Operational Efficiency of Malaria Programme and Treatment in Rural and Urban Baroda

Chapter 1

Evaluation of Operational Efficiency of the National Antimalaria Program in "High-Risk" Rural Areas of Vadodara District

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Abstract

Background: Malaria was and is a major scourge in India contributing to more than three-fourths of the total cases in the South-East Asian Region (SEAR). Malaria is largely influenced by the local environmental conditions but can be kept in check if the operational implementation of the National Antimalaria Program (NAMP) is effective. Keeping in mind the context of the situation in Gujarat, there was an urgent need to carry out a study to assess the operational aspects of the ongoing malaria control program.

Objectives: To assess the operational aspects of NAMP in "high-risk" areas of rural Vadodara, seeking bottlenecks and possible correlation to the malaria situation in those areas.

Methodology: From 269 "high-risk" villages, 20 villages were selected randomly from 10 Talukas. 40 slide smear negative and 19 smear positive patients, 10 laboratory technicians, 10 Multipurpose Worker (MPW) Supervisors and 18 MPW and 18 Voluntary Workers were interviewed. The performance of the malaria clinic and the NAMP staff was evaluated using a scoring system.

Results: The monthly blood examination rate (MBER) targets could not be achieved in 8 out of 10 primary health centers (PHCs) by active surveil-

lance (AS) workers. The mean time interval between blood smear collection (BSC) and its receipt in the laboratory was 7.1 days. Almost half, i.e. 46% of smear- negative patients having received presumptive treatment (PT) and 22% of smear-positive patients receiving radical treatment (RT) were supervised. Administration of "adequate" presumptive treatment and radical treatment to the above two sets of individuals was 65% and 58% respectively.

Conclusions: Overall, the performance of 50% of malaria clinics and 94% of villages was poor to average. The study has found enough evidence to conclude that there were lapses in the operation of the NAMP.

1. Introduction

The global incidence of malaria is estimated to be between 300 and 500 million clinical episodes with 1.1-2.7 million deaths occurring per year [1]. In India; about 1.65 million cases were reported in 2003 with the proportion of cases caused by Plasmodium falciparum (Pf) being 42% [2]. In the state of Gujarat, the districts of Surendranagar, Surat, Kutch and Patan reported higher number of malaria cases from 2001-2002 as compared to previous years [3]. Following the trend of higher incidence in other districts, the district of Vadodara also reported higher incidence as indicated by an increase in the number of "High risk" villages from 29 in 2004 to 269 in the year 2005.

The National Antimalaria Program (NAMP) that was integrated into the National Can we try to get Vector and Vadodara without the hiphen district since its launch at the national level [3,4]. The bottlenecks in implementing malaria control measures mainly relate to the time lag at various stages starting from collection of blood smear of fever cases to the administration of radical treatment to the smear-positive cases. The entire edifice of malaria control is based on accurate and early laboratory diagnosis of blood smear from fever cases and prompt treatment of those found positive. In view of the increasing incidence of malaria reported in the endemic districts and in the absence of recent data, there was an urgent need to carry out a study to identify the bottlenecks in malaria control in the state and to assess the operational aspects of the ongoing malaria control program.

2. Methodology

The study was carried out during January 2005 to July 2005. A list of "high-risk" villages as defined by NAMP for the year 2004 was obtained from the District Malaria Officer (DMO), Vadodara. The district of Vadodara has 12 Talukas and there were 75 Primary Health Centers (PHCs) as on January 2005. The Enhanced Malaria Control Project (EMCP), now a component of NVBDCP, has been in operation in four Talukas located in the tribal belt of the district. There were 269 "high-risk" villages in 2004, distributed among 42 PHCs of the 12 Talukas of Vadodara district. Based on the criteria of endemicity, i.e., Talukas having at least

five "high-risk" villages, 10 out of 12 Talukas and those PHCs having ≥ 2 high risk villages were included in the present study.

A simple random sampling method was adopted for selecting one PHC from each of the ten talukas and subsequently, for selecting two "high-risk" villages from each of the PHCs selected. Thus, a total of 20 "high-risk" villages were to be studied from 10 PHCs. We interviewed two slide-negative individuals and one slide-positive individual and a village leader from each "high-risk" village selected for the study. To minimize the recall bias, only those slide-positive or slide-negative individuals who had fever and were administered either presumptive treatment (PT) or Radical Treatment (RT) during the last one month of the visit by the investigator were included in the study. Consent for participation in the study was obtained from these individuals after explaining the purpose of the interview and the study to them.

For the evaluation of the operational efficiency of NAMP, it was planned that information would be collected on the time taken between the successive stages of the process, commencing from collection of blood smears from fever cases to administration of the RT to slide -positive individuals. The study also aimed to assess the functioning of Malaria Clinic at the PHCs selected, Laboratory Technicians (LTs) manning these clinics, Multipurpose Supervisors (MPs) responsible for administering and supervising the administration of Radical Treatment (RT) to the slide-positive cases of malaria, Multipurpose Workers (MPW) for their role in NAMP and Voluntary Workers (VW) associated with NAMP and NAMP activities in the "high-risk" villages.

Performance of the Malaria Clinic at each PHC was evaluated using methods such as inspection, observation and verification of records to compare the targets and achievements of Monthly Blood Examination Rate (MBER). Performance of the paramedical staff involved in NAMP activities at the PHCs and VWs associated with the program at the village level was evaluated during visits to the PHCs and the "high-risk" villages selected for the present study. This assessment was carried out using methods like inspection, observation, verification of malaria clinic records and interviews of malaria slide-positive and slide-negative individuals as well as leaders of the "high-risk" villages. The performance of the clinic and of various cadres was rated on the basis of a point system on a scale of 0-5. A point score of 4-5 was rated as good, 2-3 as average and 1-0 as poor. Passive surveillance is defined as blood smear collection at malaria clinic, by malaria link worker and by Fever Treatment Depot (FTD) holder. Similarly, active surveillance is defined as blood smear collection by any agency during visit of the house with a case of fever. Thus, 10 PHCs and an equal number of LTs and MPSs were contacted. Also, 20 villages, 40 slide-negative and 19 slide-positive individuals, 18 village leaders and 18 VWs were interviewed from the 20 "high-risk" villages.

3. Data Analysis

Information collected using the pretested proforma was analyzed using Epi-info software (version 6.04d) and tabulated. Data cleaning and double data entry was done to check for consistency. Appropriate statistical tests were applied to draw conclusions.

4. Results

In spite of making a determined effort, our study team could not interview all the 20 slide-positive individuals and 20 VWs as planned. Finally, a total of 10 PHCs and an equal number of LTs and MPSs were assessed. Also, 20 villages, 40 slide-negative and 19 slide-positive individuals, 18 village leaders and 18 VWs were interviewed from the 20 villages visited.

Table 1 shows a comparison of MBER targets, their achievement and percentage of deficit/excess in the achievement of the targets for the month preceding the visit of the study team to the concerned PHC. In six out of the ten PHCs studied, MBER targets for both active and passive surveillance could not be achieved. When active surveillance (AS) targets were compared, eight out of ten PHCs fell short of the MBER targets with three PHCs reporting deficit in target achievement by more than 80%. For passive surveillance (PS), the achievements exceeded the targets in eight out of ten PHCs and it was found that three PHCs had achieved more than 100% of their target. Passive surveillance is defined as BSC at malaria clinic, by malaria link worker and FTD holder. Similarly, active surveillance is defined as BSC by any agency during visit of the house with a case of fever.

There was no full-time laboratory technician appointed in three out of ten Malaria Clinics studied at the PHCs. Basic facilities at the Malaria Clinics were not “adequate” in four out of the ten clinics; however, nine out of ten Malaria Clinics had functional microscopes and all the malaria-specific registers. Full-time multipurpose supervisors (MPS) as well as adequate facilities for BSC and staining material were not available in 50% of the clinics. Until the time of interview by the study team, 30% of the PHCs had not completed the task of selecting voluntary workers to carry out NAMP activities in the villages. All the clinics received a regular and adequate supply of antimalarial drugs during the last one year.

Table 1: Comparison of targets and achievements of monthly blood examination rate for active and passive surveillance in primary health centers studied

Name of PHC	Active surveillance			Passive surveillance			Total		
	Target	Achieved	Deficit/ excess (%)	Target	Achieved	Deficit/ excess (%)	Target	Achieved	Deficit/ excess (%)
Bajwa	280	211	–24.7	153	435	+184.3	433	646	+49.2
Koyli	427	193	–54.8	58	244	+320.7	485	437	–9.9
Kelanpur	307	363	+18.2	204	216	+5.9	511	616	+20.5
Thuvavi	235	45	–80.7	157	165	+5.1	392	210	–46.2
Samlaya	690	95	–87.0	465	899	+93.0	1155	994	–13.9
Pipaldi	192	249	+29.7	33	100	+203.0	225	349	+55.0
Suryaghoda	135	83	–38.5	90	108	+20.0	225	191	–15.1
Devhat	281	08	–97.2	188	153	–18.6	469	161	–65.7
Asoj	327	220	–32.7	218	192	–11.9	545	412	–24.4
Chalamli	194	81	–58.2	130	318	+144.6	324	399	+23.0

Abbreviations: PHC - Primary health center

Table 2: Time period taken between various stages from blood smear collection to administration of radical treatment (n = 19)

Sr. no.	Number of days taken between	Interview of slide positive individuals		Interview of slide positive individuals		Discrepancy days	
		AS	PS	AS	PS	AS	PS
1	BSC and BS received at lab	7.1	0.0	NA	NA	NA	NA
2	BS received at lab and BSE	1.9	0.2	NA	NA	NA	NA
3	BSE and administration of RT	2.0	1.4	NA	NA	NA	NA
4	Total	11.0	1.6	16	1.8	05	0.2

AS - Active surveillance, BSC - Blood smear collection, BS - Blood smear, PS - Passive surveillance, BSE - Blood smear examination, NA - Not applicable

Information about the time lag at each stage of malaria control, i.e., from smear collection to treatment obtained from PHC records and interviews of 19 slide-positive individuals was compared [Table 2]. It was seen that there was a discrepancy of five days between BSC and RT administration in AS and 0.2 days in PS.

A total of 40 slide-negative individuals were interviewed for collection of information about their history of fever and the details of PT as shown in **Table 3**. The mean time interval between onset of fever and blood smear collection (BSC) was 3.6 days, being three days in males and 4.2 days in females. Twenty-six out of forty (65%) slide-negative individuals had

received adequate PT according to NAMP guidelines. However, while 83% males received adequate PT, only 50% females received adequate PT. All the 26 individuals who had received adequate PT also completed it with 12 of these (46%) being supervised during PT.

A total of 19 slide-positive individuals were interviewed about RT as shown in Table 4. The mean number of days between onset of fever and BSC was 3.9 days. All the 19 individuals interviewed had received RT but RT Was adequate only in 58% (11/19) of the cases. There was no gender difference noted in the proportion of individuals who received adequate RT. When responses about completion of RT were analyzed, it was found all four males who had received adequate RT, had also completed it, while in the case of females, only 71% (5/7) had completed it. Supervised RT was only given in 22% of these smear-positive individuals.

Out of 19 cases of malaria, seven (two male) individuals had Pf malaria. A follow-up blood smear collection was carried out in 5/7 (71%) individuals with Pf. The mean duration between first-time and follow-up BSC was eight days, four days in the case of males and nine days in the case of females. BSC was carried out from all family members in all seven cases of Pf (100%). A search for fever cases in the entire village was carried out in 5/7 (71%) villages where one or more case/cases of Pf occurred.

Out of the 20 villages visited, a regular and adequate supply of antimalarial drugs and facilities for regular BSC were not available in eight villages (40%). Anti-adult measures in the form of indoor insecticidal spray (synthetic pyrethroids) were not carried out at all in 50% of the villages (10/20) villages. In four villages (20%), there was no full-time MPW male worker available to carry out NAMP activities and none of the villages had regular availability of insecticide-treated bed nets (ITBN)

Table 3: Response of slide negative individuals from the study population

Sex	Number of individuals interviewed	History of fever(%)	Mean number of days between fever and BSC	Adequate PT received (%)	PT completed (%)	PT supervised (%)
Male	18	18 (100)	3	15/18 (83)	15/15 (100)	04/15 (27)
Female	22	17 (77)	4.2	11/22 (50)	11/11 (100)	08/11 (72)
Total	40	35 (88)	3.6 (n=36)	26/40 (65)	26/26 (100)	12/26 (46)

Abbreviations: PT: Presumptive treatment

Table 4: Responses of slide positive individuals about radical treatment

Sr. no.	Sex	Number of individuals	Species		Mean number of days between fever and BSC	RT received (%)	Adequate RT (%)	RT completed (%)	RT supervised (%)
1	M	7	5	2	3.3	7 (100)	04/7 (57)	4/4 (100)	2/4 (50)
2	F	12	7	5	4.3	12 (100)	7/12 (58)	5/7 (71)	0/5 (00)
3	T	19	12	7	3.9	19 (100)	11/19 (58)	9/11 (81)	2/9 (22)

Abbreviations: BSC: Blood smear collection; Pv: Plasmodium vivax; Pf: Plasmodium falciparum; RT: Radical treatment

Thirty per cent of the MPWs (6/20) did not visit the villages allotted to them regularly for active surveillance activity under NAMP. Forty per cent of the MPWs (8/20) did not inquire with all houses about fever cases nor did they take blood smears from all individuals who had history of fever during their scheduled visit to the village. However, 85% (17/20) of them demonstrated the correct technique of preparing and staining peripheral smears (PS) for malaria parasite (MP). All the MPWs administered PT to all those from whom blood was collected for preparing peripheral blood smear. Eighty per cent of the MPWs (16/20) had not supervised the PT administered by them to individuals with history of fever.

All the ten LTs who were interviewed had received training in the procedure for laboratory diagnosis of malaria at least once from a designated training institution. Nine out of ten LTs maintained all the malaria-specific registers up to date and the microscope in good condition and demonstrated the correct technique of preparing and staining good-quality PS for MP.

All the slide-positive cases who visited the PHCs within two days of blood collection, received the RT from the MPSs at the PHCs. None of the MPSs made home visits to the slide-positive individuals in their area, either for administration or for supervision of RT for the entire duration.

The VWs associated with NAMP at the village level are fever treatment depot (FTD) holders, drug distribution centre (DDC) holders and voluntary link workers (VLW). Fifty per cent of the VWs (9/18) did not spare adequate time for the responsibilities they volunteered for; 44% (8/18) of them did not have correct knowledge about the preparation of PS for MP and 28% (5/18) lacked correct knowledge about dose and schedule of PT. As many as 89% (16/18) VWs did not supervise the PT given to all slide-negative individuals who contacted them for fever treatment.

The performance rating criteria has been mentioned in the methodology section. The performance of all (100%) LTs was found to be “good” and that of all (100%) MPS was “average”. The performance was “average” to “poor” in the case of 44% of MPWs, 50% of VWs, 50% of malaria clinics and 94% of the villages studied [**Figure 1**].

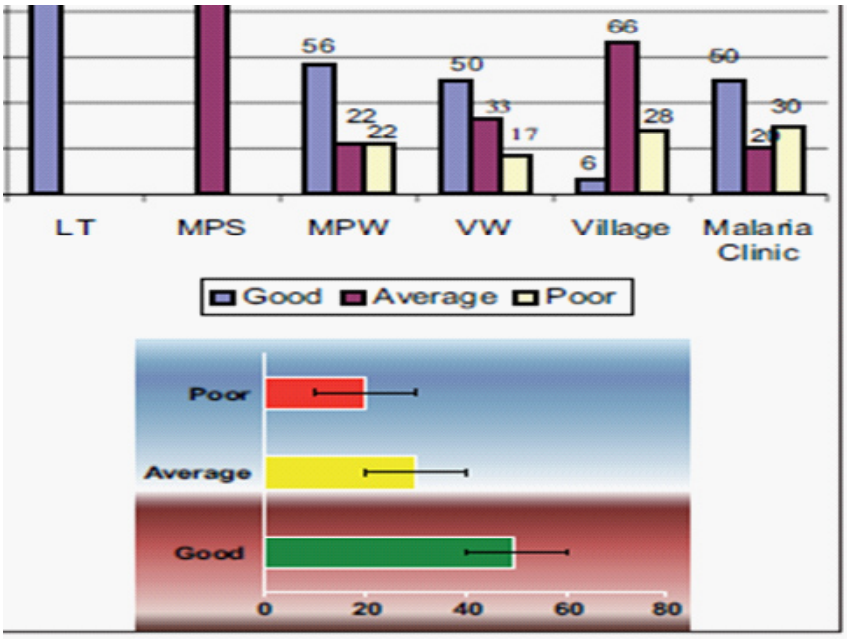

Figure 1: Performance of malaria clinic and health workers associated with National Antimalaria program (%)

5. Discussion

The MBER targets could not be achieved in 8/10 PHCs by AS agency workers. The mean time interval between BSC and its receipt at the laboratory for examination was 7.1 days. Sixty-five percent of smear-negative cases were administered pt and 46% were supervised for the entire duration of PT received. For the entire duration of RT received, 58% and 22% of smear-positive cases were administered and supervised respectively. The study findings also suggest that there were sincere efforts made in blood collection for preparing peripheral smear (PS) for malaria parasite (MP) by MPWs. A time lag of 3.6 and 3.9 days between onset of fever and BSC was noted in slide-negative and slide-positive cases respectively. Such delays could be attributed to the lack of availability of BSC facilities on a regular basis in the villages (44% of villages) or even lack of knowledge about the availability of such services.

Nearly 40% of the cases did not receive the treatment in "adequate" doses. Almost all (17/18) MPWs possessed the requisite skills for taking and staining "good quality" PS for MP. This finding clearly indicates that although the MPWs are not lacking in skill, they may be lacking in sincerity in discharging these responsibilities as prescribed by the NAMP.

It was also noted that none of the slide-positive individuals was visited at their homes by the MPSs for administration or for the supervision of RT. Thus, it seemed that MPS were neglecting the responsibilities assigned to them under NAMP. These findings point to the lack of sincere efforts by health workers.

The fact that the whole village survey for fever cases was carried out in only 5 out of 7 villages reporting a case of Pf, that too during the non-transmission season of malaria, i.e., December to May is indicative of the failure of the PHC administration to fully comply with

the provisions under the program.

Absence of full-time LTs and MPSs in 30 and 50% of the malaria clinics respectively, and the lack of adequate facilities for BSC and staining in 50% of the clinics may have resulted in the "average" to "poor" performance of these malaria clinics [**Figure 1**]. These findings also suggest failure on the part of the district authorities and/or at the PHC level.

The "poor" to "average" performance of NAMP in 94% of the villages [**Figure 1**] could be attributed to 1) lack of supply of antimalarial drugs and BSC facilities on a regular basis in 44% villages, 2) no insecticidal spray at all in 56% villages, 3) non-availability of full-time MPW in 22% of the villages and 4) non-availability of ITBN on a regular basis in any of the villages. All these observations point to the combined failure of district authorities, PHC administration and the paramedical workers to discharge their duties efficiently and sincerely.

When the performances of individual cadres of workers was compared with reference to their roles in NAMP, LTs were found to be the most sincere, efficient and possessing the requisite skills. Ninety per cent (9/10) of them had kept all the malaria-specific registers up to date, the microscopes in "good" condition and possessed the "correct" technique of preparation and staining of PS for MP and examined all the PS on the same day. This has resulted in their performance being "good" in all instances.

Thirty per cent of MPWs did not visit their villages regularly, 40% did not inquire about fever cases from all houses nor did they collect BS from all persons with history of fever and 80% did not ensure the supervision of PT of those individuals to whom they administered PT. As a result, their performance was found to be "poor" to "average" in 44% of the cases [Figure 1]. None of the MPSs took the trouble to visit the slide-positive cases for administration or supervision of RT. However, they administered the RT in adequate dose and under supervision to all those smear positive cases who reported at malaria clinic. As a result, the performance of all of them could achieve "average" rating only. Half of the VWs did not spare enough time for NAMP activities, 44% did not possess the correct knowledge of preparation of PS for MP and 28% did not know the correct dose and schedule of PT. It resulted in their performance being rated as "poor" to "average" in 50% of the cases.

6. Conclusion

The NAMP guidelines have fixed seven days as the maximum allowable time limit between BSC and administration of RT in case of *Plasmodium vivax* and five days in case of *Plasmodium falciparum*. When findings are compared with NAMP norms, two important shortcomings have been noticed in the functioning of NAMP: (i) time delay in administration of RT by AS agencies (ii) discrepancy between information obtained from PHC records and slide-positive cases. The discrepancy between information from two sources could be real or

could be due to recall bias, but since discrepancy is negligible in the case of PS (1.8 against 1.6) as compared to that in the case of AS (16 against 11), it seems real in the case of AS. Again in the case of AS, when time lag at various stages from BSC to administration of RT is compared, the mean time lag between BSC and receipt of the same slide at the Malaria Clinic was found to be maximum (mean = 7.1 days), followed by two days between blood smear examination (BSE) and administration of RT and 1.9 days between receipt of the slide at the clinic and BSE. The mean time lag between onset of fever and BSC for the same slide-positive individuals was 3.9 days [**Table 4**]. This finding when viewed in light of the mean time lag of 7.1 days between BSC and receipt of same at Malaria Clinic, conveys that there was mean time lag of as many as 11 days from the onset of fever to receipt of PS for MP at the Malaria Clinic and a mean time lag of 15 days from onset of fever to administration of RT, even if only PHC records are referred to. These findings reflect poor functioning on the part of the AS and PS agencies, where BS is collected at a place other than the PHC headquarter village and then sent to the Malaria clinic at the PHC laboratory.

7. Limitations of the study

A bias of any nature, including recall bias, may influence the assessment process, which may result in incorrect inferences being drawn. However, due care was taken to check this during the interview sessions. It was not possible to determine village-wise targets and achievement of MBER targets from PHC records. Hence, PHC-wise target and achievement of targets were compared, which may not reflect the true picture of the functioning of NAMP in the "high-risk" villages studied.

Since the survey was carried out during the non-transmission season, only a few cases were reported even from "high-risk" villages. Therefore, the workload on all the workers involved in NAMP was considerably reduced. In fact, the performance of any worker or PHC or village with reference to NAMP activities, if found poor during non-transmission season, would suggest that, the performance of the concerned worker or PHC or village, in all probability, would be worse during transmission season. Therefore, this evaluation study may not reflect the real performance or may reflect over-performance of NAMP in the studied villages.

8. Recommendations

The value of treatment under supervision for the entire duration must be emphasized to all staff. The active surveillance agency workers and voluntary workers must be instructed to promptly dispatch PS for MP. The Medical Officer of PHC should, in consultation with the District Malaria Officer (DMO), calculate the MBER and motivate the staff to complete the targets. All the vacant posts of paramedical and voluntary workers must be filled up immediately. The DMO and PHC MO should ensure that all "high-risk" villages receive adequate

insecticidal spray and ITMN.

10. Acknowledgment

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