risk districts of Assam in order to know whether the activities of malaria control programme were taking place in effective and judicious manner. It was also envisaged that the results of evaluation might focus on the ways of improving disease control and might also be considered in the context of social and economic factors relevant to the disease and community.

Material & Methods

Study sites: The present investigation was carried out during July–October 2007 in three *P. falciparum* endemic districts of Assam, namely Nagaon, Karbi-Anglong and Cachar covering an area of 3831, 434 and 37865 km^2 and population of ~2.3, 0.8 and 1.4 million respectively. In each district, two PHCs (except in Karbi-Anglong district), four sub-centres (except PHC Lakhipur) and 2–8 villages were selected

for evaluation. Selection of these PHCs was made on the basis of high API, *Pf %*, mortality, etc. Thus, PHCs Kathiatoli and Samaguri in District Nagaon; Manjha in District Karbi-Anglong; and Udarband and Lakhipur in District Cachar along with their sub-centres (n=10) and respective villages (n=16) were selected. A little change in the number of study sites against the proposed numbers was made considering the local problems and feasibility to approach the sites.

Districts Nagaon and Karbi-Anglong are situated in the central part of Assam, whereas District Cachar is in the southern part (Fig. 1). Inhabitants of these study sites are socioeconomically backward and mainly belong to the tribes of aborigine. Paddy cultivation, collection of forest products, handlooms, daily wages job etc. are their main occupations. The villagers traditionally use scanty clothes on their bodies and are reluctant to use mosquito nets and any other protective measures against mosquito bites. Houses are made of bamboo with thatched roof and walls are plastered with mud. Cattlesheds are made in open without walls adjacent to house. Most of the villages are situated in hilly forested areas, intercepted by slow flowing perennial streams, *katcha nallahs* and drains forming innumerable water pockets provided perennial breeding sites for mosquitoes. Villages are small, sparsely populated, inaccessible during rainy season and with poor health facilities. Low literacy rate, reluctance to accept medical treatment, migratory mode of living, etc. are the important features of the villag-
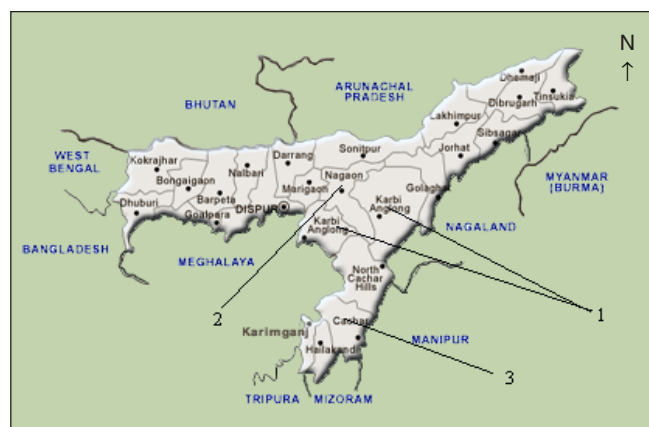

Fig. 1: Map showing study districts of Assam
　　　　1. Karbi-Anglong; 2. Nagaon; and 3. Cachar

ers. The annual rainfall, temperature and humidity of the area ranged from 500 to 2200 mm, 10–33°C and 38–97%, respectively which make the entire area conducive for mosquito proliferation.

Study design: All the investigations were made on the basis of questionnaire-based protocol designed by NVBDCP for evaluation. The investigation was focussed mainly on collection and analysis of epidemiological and spray records of PHCs to know the trend of malaria transmission and spraying coverage, inspection of passive surveillance at PHCs and sub-centres, use of rapid diagnostic kits (RDK), laboratory activities both at district and PHC level that included on the spot cross-checking of positive and negative blood smears, maintenance of records, etc., movement registers of DMOs, PHC Incharge and other supervisory staff, IEC activities in the villages, involvement of Accredited Social Health Activists (ASHA) in the programme, fever tratment depots (FTDs), establishment of village health sanitation committee, etc. Concurrent and consecutive visits were made in the villages to check the IRS activities. Randomly selected houses of these villages were thoroughly inspected to check the quality and coverage of spray. However, during the concurrent visit in the village Thong Timong of sub-centre Upper Haflong, spraying operations were supervised and community response towards the spray operations was noted on the spot. Efforts made by the PHCs towards the use of alternative vector control measures and community perception about the insecticide-impregnated bed nets were also enquired and recorded. Store, staff position and their training were also checked.

Results & Discussion

Administrative commitment: Of the three districts investigated, District Malaria Officer (DMO) was posted only in Districts Cachar and Karbi-Anglong, however, in District Nagaon, District Vector Borne Disease Control Officer (DVBDCO) was in additional charge of DMO. It was further noted that the criteria laid down for the preparation of micro-action plan were not followed properly in District Cachar,

however, >80% points raised in the criteria were covered by two districts, namely Karbi-Anglong and Nagaon while preparing the plan. Due to various administrative constraints, it could not be followed properly, as reported by DMOs of the district concerned. Movement registers of DMOs and PHC Incharge were not maintained properly in any district indicating thereby lack of proper field work supervision which was evidenced by irregularities observed (described below separately) while monitoring various activities like active surveillance, laboratory work, maintenance of records, etc. in the PHCs.

Surveillance activities: Analysis of data of passive case detection (PCD) revealed the occurrence of 458 malaria cases out of 1684 fever cases attended (cumulative data of three districts) in outpatient department (OPD) during the last month of our visit to PHCs. These cases were treated well with suitable antimalarials, however, 13 serious *P. falciparum* cases (10 from PHC Kathiatoli of District Nagaon and three from PHC Manjha of District Karbi-Anglong) were referred to respective district hospital for further treatment. Over all activities of PCD centres were found satisfactory. The results of analysis of epidemiological data collected through active surveillance system have been depicted in Table 1. It revealed the occurrence of 10, 13.5, 2.5, and 0.2% slide positivity rate (SPR) and 100, 85, 17 and 45% *P. falciparum* percentage (*Pf %*) in PHCs Udarband, Manjha, Samaguri and Kathiatoli respectively. Due to non-availability of data of PHC Lakhipur it could not

Table 1. Results of active surveillance carried out by different PHCs during July–October 2007

District	PHC	BSC/ BSE	Total (+) ve	*P. falciparum*	SPR	*Pf %*
Cachar	Udarband	2185	212	212	10	100
Nagaon	Samaguri	3893	98	17	2.5	17
	Kathiatoli	4118	11	5	0.2	45
Karbi-Anglong	Manjha	2918	396	338	13.5	85

Note: Data of PHC Lakhipur was not available.

Table 2. Brief epidemiological situation of malaria in high-risk districts of Assam

Year	District Nagaon					District Karbi-Anglong					District Cachar				
	SPR	SFR	API	ABER	Deaths	SPR	SFR	API	ABER	Deaths	SPR	SFR	API	ABER	Deaths
2002	3.3	30	1.5	4.6	0	17	14	63	37	0	3.3	3.3	1.5	4.6	0
2003	2.6	57	1.6	4.3	9	16	14	53	42	18	4.0	4.0	1.6	4.3	1
2004	2.2	51	1.7	4.0	0	13	11	35	27	10	4.3	4.3	1.7	4.0	0
2005	1.7	27	2.0	6.3	1	14	11	36	28	14	3.2	3.2	2.0	6.3	0
2006	0.5	40	2.9	9.0	1	20	16	50	24	14	3.2	3.0	3.0	9.0	0

SPR – Slide positivity rate; SFR – Slide falciparum rate; API – Annual parasite rate; ABER – Annual blood smear examination rate.

be incorporated. High *Pf* % in these areas was observed due to predominance of the species in northeastern region. The occurrence of high *Pf* % even in the year of low prevalence of the disease is a strong indicator for the emergence of drug resistant strains which need attention of health and policy makers[4] (Table 2). Occurrence of high incidence of malaria in Districts Karbi-Anglong and Cachar as compared to District Nagaon (Table 2) were noted because these districts were surrounded by more than one interstate border and these borders are highly porous where generally intermixing of population with varying degrees of immunity against malaria takes place[5]. Of the 57 malaria cases (19, 17 and 21 cases from Districts Karbi-Anglong, Cachar and Nagaon respectively) checked to see the proper and timely distribution of radical treatment, only 11 (19%) patients accepted timely receipt of radical treatment, however, of the remaining 46 patients, 17 received partial/delayed treatment by 1–2 weeks and 29 patients did not receive redical treatment. Enquiry about the further treatment of the patients who received partial treatment revealed that 40, 23 and 24% patients received treatment from quacks, private physicians and PHCs respectively and the rest 9% did not respond. Delayed/partial administration of radical treatment was observed because of indiscriminate functioning of active surveillance system in the villages. It is worth mentioning here that sub-optimal exposure of malaria parasites especially *P. falciparum* to antimalarial drugs may lead to the development of resistant strains in the area[4,6]. To observe the performance of surveillance worker in the field, as many as 611 villagers from different study villages were interviewed, of which 436 (71%) villagers reported unsatisfactory performance by saying that the surveillance worker generally prepare blood smears sitting at one place in the village instead of house-to-house visit and even during the peak transmission season their visits remained highly irregular.

Rapid diagnostic test kits (RDTKs): Indiscriminate use of RDTKs by PHCs for routine diagnosis of malaria has resulted into misuse of kits which may ultimately hamper the moto of retaining its cost-effect iveness in the programme as has been evidenced by the data provided by PHCs for analysis. Out of 8678, 2369 and 1428 kits used only 13, 19 and 21% kits have shown positivity for malaria at the PHCs of Districts Nagaon, Cachar and Karbi-Anglong respectively. However, as per norms, kits should only be used in emergency in PHCs, and District hospitals and in remote areas where laboratory facilities are not available and by a well-trained person otherwise it may produce maximum negative results that would lead to wastage of kits and failure of Govt's efforts in adding additional tool in the malaria control programme.

Accredited social health activists (ASHA) and fever treatment depots (FTDs): These two activities are considered to be the most important components of the surveillance of the programme. Effective implementation of these activities plays an important role

in bringing down malaria incidence but so was not observed in the villages subjected for evaluation. As out of 22 ASHA assessed, none was found involved in the antimalaria programme because of various administrative problems like training, supply of field kits, etc. However, of the 13 FTDs monitored, only one was found partially functional and the rest were found closed. Actually, FTDs were introduced in malaria control programme to extend the reach of malaria treatment to more under-served and remote areas but these volunteers were given drugs and slides only on adhoc basis and are seldom visited or given any encouragement by the PHC staff resulting in very poor response from these volunteers.

Laboratory activities: All the nine laboratories of the study districts/PHCs were found equipped with good microscopes and trained lab technicians. However, maintenance of records was not found up to the mark in any PHC due to lack of supervision, except in PHC Udarband and sub-PHC Mahendijua of Manjha where maintenance of records was found a bit satisfactory. On the other hand examination of 180 blood smears (90 each positive and negative) revealed discrepancy in the results of PHCs to the extent of 35 to 43%

(Table 3). However, maximum (44%) discrepancy in the examination of positive blood smears and 30% in the negative blood smears was observed in these districts (Table 3). It is evident from these observations that due to misdiagnosis and/or misidentification of parasite species, true incidence of malaria was not reported, otherwise, it could have been much higher than the presented number of malaria cases for evaluation[7,8]. Other laboratory activities such as staining and preparation of blood smears, distribution of results of active surveillance to field workers, etc. were not found up to the mark in any laboratory except SHC Mahendijua of PHC Manjha. During the inspection of microscopists and laboratory activities at district/PHCs, it was also noted that the existing workload on the majority (>80%) of malaria microscopists is too high to allow correct examination and maintenance of records. Excessive work load on microscopists and lack of supervision of laboratory activities were the main causes of irregularities.

Vector control activities: The results of evaluation of IRS have been shown in Table 4. Although PHC records show about 69–99%, but apparently spray coverage was 17–43% in the districts investigated

Table 3. Results of cross-checking of blood smears of different PHCs of the districts subjected for evaluation

District	Laboratory	No. of blood smears examined on the spot and discrepancy observed						Average discrepancy at Distt. level %
		(+)ve blood smears No.	Discrepancy observed in blood smears No. (%)	(–)ve blood smears No.	Discrepancy observed in blood smears No. (%)	Total blood smears No.	Discrepancy observed in blood smears No. (%)	
Cachar	District Laboratory	20	7 (35)	20	6 (30)	40	13 (32.5)	
	PHC Udharband	20	4 (20)	20	1 (5)	40	5 (12.5)	36
	PHC Lakhipur	10	8 (80)	10	10 (100)	20	18 (90)	
Nagaon	PHC Katmhiatoli	10	7 (70)	10	2 (20)	20	9 (45)	
	PHC Samaguri	10	6 (60)	10	2 (20)	20	8 (40)	43
Karbi-Anglong	PHC Manjha	10	8 (80)	10	5 (50)	20	13 (65)	
	Sub-PHC Mahendi Jua	10	0 (0)	10	1 (10)	20	1 (5)	35
Total		90	40 (44)	90	27 (30)	180	67 (37)	

Table 4. Observations on DDT spraying in high risk districts of Assam

District	Villages checked	House/room checked		Spraying status of house/room				Status of sprayed houses/rooms				Status of unsprayed houses due to		
				Sprayed		Unsprayed		Mud plastered		Undisturbed		Refusal	Negligency	Locked
		House	Room	House	Room	House	Room	House	Room	House	Room			
Cachar	5	54	215	9 (17)	44 (20)	45 (83)	171 (80)	4 (44)	22 (50)	5 (56)	22 (50)	22 (49)	16 (36)	7 (16)
Nagaon	7	67	242	15 (22)	53 (22)	52 (78)	189 (78)	9 (60)	32 (60)	6 (40)	21 (40)	25 (48)	20 (38)	7 (13)
Karbi-Anglong	4	21	73	9 (43)	31 (42)	12 (57)	42 (58)	3 (60)*	11 (61)	2 (40)*	7 (39)*	6 (50)	4 (33)	2 (17)
Total	16	142	530	33 (23)	128 (24)	109 (77)	402 (77)	16 (48)	65 (51)	13 (39)	50 (39)	53 (49)	40 (37)	16 (15)

Figures in parentheses indicate percentage; *Data of houses checked during consecutive visits.

revealing inadequate coverage. Of the 142 houses of 16 different villages monitored, 33 houses were found sprayed with DDT and the remaining 109 houses were left unsprayed due to refusal (49%), negligence of spraying squad (37%) and locked houses (15%). Of the sprayed houses, 48% houses were observed to be mud plastered within 7–15 days of spraying. Most preferred spraying sites were outdoors rather than indoors.

As recommended by World Health Organization (WHO) for effective malaria control measures, IRS requires coverage of at least 85% of dwellings, ensuring that the majority of endophilic and/or exophagic mosquitoes are exposed to the insecticides but in the present investigation, coverage was very poor, i.e. 17–43% as against 69–99% reported by the State Government[9,10]. Poor spray coverage was noted because of patchy spraying associated with excessive insecticide deposits on walls due to defective nozzles used while spraying as was observed during the concurrent visits in the villages. As many as six spray pumps were checked, of which four pumps were found discharging either more or less than the required quantity (1 litre/min) of insecticide solution. Among other reasons, lack of technical knowledge among the spray crew and supervisory staff because of partial training, refusal for spraying due to foul smell, making the house dirty, disbelief on the effectiveness of DDT spraying and progressive development of fatigue and reluctance among the villagers to allow spraymen into their rooms for spraying due to the use of IRS in malaria campaign in the country for the last several decades, sericulture, absenteeism from house, etc. were observed to be the main reasons of poor coverage. These findings are in consonance with the earlier investigations[4,11]. Motivation through intensive IEC campaign involving various groups of people like *Panchayat* and religious leaders, teachers, private doctors, etc. should be given prime importance at the time of spraying to avoid refusal and mud plasting of sprayed walls.

Epidemiological situation (malaria trends): Brief epidemiological situation of malaria has been depicted

in Table 2. It revealed declining trend of malaria during the period from 2002–06 in Districts Nagaon and Karbi-Anglong as evidenced by malaria incidence and positivity indicators. However, in District Cachar, there was slight increase in malaria cases during 2002–04 calling for coordinated efforts to avert impending malaria outbreaks. The SPR ranged between 0.5 and 3.3%, and 17 and 20% in Districts Nagaon and Karbi-Anglong respectively. The continuous decline of parasite load in the community in these districts might be due to increased awareness among the people about malaria and its prevention as was evidenced by 100% acceptance of insecticide impregnated bed nets and its use by the community in the present study[4]. The API and ABER ranged from 1.5–3 and 4–9, 35–63 and 24–42 and 1.5–3 and 4.3–9 in Districts Nagaon, Karbi-Anglong and Cachar respectively. The ABER was <10% in Nagaon and Cachar districts (Table 2) which is suggestive of fragmented surveillance—a measure that is considered important to monitor the progress of disease interventions and early detection of outbreaks[12–14]. This may be one of the reasons of continuous occurrence of malaria outbreaks across the state including these districts. Of the districts investigated, maximum deaths were reported from Karbi-Anglong and Nagaon followed by Cachar. It is worthmentioning here that although the trend of malaria was noted declining in these districts, high mortality and morbidity is continuing. It may be because of the location of these districts on more than one interstate borders except Nagaon district. The populations of border areas are considered to be at great risk and believed to be infectious reservoirs for persistent transmission of malaria due to intermixing of non-immune and immune population at border areas. These factors might have played an important role in enhancing malaria mortality and morbidity in these districts[15].

Other activities: Various important components of the programme like constitution of Village Health Sanitation Committee, information education and communication activities, capacity building, use of larvivorous fishes, etc. were not exercised properly. Observations also revealed non-availability of stocks of antimalarials and other store articles for three months at district level and for one month at PHC level to meet the emergency requirement as has been proposed in the programme.

With these observations, it can be concluded that the long-term malaria control strategy should be based on generation of increased awareness on the disease and various methods of its control, health care access and administrative commitment at district/state level for increased prosperity, particularly in resource-poor settings. The observation also necessitates further in-depth evaluation with appropriate regular active surveillance round the year with early detection and prompt treatment facilities in order to control malaria effectively in these districts.

Acknowledgement

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