"ROLL BACK MALARIA"

COUNTRY

STRATEGY PAPER

BHUTAN

INTRODUCTION :

Bhutan is a landlocked country and is bounded in the east, west and south by Arunanchal Pradesh, Sikkim and Assam & West Bengal States of India respectively.

Geographically the country is a mountainous rugged terrain system with very limited accessibility. The climate is cold and snow bound in the north gradually changing to warm and hot in the south. The north and the south is joined by many riverine valleys.

The country is divided into Twenty (20) Administrative Division called Dzongkhags (District). Each Dzongkhag is administrated by Dzongda equivalent to a Governor.

MALARIA CONTROL PROGRAMME :

Then the National Malaria Eradication Programme, now Malaria Control Programme is the first programme to be implemented in the Health Services. It was started in 1962. Then it was Malaria Eradication Programme and the Programme was a vertical programme. The Decentralisation process started in the early eighties. In 1994 the Programme was reoriented from Eradication to Control and gradually the Malaria Control was completely decentralised and then the malaria control activities were integrated into the general health delivery system. Now all the control activities are carried out by the Dzongkhag (District) Health Services. This has been implemented as per the recommendations made by the Amsterdam Ministerial Meeting, Global Malaria Control Strategy followed by the Regional Working Group Meeting on Implementation of Revised Malaria Control Strategy, 1993.

REVIEW OF MALARIA CONTROL ACTIVITIES.

POPULATION AT RISK :

More than half the population of the country is in the malarious area with varying intensity of transmission. The Southern Districts of Samdrupzongkhar, Sarpang, Chukha (Phuntsholing Sub-Division) Samtse falls under the perennial malaria transmission belt. These District also are the gateway for trade and commerce. The population of the non-malarious area in the North and Central part have to come to the Southern District for trade and commercial activities. The whole southern border belt is porous and enjoys free movement in and out across the border. Thus the population of non-malarious areas are also exposed to the risk of malaria infection.

CASE INCIDENCE :

The malaria case incidence was 518 cases in 1965. The malaria cases fluctuated between few hundred till 1971. In 1972 the case incidence rose to 1,376 cases. Since, then the malaria incidence increased steadily to a peak number of malaria case incidence of 18,368 positive malaria cases in 1984. Then in 1985 the cases came down to 7,043 cases, but increased to 19,916 the following year. There was ups and downs in the malaria case trend, and showed 22,126 positive cases in 1991. Malaria cases increased rapidly from 1991 onwards and reached as high as 39,852 cases in 1994, making it the highest no

The percentage of case load decrease from 1994 to 1998 is approximately about 80%.

Year	BSC	+VE
1965	10,189	518
1966	7,148	144
1967	15,329	405
1968	12,913	247
1969	25,531	672
1970	30,886	630
1971	31,369	720
1972	38,703	1,376
1973	47,909	3,402
1974	47,874	4,613
1975	48,170	7,929
1976	47,699	8,035
1977	33,611	3,328
1978	39,518	3,483
1979	41,079	5,375
1980	45,487	3,933
1981	48,361	4,522

Year	BSC	+VE
1982	51,939	6,328
1983	42,633	5,213
1984	62,667	18,368
1985	31,763	7,043
1986	82,639	19,916
1987	69,029	13,134
1988	51,164	11,314
1989	71,653	19,162
1990	33,973	9,497
1991	67,699	22,126
1992	73,986	28,900
1993	78,321	27,512
* 1994	96,020	39,852
1995	**83,743**	**23,188**
1996	**76,019**	**15,696**
1997	**68,153**	**9,029**
1998	58,086	6,995

* BASE YEAR FOR COMPARATIVE ANALYSIS

ANNUAL PARASITE INCIDENCE :

The Annual Parasite Incidence rate was one of the highest in the South East Asia region. Over the years the API has dropped down considerably but still the rate of 25 per 1000 population is not acceptable and should be aimed to be brought down to 10 or below.

Y E A R	1993	1994	1995	1996	1997	1998
API		111	66	45	26	20

CASE MORTALITY :

Deaths due to malaria has also shown improvement. It has reduced from 62 malaria related deaths in 1993 to 14 deaths in 1997 and 17 deaths in 1998.

Y E A R	1993	1994	1995	1996	1997	1998
Deaths due to Malaria	63	48	39	27	14	17

Beside the Hospitals and the Health Facilities in the malarious areas, the Health Centres of the non malarious area are also reporting regular sporadic cases of malaria.

MALARIA DRUG POLICY :

Anti-malarial drugs is part of the Essential Drugs Programme. Procurement, distribution and monitoring will be done by the Essential Drug Programme. The following anti-malarial drugs are being used in the country at present :

First Line :- Chloroquine + Primaquine

Second Line :- S-P Compounds

Third Line :- Quinine & Quinine + Tetracycline

All the anti-malarial drugs will be procured and distributed through the Essential Drugs Programme. The respective anti-malarial drugs will be made available for use at the following levels :

2. Community or Village Level. (VHW DDC) : Chloroquine

3. Basic Health Unit Level : Chloroquine (Both tablet & injectibles) Primaquine & S-P Compounds.

3. Hospital Level : Chloroquine, Primaquine, S-P Compounds. Quinine and Tetracycline

The use of different drugs and their combination will have to be assessed both by In-vivo and In-vitro sensitivity tests and be able to make timely changes in the areas of known drug resistance. Drug

Policy should not be static, but be able to respond to changing needs and, therefore, may require revisions from time to time.

DRUG RESISTANCE STATUS :

Monitoring of Sensitivity of anti-malarial drug is carried out regularly by the Anti-malarial Drugs Sensitivity Study Unit. Both in-vitro and in-vivo test are carried out.

Recently the drug resistance studies are carried out as per the protocol developed by WHO, adopted by the Workshop on Monitoring of Therapeutic Efficacy of Anti-Malarial Drugs, Anuradhapura in Jan. 1997. The findings of the study by Lot Quality Assurance Sample (LQAS) method in four sites shows that Plasmodium Falciparum has developed resistance to Chloroquine. Similar studies using the same protocol are being carried out for S-P Compound (SDX/PYR compound) and result shows that Pl. falciparum parasite has developed resistance to the 2nd. line drug.

Choloroquine is not used for the treatment of Pl. Falciparum Malaria and the therapeutic efficacy of S-P Compound in Pl. Falciparum malaria is doubtful due to development of resistance by the malaria parasite.

Two new anti-malarial drugs has been introduced in the treatment of Pl. Falciparum malaria. They are a). Mefloquine Tablet b). Artimisinin Derivatives. Other anti-malarial drugs will be introduced as an when required.

INSECTICIDE POLICY :

The Ministry of Agriculture is the largest importer and user of various insecticide, pesticide, weedicide, fungicide etc. A Policy on Insecticide in general has not been framed in the country, therefore the Ministry of Agriculture has initiated a framing of a comprehensive Policy on Insecticide in 1998 and will be put in the National Assembly for formal discussion and approval.

In Public Health the use of insecticide has to be justified by investigations in regards to its environmental, ecological effects, socio-economic factors and its applicability & acceptance in the community. The procurement will be done through the Unit of Supplies & Management in the Health Division. The distribution to Districts will be carried out by NMCP as per the requirement placed by the individual districts.

Regular monitoring of susceptibility status of insecticide of the vector will be carried out by the Entomological Unit of the NMCP. The insecticide should be changed based on the results of susceptibility tests.

ENTOMOLOGICAL STATUS :

The following are the Anopheles Species of mosquitoes detected in the country. An. Maculatus, An. Minimus, An. Fluvitalis, An. Culicificies, An. Annulari, An. Barbistris, An. Majadi, An. Karwari, An. Vagus, An. Hyrcanus.

Due to the absence of an Entomologist not much work on entomology could be carried out. In 1997 a BSc graduate was allotted by RCSC for Malaria Control Programme. He was sent to [illegible] Pondicherry, India for a one year [illegible] course through WHO Fellowship in July 1997.

He has successfully completed the Post Graduate Diploma in Medical Entomology and joined the National Malaria Control Programme as the full time Entomologist.

Vectors of malaria is not incriminated, but it is assumed that the combination of Minimus, Fluvitalis and Dirus are the main vectors responsible for the transmission of the disease. Minimus and Fluvitalis has been found and though not incriminated, they are very efficient in the transmission of malaria.

VECTOR CONTROL :

A. Indoor Residual Spray :

Selective Indoor Residual Spray is still the main stay of the vector control measure. DDT has been in use as the insecticide for the indoor residual spray since the sixties. In 1994 the decision was made to change the insecticide for the indoor residual spray. DDT was replaced by Deltamethrine, a synthetic pyrethroid compound. From 1995 Deltamethrine has been in use as the insecticide for In-door Residual Spray. The change of insecticide made good impact on the reduction of malaria cases. The encouraging trend set in, in the reduction of malaria case load is still continuing in 1998. The life span of Deltamethrine with uninterrupted use is understood to be four to five years, so it is used very selectively. In the light of the fact that vector will develop resistance within a short span of years, Deltamethrine as In-door residual Spray is being gradually withdrawn and impregnated mosquito net is implemented to maintain the gains so far made by Deltamethrine spray.

In 1999 impregnated mosquito net has been implemented all over the country replacing the indoor residual spray with deltamethrine.

B. Larval Control :

Temephos (Abate) is used as the chemical for larval control measure. Larval control measure is mainly used in the urban and peri-urban areas. Other options of larval control measures are kept open. Biological control measure is limited due the terrain's system, but can be of use in few selected places. Another option is to use BTI for larval control measure.

C. Thermal Fogging :

Thermal fogging with synthetic pyrethroid has been tried on a trial basis. The result was not encouraging and fogging has been stopped as a vector control measure. But it is still retained as an option in case of local and focal outbreaks. This option is used to bring down the adult mosquito population in confined outbreak areas. In this way the infective vector density will be brought down breaking the malaria transmission cycle.

ITBN (INSECTICIDE TREATED BED NET) :

From 1997 In-door Residual Spray was withdrawn in phased manner and in its place the use of Insecticide Treated Bed Net was encouraged and motivated.

In-door Residual Spray with synthetic pyrethroid was completely stopped from 1999 in the country due to various reason. Firstly the insecticide is costly with high recurrent expenditure and cannot be sustained in the long run. Secondly to prevent the vectors from developing resistance to the insecticide as the synthetic pyrethroid group of chemical is the third generation insecticide. There are no other new chemicals being developed.

Now insecticide treated bed net is motivated and encouraged country wide for use in the prevention & protection against malaria infection. Till date more than 13,000 nos. of insecticide treated bed net has been distributed free of cost.

The initial cost of bed net is high as spraying, but in the long run it is affordable and sustainable as the recurrent expenditure is cheaper by ten times or more.

Communities are motivated and encouraged to use insecticide treated net and are required to purchase their mosquito net as per their family size & requirement. The Malaria Control Programme will procure and provide the insecticide and the treatment of mosquito nets is carried out by the District Malaria Staff. The expertise of treating mosquito net will be transferred slowly to the communities themselves.

STRATIFICATION OF MALARIOUS AREA :

The malarious area of the country has been stratified as follows ;

- Forest Malaria
- Forest Fringe Malaria
- Project Malaria
- Low Mountain Malaria
- Urban Malaria

Further it is stratified into the following based on the transmission pattern ;

a). Area of perennial transmission

b). Area of seasonal transmission

c). Area of potential transmission (Conducive factors for transmission is present)

d). Area of no transmission. (Where transmission cannot take place)

These areas are further stratified (Micro Stratification) into village using the malaria caseload data. The analysed data of the monthly malaria morbidity & mortality reports from the Health Centres is used for the micro stratification.

MULTI-SECTORAL APPROACH IN THE CONTROL OF MALARIA (INVOLVEMENT AND CO-ORDINATION) :

Realising the need and the importance of involvement of other sectors in the control of malaria, a workshop was held to sensitise other sectors in the dynamics of malaria transmission and its control in 1995.

The list of the sectors represented are as follows :

- Planning Commission
- Home Affairs
- Immigration & Census
- National Budget & accounts
- Works and Housing
- Dept. of Roads
- Public Works Dept.
- Public Health Engineering
- City Corporation

- National Environment Commission
- Agriculture (Irrigation)
- Water and Sanitation
- Bhutan Chambers of Commerce & Industries
- Royal Bhutan Army
- Royal Bhutan Police

Under the Environmental Management, Anti-mosquito measures (Mosquito proof drains) etc. development and implementation in Sarpang, Gaylegphu and Samdrupzongkhar was carried out on a trial basis. The Municipal Corporation of the Districts carried out the works in co-ordination with Malaria Control Programme.

The result was very encouraging, mosquito density had reduced in the urban area. Drainage of wastewater and rainwater has improved leading to improvement in hygiene, in general.

The engineering solutions of anti-mosquito measures is planned to be taken up in other urban areas and also in the rural areas wherever it is found applicable and feasible.

COMMUNITY PARTICIPATION :

Community participation is vital to the malaria control. To maintain and sustain the good result gained from the use of synthetic pyrethroid (Deltamethrine) as the insecticide for Indoor Residual Spray, communities must be encouraged, involved and health educated to carry out preventive measures at the village and community levels.

The use of impregnated mosquito nets has already been introduced at the village and community level. Impregnated mosquito net use is

seen as an affordable, maintainable and sustainable control measure compared to the highly prohibitive cost of synthetic pyrethroid spray.

Advocacy and IEC on malaria has been combined with the implementation of the impregnated mosquito net . The communities will purchase their mosquito nets, the insecticide for the impregnation and the expertise will be provided by the programme. In a phasewise manner the impregnation procedure and know how will be transferred to the communities themselves, so that the malaria disease prevention becomes a self-sustaining activity of the communities in general.

GOAL :

* **To reduce malaria transmission to such a level that it ceases to be a public health problem.**

OBJECTIVE :

i. **To reduce malaria morbidity to 10 per 1000 in risk area or to reduce API from 25 to 10 by the end of RBM project period.(Five years period).**

ii. **Reduce malaria mortality to under 1 per 1000 cases by the end of RBM.**

iii. **To prevent and contain malaria outbreaks**

iv. **To sustain and maintain the gains achieved so far by indoor residual spray with synthetic pyrethroid.**

STRATEGY :

1. **Early Diagnosis and Prompt Treatment (EDPT) and effective case Management.**

2. **Control of vectors by selective use of insecticides for control of adult and larval stages of vector, the control method tailored to the endemicity and intensity of transmission in specified localities.**

3. Control of epidemics through the use of epidemiological monitoring tools and emergency action thereof, and

4. Increasing the awareness of Malaria and its transmission dynamics through IEC activities on malaria (information, education and communication) activities on malaria thereby, stimulating community participation in the prevention and protection from malaria infection and control of malaria.

5. Multi-Sectoral involvement, especially Municipal corporation, PWD, Irrigation projects, and other Project areas etc. in the prevention, control and elimination of mosquito breeding ground through engineering solutions by Manipulation, Modification measures and environmental management.

6. Motivation, encouragement and promotion for community participation in the use of impregnated mosquito nets as an self sustainable malaria prevention measure.

7. Timely change of anti-malarial drugs through regular monitoring of therapeutic efficacy and treatment follow up for parasite clearance.

8. By carrying out workshop, training, refresher courses to update knowledge, skill for all categories of peripheral health worker and malaria technician and share experiences.

ACTIVITIES :

1. CAPACITY BUILDING :

The malaria control activities is decentralised and integrated into the general health delivery system. The activities are carried out by the Dzongkhag (District) Health Services.

Though there is requirement of additional manpower to carry out The control activities but due to non-availability. additional Manpower could not be added. Therefore, due to the extra burden and work placed on the existing workers the quantity and quality of work is compromised. The additional manpower needs to be placed through induction training of Malaria Technician. Other necessary training and refresher courses also need to be conducted timely to update the knowledge and skill of the existing Health Workers. The following in country needs to be carried out.

I. *IN COUNTRY :*

a). MALARIA TECHNICIAN TRAINING :

Induction training of new Malaria Technicians to fill in the additional requirement and replacement of old workers. The course is for a period of one year or twelve months. The raining will be carried out by NMCP under the umbrella of Royal Institute of Health Sciences, Health Division, Thimphu.

b). IN-SERVICE TRAINING :

Timely updating of Skill and knowledge of Health Worker is essential for quality of work and technique, and also to encourage and motivate to work.

The following training, refresher courses & workshop has to be conducted.

i. **Basic in the Techniques of Malaria Microscopy.**

ii. **Diagnosis and Treatment of uncomplicated malaria.**

iii. **Refresher Courses.**

iv. **Management of Severe and Complicated Malaria.**

II. *IN COUNTRIES OF THE REGION :*

In capacity building one of the main constraint is the availability of Training Institutes for specialised courses in the country. The Country has no infrastructure or the capacity to organise the Specialised courses required for capacity building in malaria control. The institutes and training centres in the countries of the Region needs to be explored. The specialised courses for capacity building in malaria control is being regularly conducted in the countries of the region. Opportunity to get the specialised courses needs to be taken up as priority.

a). **Malariology course for Managerial Level.**

b). **In-vivo and In-vitro sensitivity.**

c). **Multi-disciplinary course on Vector control, Parasitology & Entomology.**

d). **Health Education.**

e). **Medical Entomology course.**

2. IEC ON MALARIA :

The IEC component of the malaria control programme has been the weakest. Now active collaboration and co-ordination with IECH Bureau in the Health Division in the operational research, development, production of IEC on Malaria materials and implementation of IEC activities in the country should be taken on a priority basis. Support fund will be required for the development of materials and to carry out the IEC activities.

a). Materials for IEC malaria :

i. **Audio and visual material.**

ii. **Posters, chart, flip charts etc.**

b). IEC on malaria intensification:

i. **Exhibition.**

ii. **Symposium.**

iii. **Advocacy and Sensitisation.**

iv. **Malaria awareness campaigns**

3. BIO-ENVIRONMENTAL MANAGEMENT :

Chemical methods of vector control though efficient are of temporary nature and needs to be repeated on a regular cycle. The use of chemical is viewed by the National Environment Commission as contamination of the environment. The Policy of the National Environment Commission on Preservation of Environment is restricted use of chemical in the environment and far as possible to do away with the use of chemical. The use of Natural, Ecological and environmental friendly measures are encouraged.

Environmental Management measures are costly to be implemented but are of permanent nature and more reliable in the long run. Development of resistance to environmental measure is not likely unlike to the chemicals used.

Fund support used in environmental management will do away with the dependence on chemicals for vector control.

A. ENVIRONMENTAL MANAGEMENT :

i. Manipulation.

ii. Modification.

iii. Other engineering solutions.

B. BIOLOGICAL MANAGEMENT :

i. Larvivorous fishes.

ii. Biocide.

iii. Use of other biological methods.

4. STRENGTHENING OF MALARIA UNIT IN THE DISTRICT :

The capability to carry out various activities in the control of malaria is limited in the districts at the present juncture. There is an urgent need to strengthen the district malaria team so that they are able to carry out the basic activities related to malaria control in their district.

Besides the regular activities like parasitology, spraying

operation, treating of mosquito net with chemical etc the district team also should be able to perform other basic activities in the district such as :

i. Basic entomological works.

ii. Able to carry out the follow up on the study of 'Monitoring of Therapeutic Efficacy of Anti-malarial Drugs'.

iii. Assist the Drug Sensitivity study team.

Personnel trained adequately in the skill and knowledge to be able to carry out the needed activities should be developed and placed in the districts.

5. ITBN USE MOTIVATION & SUSTAINANCE :

Insecticide treated mosquito nets has been found to be a affordable and sustainable measure and as an alternative to indoor residual spray in prevention, protection against malaria infection. This has be experienced in various parts of the world. The indoor residual spray operation is expensive and the logistic and terrain system doesn't allow total coverage.

In the country the indoor residual spray has been gradually phased out. The spray operation was completely phased out in 1999. The spray was replaced by insecticide treated mosquito nets. The use of insecticide treated mosquito net in the prevention and protection against malaria infection is widely encouraged, promoted and motivated. More then 10,000(Ten thousand) treated mosquito nets has been distributed since 1997 as promotional activity in the community. This is aimed to get access into the community and to get their co-operation and participation to promote and motivate the use of treated mosquito nets.

To sustain and further promote the use of treated mosquito nets and to habituate families in the community, various activity aimed at community to participate must be undertaken. Advocacy at different levels such as;

A. Dzongkhag (District) authorities level.

B. Dzongkhag Yargay Tshokchung (DYT) members. (District Development committee).

C. Dungkhag Yarkay Tshokchung (Sub-divisional Development Committee) members.

D. Geog Yarkay Tshokchung (GYT) Members. (Block Development Committee).

E. Village Elders.

F. Families in the community.

G. Business community (BCCI Members)

Social marketing :

This is seen as an important component whereby mosquito nets are made readily available in the market at reduced price. This activity has already been initiated by the Dzongkhag Authorities through the DYT (District Development Committee) Advocacy and IEC activity.

The Customs are requested to waver of the tax on mosquito nets. The business community to market the mosquito net at no loss no profit basis as a part of social service to the community in alleviating the suffering from malaria the disease.

Subsidised mosquito nets :

There are section of people who are unable to purchase mosquito at the price charged in the market though it is attractive. To make it more consumer friendly, mosquito nets at a subsidised price should be worked out to cater to this group of individuals. This could in the form of where there is cost sharing of mosquito net i.e. 50% of the cost of net to be paid by the individuals. For the activity;

a). A revolving fund could be proposed and set up where the community themselves should be made responsible to run the activity monitored and supervised by the programme.

b). The programme takes up the activity of subsidised mosquito net.

Cost free mosquito net :

In the malaria endemic areas of the country there are still individual and families who are not able to afford to buy mosquito nets be it at no profit no loss or subsidised rate. Their numbers are few may run into few hundreds. Provision to take care of this section of people with no resource should looked into. Adequate prevention & protection against malaria infection must be provided to this individuals and families.

Malaria Transmission and Control in Huruluwewa, Sri Lanka

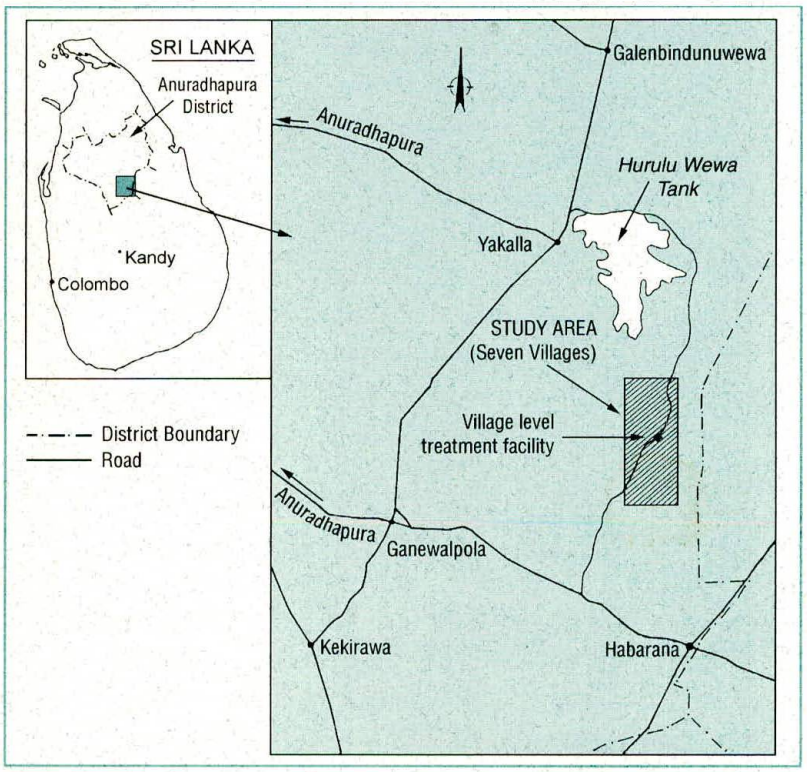
A collaborative research program between the International Water Management Institute, the University of Peradeniya, and the Anti-Malaria Campaign

Summary of Research Findings

A series of studies was conducted between July 1994 and March 1998 to increase the knowledge of malariology in the context of a traditional Sri Lankan dry zone environment with extensive irrigated agriculture, and to identify and assess the feasibility of new control interventions that could supplement the ongoing control efforts by the government. The main focus of the new interventions was related to water management for vector control and community-based initiatives for diagnosis and treatment of malaria.

Initially the studies focused on one village but were later expanded to include the communities living in seven neighboring villages with approximately 2,500 individuals (see figure 1). For two of the studies, the sub-basin of the river was used as the basis for analysis. The land in the study area comprises homesteads, land under small-scale reservoir-based irrigation, and areas under slash and burn cultivation (*chena*). One stream crosses the study area and serves as the main drainage point of the Huruluwewa watershed. In addition, this stream conveys irrigation water from upstream irrigation systems to a large irrigation reservoir downstream of the study area.

FIGURE 1. The study area.



ANOPHELINE LARVAL ECOLOGY

Intensive larval sampling was conducted in a village ecosystem

to describe the breeding habitats of the potential malaria vectors and to document the temporal relation between environmental factors and larval abundance. During the dry season, the species considered to be the major vector of malaria in Sri Lanka, *Anopheles (An.) culicifacies*, was found exclusively in small pools when the water level in the stream was low. However, later in the year, the large number of pools created by the pre-monsoonal rains within the bed of the irrigation reservoirs and in the paddy drainage area created opportunities for *An. culicifacies* breeding at a time when the breeding potential in the stream had been reduced by the inflow of rainwater. Clearly, flow dynamics of the stream and the timing of the pre-monsoonal rains were important determinants of *An. culicifacies* larval abundance. Secondary vectors were found to have distinct breeding preferences and the overall abundance was associated with the availability of habitats that were created by agricultural activities. Seepage areas below the reservoir walls were important breeding habitats for *An. jamesii* and *An. nigerrimus*. Irrigation canals produced *An. barbirostris*, *An. peditaeniatus* and *An. varuna*, and rice fields and temporary pools in chena and home gardens produced *An. peditaeniatus* and *An. vagus*. *An. varuna* coexisted with *An. culicifacies* in the stream but it could maintain breeding potential at higher water levels as well. Breeding in the rice fields and irrigation channels was limited to some extent by the water rotations practiced in the area to conserve water.

When looking at the characteristics of the breeding sites of four of the likely malaria vectors in the area, it was found that *An. culicifacies*, in contradiction of the general belief, was able to exploit habitats that were shaded and contained turbid water. However, it was found that the availability of pools in the stream and in the reservoir bed was highly predictive of the presence of *An. culicifacies* irrespective of overall habitat characteristics such as exposure to sunlight, type of substratum, turbidity of the water, and the presence of vegetation and fauna.

TRANSMISSION DYNAMICS

To describe the transmission dynamics of malaria in a study village and to determine the importance of the various potential vectors, adult mosquitoes were sampled and the number of human malaria cases were recorded. An approximation of the entomological inoculation rate was obtained by using species-specific values of abundance, circumsporozoite rates, and the human blood index. A total of 14 different anophelines was collected. Of these, 7 different species were infected with either *Plasmodium (P.) falciparum* (76%) or *P. vivax* (24%). The highest sporozoite rate was found in *An. barbirostris* (0.015) followed by *An. culicifacies* (0.011) and *An. annularis* (0.010). Serotype PV247 was recorded from a vector (*An. varuna*) for the first time in Sri Lanka. Human blood was found in 10 different species. The highest human blood index was seen in *An. culicifacies* (0.095) followed by *An. nigerrimus* (0.052) and *An. tessellatus* (0.050). Although *An. culicifacies* was only the fifth most abundant species, it had the highest mean number of infective vectors (MIV) per collection night—more than three times that of the next two on the list, *An. vagus* and *An. peditaeniatus*.

The unstable nature of malaria was clearly demonstrated during the study period. During late 1994 to early 1995, an outbreak of malaria occurred with 46 percent of the village population experiencing at least one episode of malaria. Following this outbreak, incidence of

malaria remained at a low level. High monthly MIV was associated with *An. culicifacies* during the onset of the 1994 malaria outbreak. Lower MIVs associated with low incidence of human malaria were seen when *An. peditaeniatus*, *An. subpictus*, *An. vagus,* and *An. varuna* were involved in transmission. During this malaria outbreak, close to 75 percent of all human cases was reported to be due to *P. falciparum*. During this period, only *P. falciparum* was detected in the mosquito population. For the rest of the study period, the balance between *P. vivax* and *P. falciparum* remained approximately equal in both humans and mosquitoes.

The study leaves no doubt that *An. culicifacies* was the species mainly responsible for the outbreak of malaria experienced in the village. The adult population dynamics of *An. culicifacies* was linked to the breeding opportunities made available in the slow flowing stream and in the reservoir bed, and was not correlated with the main monsoonal rains. The build-up in adult *An. culicifacies* supported the increase in human malaria cases. Seasonally highly abundant, outdoor, dusk-biting species such as *An. vagus* and *An. peditaeniatus* could have an impact on the maintenance of malaria transmission. Based on the available information, it seems likely that if the consistent low level of *An. culicifacies* breeding in the stream during the dry season could be controlled, the adult abundance of this species would be very low at the time when the pre-monsoonal rains set in. A very low abundance of *An. culicifacies* would make it difficult to fully exploit the habitats generated by the pre-monsoonal rains, especially since these habitats will only be available for a relatively short period. By the time the full monsoon floods the reservoir and the drainage areas, breeding possibilities for *An. culicifacies* are greatly reduced.

RAINFALL AND MALARIA

Information on mean monthly rainfall and mean monthly relative humidity was correlated with the monthly malaria incidence from 1979 to 1995 for the area covered by a district hospital, which included the villages in the smaller study area. The analysis was done to provide more information on the seasonality and annual changes in incidence levels of malaria linked to meteorological parameters and to see if a possible predictive formula could be derived. Aggregated data from 1979 to 1995 showed an increase of rainfall in October with a peak in November, and an increase in malaria incidence in December followed by a peak in January. However, with the same two-month time lag, the correlation between monthly rainfall and monthly malaria incidence was not very strong. A better correlation was obtained when the distribution of rainfall over a month was taken into account. Despite the statistical significance, the practical relevance of the relationship between higher than average seasonal rainfall and higher than average seasonal malaria incidence is probably limited. Rainfall and relative humidity alone were not sufficient to predict increases in malaria incidence. The entomological findings in the study area indicate that the occasional inter-monsoonal showers occurring during the dry season and the distribution of the pre-monsoonal rains will be more important for the build-up of *An. culicifacies* than the rainfall during the main monsoon season. However, a range of the secondary vectors breeding in groundwater pools is likely to be more directly affected by the amount and extent of the main monsoonal rains. This may also mean that transmission will be initiated earlier in a riparian village than in villages further away from waterways and, in this way, the main monsoonal rains may have an impact on the district-wide correlation between rainfall and incidence of malaria.

KNOWLEDGE, ATTITUDES, AND PRACTICES

Studies were conducted to answer a range of questions related to the knowledge of malaria among the communities in the study area, their use of preventive measures, and strategy for coping with malaria illness. Information on the treatment-seeking behavior of the population was collected and a qualitative assessment was made of the rationale behind their preference for certain types of facilities. Methodologies were derived to estimate the economic impact of malaria on households in a selected village.

The surveyed community of five villages had a high knowledge of malaria with 98 percent of them being aware that two different types of malaria were present in the area and with one of the two (*P. falciparum*) having the potential to develop what was locally described as "brain malaria." The correct treatment for malaria was indicated by 98 percent of the respondents although side effects of antimalarials were often confused with symptoms of the disease. Almost all the respondents knew that mosquitoes were involved in transmission. Several studies in the area indicated that the community gave a very high priority to the confirmation of infection by blood-film test before taking treatment. A survey conducted just after the main transmission season showed that overall malaria was ranked as the third most important community problem, after lack of water for cultivation and poverty.

Several surveys conducted during the study period have shown that the community made exclusive use of western-type facilities for diagnosis and treatment. Approximately 85 percent of the community made use of some form of government facility before the introduction of a malaria treatment center in one of the study villages. Home treatment with paracetamol was the first medication taken in 85 percent of the households. In addition to the drug-based treatment, special diets were often prepared for the patients to re-establish the "hot/cold" balance of the body and to regain energy.

More than 90 percent of the households had their houses sprayed with residual insecticide under a government-funded spraying program. In 23 percent of the households, one or more of the members made use of mosquito nets. The use of mosquito nets was significantly more prevalent among the well-off families. During the rainy season, a common preventive measure was the burning of commercial anti-mosquito coils (54% of households) or the roasting of traditional herbal remedies known for their repellent effects (69%). Environmental based control interventions were not carried out in the area and no community involvement in vector control took place outside the government-funded spraying program.

ECONOMIC BURDEN TO HOUSEHOLDS

The total direct expenditure on a single malaria episode was approximately US$3.00, which should be compared with a median annual household income of approximately US$260.00 for the surveyed community. The money spent on special diets for malaria patients was the highest item of expenditure. The opportunity cost to the households related to labor days lost due to illness was estimated on the basis of daily activity records and confirmed malaria cases, and the application of actual wage rates for men, women, and children. In a year with an average malaria incidence the economically active age group (14 to 60 years) lost 1.8

percent of working days due to malaria and 5.2 percent due to all other illnesses. This resulted in an average annual economic loss per household of US$15.50 for malaria and US$47.50 for all other illnesses, corresponding to 6 percent and 18 percent of annual household net income, respectively. A few families were greatly affected by malaria with eight families losing more than 10 percent of labor days during the most important agricultural season. Children not part of the economically active age group lost on average 2.7 percent of school days over a one-year period due to malaria and 3.2 percent due to other illnesses. The methodology developed to assess the economic impact of malaria could easily be applied elsewhere and is especially relevant under conditions of unstable malaria where the adult population is directly affected by the disease.

The very high knowledge of malaria, the perceived seriousness of the disease, and the relatively high economic cost of the disease to the households should make the community receptive to increased involvement in control activities. However, the traditional reliance on free services from the government for the control of malaria is likely to make the community less interested in participation in disease control. Also, the low income of the community makes it difficult to introduce control measures that increase the financial pressure on families, such as privately purchased bed nets or user fees to cover improved services. In monetary terms, the absolute cost of malaria to the households is relatively low, although high as a percentage of income, making it more difficult to identify new interventions with a favorable cost-benefit ratio.

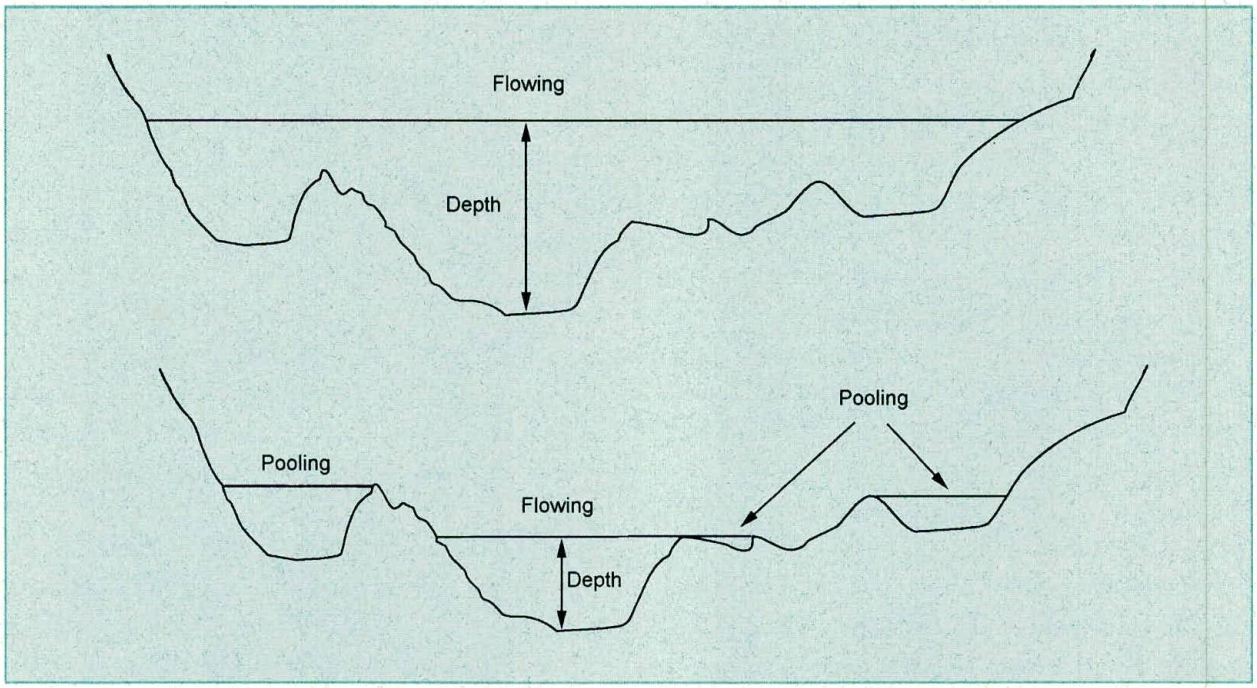
RISK FACTORS FOR MALARIA

To identify the risk factors for malaria and possible preventive measures, an epidemiological study was done in a village over a one-year period. Both environmental and socioeconomic risk factors were studied. Individuals living in houses where bed nets were used had a significantly reduced risk of getting malaria compared with families not using mosquito nets (relative risk of 0.16, 95% CI 0.05–0.45). Usage of traditional fumigants was also associated with a reduced risk of malaria. Interestingly, families using commercial anti-mosquito pyrethrum coils had a significantly higher risk of malaria infection than individuals living in houses where they were not used. Living close to the stream was a risk factor for malaria early in the transmission season but this did not reach statistical significance. It was not possible to assess the risk-related differences in educational status and quality of house constructions due to lack of variation in these factors between households.

WATER MANAGEMENT AS A CONTROL MEASURE

The association between water levels in the stream and the breeding of *An. culicifacies* was studied in great detail. The feasibility of using water management measures to reduce the larval abundance was also assessed. Entomological sampling took place in the stream on a fortnightly basis over a period of almost three and a half years. The highest number of immature *An. culicifacies* was found in August and September when there was virtually no flow in the stream. The second highest peak was observed in the period from February to April, when the water level was relatively low. It was found that the maximum stream water depth in the 14-day interval before sampling took place best explained the number of larvae. The larval abundance was reduced by 84 percent when the water level in

FIGURE 2. Breeding sites created in the stream when the water level drops.



the stream was increased from pooling level (close to 0 cm) to 50 cm (see figure 2).

A series of reservoirs was built early this century across the waterway upstream of the study area and the water levels were controlled by water releases from these reservoirs. The impact of different water management scenarios was tested using a water balance model and the established relationship between larval abundance and stream water depth. A range of water management options was tested for their impact on larval abundance using mathematical models. These included changes in the temporal upstream water allocations, agricultural practices, and physical maintenance of the reservoirs, all having the aim of making water available for fortnightly releases into the stream during the dry season. The results demonstrated potential for very effective vector control by feasible changes in irrigation management.

VILLAGE-LEVEL DIAGNOSIS AND TREATMENT

A village-level malaria treatment center was established as an experiment to test new approaches facilitating early diagnosis and prompt treatment of malaria in rural areas. The center was set up as a collaborative effort between the government malaria control staff, the researchers involved, and representatives of the community. It was housed in a single room in a village centrally located in the study area and it was able to provide services to all seven villages. The diagnosis and treatment of patients followed the standard government procedures. The assistants working at the center were selected from the community and were, after a two-week training period, entrusted with increased responsibility. After about 7 months, the center was fully managed by the assistants although supervisory visits were made by outside staff on a monthly basis.

The findings show that the village treatment center quickly took over the role as the main malaria facility serving the community. However, mothers with sick young children often preferred the government hospital since they felt that they received a more qualified opinion from the medical staff at the hospital. In addition, a small number of patients continued to make use of private facilities in the larger towns. Overall the village treatment center did not improve the response time in seeking treatment for young children but the delay for adults was reduced by 1–2 days. The group that benefited the most was the elderly and the handicapped in the community. The center significantly reduced the stress and discomfort normally experienced by them when seeking treatment for malaria. After the introduction of the center, people no longer delayed seeking treatment due to financial or time constraints, or because no person was available to accompany the patient to the hospital. The elimination of this small group of people that would normally delay seeking treatment for a considerable time is likely to have reduced the parasite reservoir in the community and may have influenced a reduction in the rate of transmission. The study indicated that the effectiveness of a village treatment center is influenced by the degree of initial support from key individuals in the community, the selection procedure and training of the staff of the treatment center, and the history of the relationship between the villages to be served by the center.

The wide fluctuations in the level of malaria incidence will make it more difficult to maintain a community interest in the treatment center, ensure a high quality of diagnosis, and financially sustain the center. To ensure the long-term sustainability of village treatment centers, it is therefore necessary to assess the feasibility of charging a user fee and the establishment of multi-purpose clinics. Government policies and administrative procedures will also need to be adjusted to facilitate the establishment of village treatment centers.

COST OF MALARIA CONTROL

An analysis of the cost-effectiveness of a range of different preventive and curative interventions was also conducted. Seen from the government perspective, a centrally located hospital capable of serving a relatively large area is the most cost-effective way of treating malaria patients. Wide use of mobile clinics and village-level facilities is an expensive control strategy for the government as the cost per case treated by them is approximately twice that of a centrally located hospital. However, when the expenses incurred by both government in providing treatment and households in seeking treatment are considered, the cost is almost the same for the three curative options, government hospital, village facility, and mobile clinics.

The government can implement a program of impregnating privately purchased mosquito nets providing protection to the households at approximately half the cost of the ongoing residual insecticide-spraying program. However, for this to be effective, there is a need to test new approaches to increase the usage of bed nets, especially by the rural poor. For larval control, the use of designated water management strategies should be explored, as this option is far cheaper than the use of chemically based larvicides.

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THIS SUMMARY IS BASED ON THE FOLLOWING PAPERS:

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The Huruluwewa malaria research project is receiving support from Danida, Norad, and the Government of Japan.

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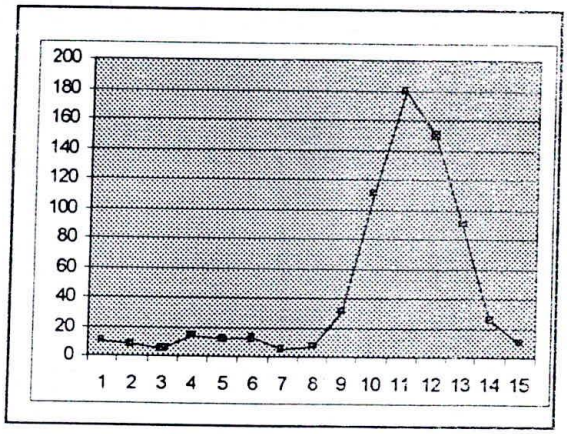
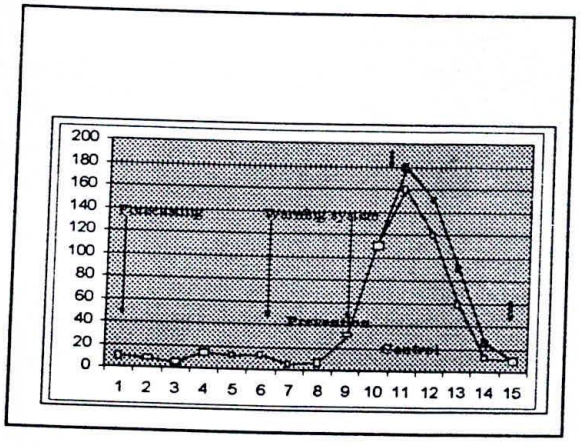
Presentation by C. DELACOLLETTE, CDS, CPC, CCS Jakarta.

Roll Back Malaria Technical Support Network for Prevention and Control of malaria epidemics

First meeting in Geneva, 23-25 November 1998





Terms of Reference of the Network

- Development of methodologies (methods / options) and support to epidemic-prone countries: (i) for the forecasting and prevention, and (ii) for early detection and control of malaria epidemics;
- Development of regional, sub-regional or country strategies for epidemic preparedness and emergency action.

Key recommendations / proposals

Need to document / review previous malaria epidemics

- **with the goal of producing practical guideline;**
- **with the goal of being better prepared for future epidemics (lessons learnt);**

Need for mapping epidemic prone areas

- requiring further analysis as part of stratification in order to prioritise realistic control options and response mechanisms;

Need for operational studies

- to identify cost-effective indicators to forecast, prevent and detect epidemics early;
- through existing Institutions or International organisms / partners;

Need to improve response capability of countries

- emergency funds,
- agreement with suppliers on the minimum stock available (drugs, insecticide, materials, etc.)
- establishment / maintenance of sub-regional stocks of emergency supplies

Other RBM TRN connections

- Situation analysis,
- Geographic mapping,
- Malaria control in complex emergencies

PARTNERSHIP & PARTICIPATION SINCE 1990:
IN INDONESIA

1. GOVERNMENT INSTITUTIONS:

- Transmigration
- Agriculture
- Tourism
- Public Works, etc

2. PRIVATE SECTORS:

- Batam - Bintan inclustries
- Timika (PT. Freeport) - Mining

3. NGO's:

- AusAid : East Nusa Tenggara
- ECHO : West Nusa Tenggara & East Kalimantan.
- MSF : Irian Jaya

4. COMMUNITY:

- Integrated Health Care Posts
- Village Drug Posts

5. MALARIA SCIENTIFIC WORKING GROUP:

- Ministry of Health
- Transmigration
- Armed Force
- NAMRU-2
- Universities.

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NTC(M)

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The Development and Use of a GIS based Surveillance System for Malaria Control for the South East Asian Region

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Surveillance is best defined as the collection of data for action. Surveillance is useful in monitoring disease trends, identifying risk factors, estimating diseases burden in a community, planning health services, allocating resources, monitoring and evaluation of programmes, and forecasting disease trends. In a good surveillance system it is essential that there is a two way transmission of information for effective action to be taken.

Geographic Information Systems (GIS) can be defined as a computer-assisted information management system of geo-referenced data (1). The term GIS has come to mean, variously, an industry, a product, a technology, and a science (2). It is seen as bounded, in a porous sense, by computer aided design (CAD), remote sensing, and relational database management systems (RDBMS). It has developed a great deal in the last 2 decades and can be used as an useful component of a surveillance system. Although originally developed for use by geographers, its applications have been constantly increasing and encompasses areas as varied as business to health. GIS can be used to capture and store spatial and attribute data, perform spatial analyses, and present data in map form. It can be used as a decision support system and has the potential to be extremely useful in disease control such as in malaria control which is community based and dependent on a number of host, vector and environmental factors.

In order to discuss the use of GIS as a component in the surveillance system for malaria control it is necessary that we first define the objectives of a surveillance system for malaria control and then see how GIS can be used to achieve them. The objectives of a surveillance system include

- detecting sudden changes in incidence of the disease,
- assisting in planning and implementing control measures,
- monitoring and evaluation of control measures, and
- forecasting epidemics.

GIS can be used to achieve each of these objectives both at the macro- and micro-epidemiological levels. For example, the mapping function of GIS can be used to identify and highlight high risk areas. In planning and implementing control operations GIS can be used to locate cases and high risk houses, and identify environmental risk factors that will assist in the choice of control measures to be used and resources required for implementation of the selected control measures. It can also be used in the monitoring and evaluation of control measures by its query ability to detect areas where control measures have not been successful as expected. The ability to demarcate areas which are epidemic prone is perhaps the most important feature of GIS as a component of a malaria surveillance system especially in this part of the world. In summary, GIS

can be used as an effective decision support system for malaria control as malaria itself is influenced by many environmental and geographic factors

The usefulness of a surveillance system will depend on the quality of data that is collected, the appropriateness of the information provided and the timeliness of the information to take necessary action. For a surveillance system to be effective we need

- reliable, valid and accurate data,
- data that is not outdated,
- the ability to process data quickly,

so that results will be available for timely action. Validity of data, which refers to the ability of the data measuring what is intended, is extremely important for a surveillance system to be able to generate useful information that can be used as a decision support system. It is, therefore, important that good indicators of malaria morbidity and mortality be identified. Reliability of data is important especially when one has to make decisions in terms of allocating resources. For example, if only part of the cases are reported as in the case where private practitioners do not report cases, is it justifiable to allocate resources only on data from Government institutions? Likewise, if the same criteria for diagnosis are not used by all or if the area of residence of the cases are not located accurately as when reporting is done by institution rather than the area of residence of the patient where (s)he would have contracted the disease, then comparisons would not be meaningful and would lead to a wastage of precious resources. It is essential that data that is being processed is not out of date and that there is a system that could process the data quickly. For example, in the case of malaria, if data is 2-3 months late and the system is not capable of processing the data quickly, the surveillance system would not be able to respond as expected in providing information for necessary action.

There are two important issues that should be addressed when establishing a surveillance system using GIS. Firstly, the spatial unit should be decided upon in advance. The selection of the unit should be based on

a) the value of the data of the unit for routine control purposes
b) the availability of data for the unit in other institutions, and
c) the likelihood of the boundaries of the unit changing in the near future.

Taking into consideration all of the above factors in Sri Lanka, as a pilot project, we have decided on a Grama Niladhari (GN) area, which is the smallest administrative unit in the country, as the spatial unit of analysis. A GN area comprises 2-3 villages and has a population ranging from 1000 to 3000. We considered it more appropriate to use a GN area as compared to a village as villages in Sri Lanka are not totally isolated collections of human dwellings like in other parts of the World but are scattered over a wide geographical area.

The second issue relates to the period of reporting. Would a monthly, fortnightly or weekly report be useful. Due consideration has to be given as to the uses of the information system. If the system is to be used for short term predictive purposes then probably weekly or fortnightly returns will be essential. Besides it would be easier to adopt a system that would comply with one that is already in existence.

Information such as climate and irrigation data from sectors other than the health sector, which usually have their own routine information systems, is necessary for a GIS based surveillance system which would assist in planning and implementation of malaria control programmes. Therefore, for optimal utilisation of information without unnecessary duplication, there should be close collaboration between all sectors. A common spatial unit that can be used by all sectors should be decided upon.

A substantial amount of data required for GIS based surveillance system for malaria control can be obtained from sectors other than health. Such data is routinely collected for other purposes and we do not have to collect these data specifically for purposes of setting up the information system. These data include census information, land use, agriculture and irrigation data, climate data including rainfall and temperature etc. Some of these data will be constant for long periods of time such as census which is estimated once a year and crop cultivation patterns which change from the rainy season to the dry season. The frequency of the other information like rainfall, temperature and river flow data will be required on the same basis as the malaria incidence data to develop predictive models. Therefore, it is evident that there has to be close cooperation between the health sector and other sectors. Setting up of such an integrated information system will not only assist in the planning, implementation, monitoring and evaluation of health services but will also be of use for other development work in the area.

In addition to making use of routinely collected data by other departments, ideally, specific data will also have to be collected for an information system for malaria control. These would include data such as parasite and vector sensitivity testing and entomological data. However, if entomology which requires a lot of resources including both human as well as financial is not possible we could use proxy measures such as rainfall, temperature and humidity that are strongly correlated with parameters such as vector abundance for predictive purposes.

Valid and reliable data alone are not sufficient for developing an effcient and effective surveillance system. The data has to be processed and analysed to give rise to a decision support system that will provide relevant information in a timely manner. Three questions we have to ask ourselves are

- Can we set up a system that would help us in deciding which option to use when?
- Can we set up a system that would help us to show vulnerable areas?
- Can we set up a system that will be able to predict disease patterns?

The answers to all the questions are in the affirmative.

A GIS based surveillance system for malaria control for the South East Asian region

The Need

Malaria is a major public health problem in the region and recent developments such as the spread of multi-drug-resistant strains of *Plasmodia* and development of vector resistance do not augur well for the future of malaria control in the region. Malaria eradication was attempted in most of the countries in the region in the 50's and 60's but eradication proved futile. Malaria in this part of the world is characterised by the presence of two species of malarial parasites, namely *P. vivax*

and *P. falciparum*, the management of each of which may differ in different countries. Epidemiologically, transmission of the disease is to a great extent determined by environmental factors such as climatic factors, which are beyond man's control, and hence, makes the region epidemic prone which has been witnessed in no uncertain measure throughout history. Factors affecting transmission are common to many countries in the region and a GIS based surveillance system will provide a basis for developing control strategies and combatting transmission based on experiences of one country being adapted to another. The existence of vectors that are common to a number of countries in the region makes a GIS based surveillance system important to study vector control strategies in a number of different epidemiological scenarios. The region is also afflicted with a number of man made scenarios which favour malaria transmission such as large scale population movements, war situations, and large scale development activities. In the case of large scale development activities, the ability of a GIS based surveillance system to identify these high risk areas will, in addition to reducing the morbidity and mortality due to malaria, ensure the success of these projects in the future.

Feasibility

Due to implementation of eradication programmes in many countries of the region, there exists an extensive infrastructure for surveillance, the potential of which can easily be exploited. Unfortunately the existing surveillance systems are ones that were used during the eradication era during which blanket residual insecticide spraying of houses were carried out and have not been modified for control purposes. The modifications of the existing surveillance systems that are needed are trivial and can easily be accomplished.

The advances in computer and information technology during the last two decades provides us with the luxury of having sophisticated computers at an affordable price, and of being able to transfer large amounts of data and information at the click of a button. The availability of such technology and computer literate personnel in all countries in the region would ensure the success of a GIS based surveillance system.

A GIS based surveillance system is currently being developed at the Malaria Research Unit, University of Colombo, Sri Lanka and has shown much potential. It would not be vey difficult to extend the programme to other countries as well.

Expected Output

The expected outputs can be summarized as follows:

Identification of high risk areas
An important output of a GIS based surveillance system is the ability to identify high risk areas in order to target control measures optimally and effectively.

Assist in choice of control programme, programme planning and implementation
As a GIS based surveillance system is expected to be a decision support system it can provide information on the feasibility of implementing a particular control strategy depending on the

applicability and effectiveness of the control strategy and available resources, and assist in programme planning and implementation by identifying necessary resources.

Monitoring and evaluation of control programmes
As the surveillance system will analyse data it can be used to monitor and evaluate control programmes.

Prediction of epidemics
With the development of mathematical models and their incorporation into the system it will be possible to use the surveillance system for forecasting purposes.

Expected benefits

A GIS based surveillance system for malaria control for the region is bound to be of immense benefit for malaria control in the region. The more important benefits are summarized below:

An uniform data collection structure
An uniform data collection structure would enable valid comparisons among different countries and regions being made. The ensuing analyses will ensure decision making with regard to distribution of funds and resources being evidence based. This would be a very important guide to international agencies such as WHO.

Timely results
As stated earlier for any surveillance system to be effective it should provide timely results so that necessary action could be taken. The use of sophisticated computers would drastically reduce the time taken for manual analyses and human errors. Use of GIS would be useful in identifying high risk areas that can be targeted for control operations.

Capacity building
Establishment of an effective surveillance system would strengthen individual member country's capacity to control malaria and to predict and deal with outbreaks of malaria.

Fostering inter-country collaboration
The establishment of a surveillance system for the region would provide the forum and the opportunity for member countries to share their experiences and apply control measures in an organised and coordinated manner.

Forecasting malaria epidemics
With collection of data and development of mathematical models it will be possible to forecast future trends in disease incidence. This will be of paramount importance in being prepared for such an eventuality, and containing and controlling unexpected outbreaks of malaria.

Evidence based decision making
The proposed surveillance system will involve evidence based decision making and as a result would ensure that limited resources are used optimally.

Reduction of malaria morbidity and mortality
As a consequence of all of the above a significant reduction in malaria morbidity and mortality is expected.

The functions of a resource network

The development and establishment of a GIS based surveillance system for malaria control can be accomplished by a resource network. The functions of a proposed resource network for surveillance for malaria control can be broadly categorised as follows:

Developing software
The resource network should coordinate all activities of member countries and develop suitable software. The software, though having basic capabilities, should be amenable to individual country requirements as well.

Training personnel
The resource network should be responsible for training of personnel in member countries on the use and application of the surveillance system.

Providing technical assistance
The network should be able to provide technical assistance on all aspects of the surveillance system including data collection, computer hardware and software and accomodating individual member country requirements.

Assisting control programmes
The ultimate aim of such a system is to assist control programmes. Thus, the network should provide necessary information to control programmes in order to make decisions based on sound scientific evidence.

Conducting research
With the large volume of data that is to be collected and analysed there is an enormous potential for operational research to be carried out. The network could act as a liaison between member countries and facilitate and assist research projects. This will have tremendous impact for the region as a whole as a forum will be established for member countries to share their experiences and formulate a coordinated strategy for malaria control.

Developing mathematical models
As a consequence of research suitable mathematical models that can predict trends in disease incidence can be developed. The network can assist member countries in developing such models.

How could Roll Back Malaria get involved?

Roll back malaria can establish a resource network for surveillance for malaria control in the region and will have to be involved with the following:

- Developing a common data collection format
- Developing software
- Providing necessary equipment
- Training of personnel
- Providing resources for conducting operational research
- Developing evidence based guidelines on malaria control strategies
- Providing management training for managers at all levels

Development of a GIS based surveillance system would form an integral component of the Roll Back Malaria programme in Asia given the wealth of information such a system can provide and be a evidence based decision support system for control programmes.

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LESSONS LEARNT FROM THE RECENT EPIDEMICS WITHIN THE REGION

THE NEPAL EXPERIENCE

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Department of Health Services
Ministry of Health, Nepal

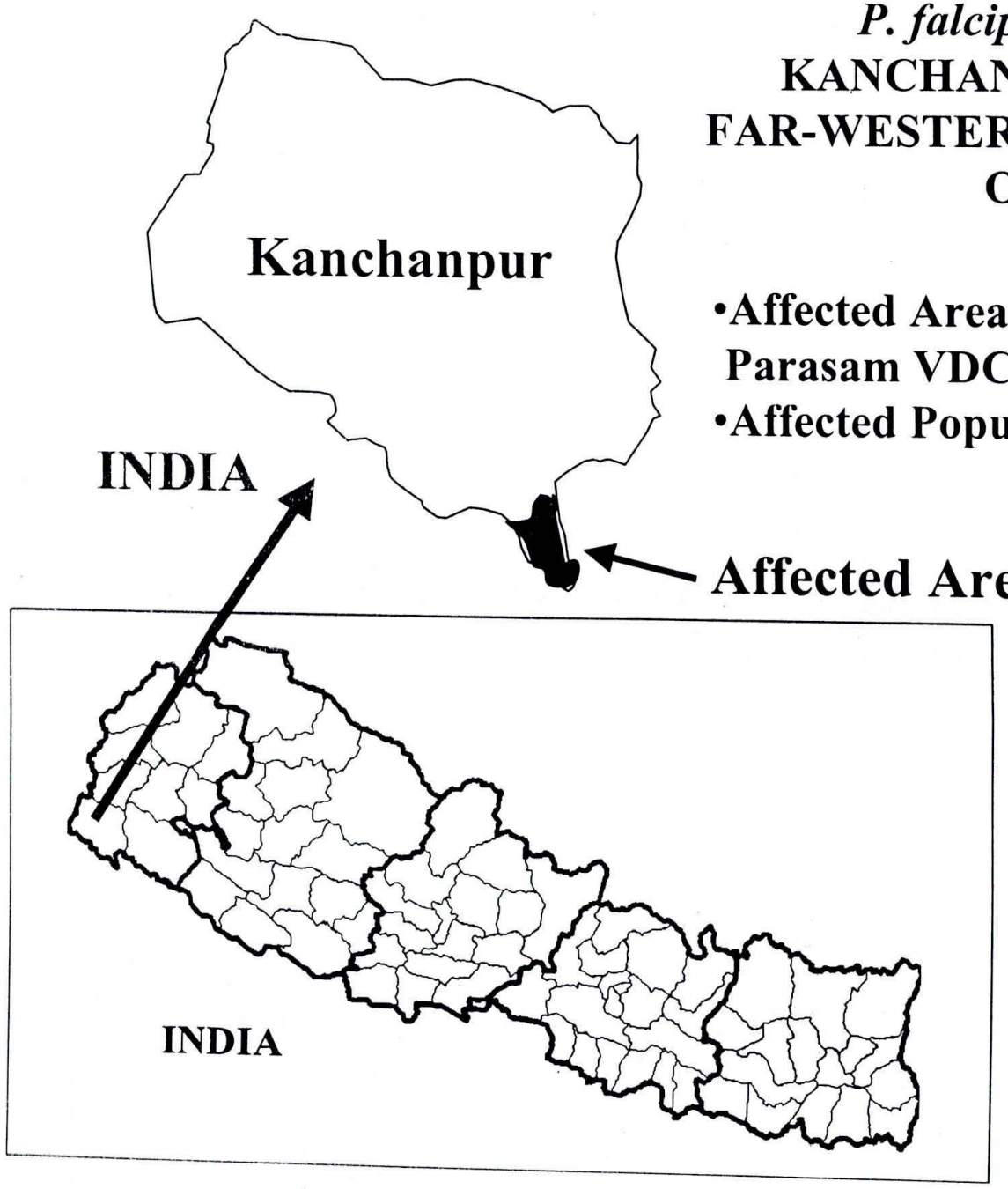
MALARIA SITUATION (I)

- Low annual malaria case load
  (9,000-10,000 cases/annually)

- 90% *Plasmodium vivax*
  10% *Plasmodium falciparum*

- Underreporting?
  SPR > 5%, BER low

P. falciparum OUTBREAK IN KANCHANPUR DISTRICT OF THE FAR-WESTERN DEVELOPMENT REGION OF NEPAL (1996)



- **Affected Area: 5 Villages of Tribhuwan Basti, Parasam VDC Sub-Health Posts**
- **Affected Population: 4,406**
- **Slides examined: 2,594**
- **Slides positive: 727 (88% *P. Falciparum with 8% severe malaria*)**
- **15 deaths reported**
- **Ecology: Forest fringe of outer terai bordering with India (UP), Lakhimpur Khiri district**

MALARIA SITUATION (II)

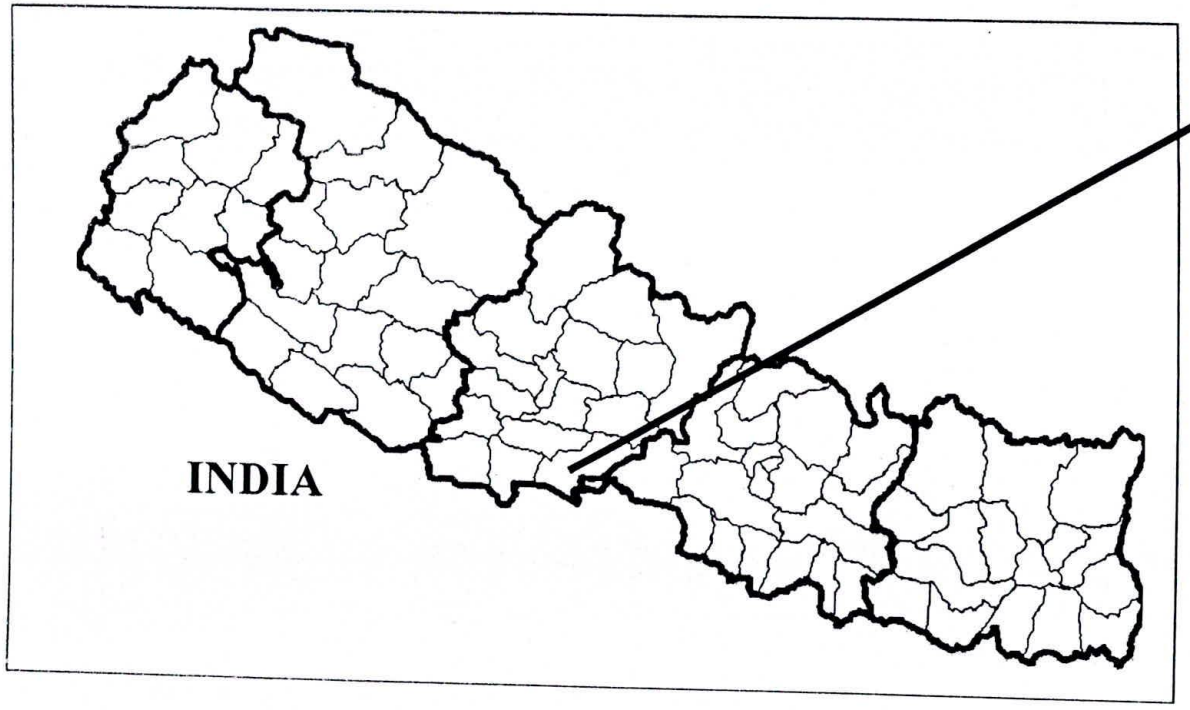
- Periodic focal outbreaks almost every year resulting in few deaths

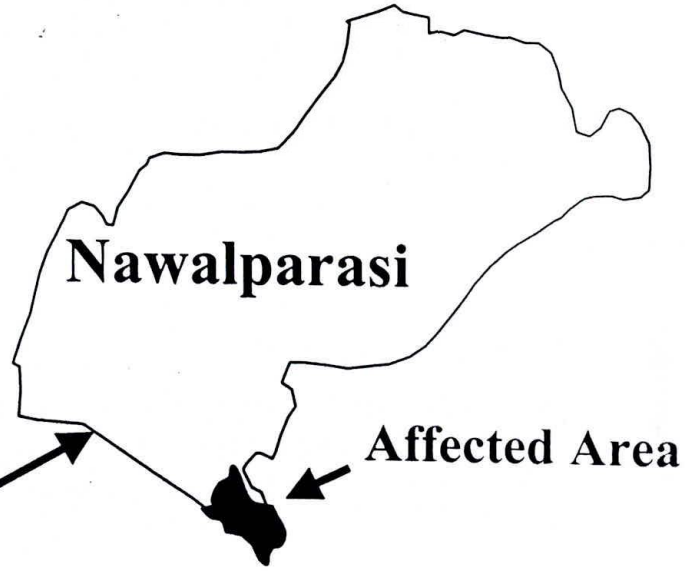
- Preponderance of *P. falciparum* (>65%) in outbreak areas

- Inadequate response to Sulfadoxine-Pyrimethamine treatment in epidemic foci

P. falciparum OUTBREAK IN NAWALPARASI DISTRICT IN THE WESTERN DEVELOPMENT REGION (1997)

- Affected Area: 3 VDCs of Pratrappur HP
- Population Affected: 18,756
- Slides Examined: 3,019
- Slides Positive: 1,045 (64% *P. falciparum*)
- Deaths: 2 deaths reported

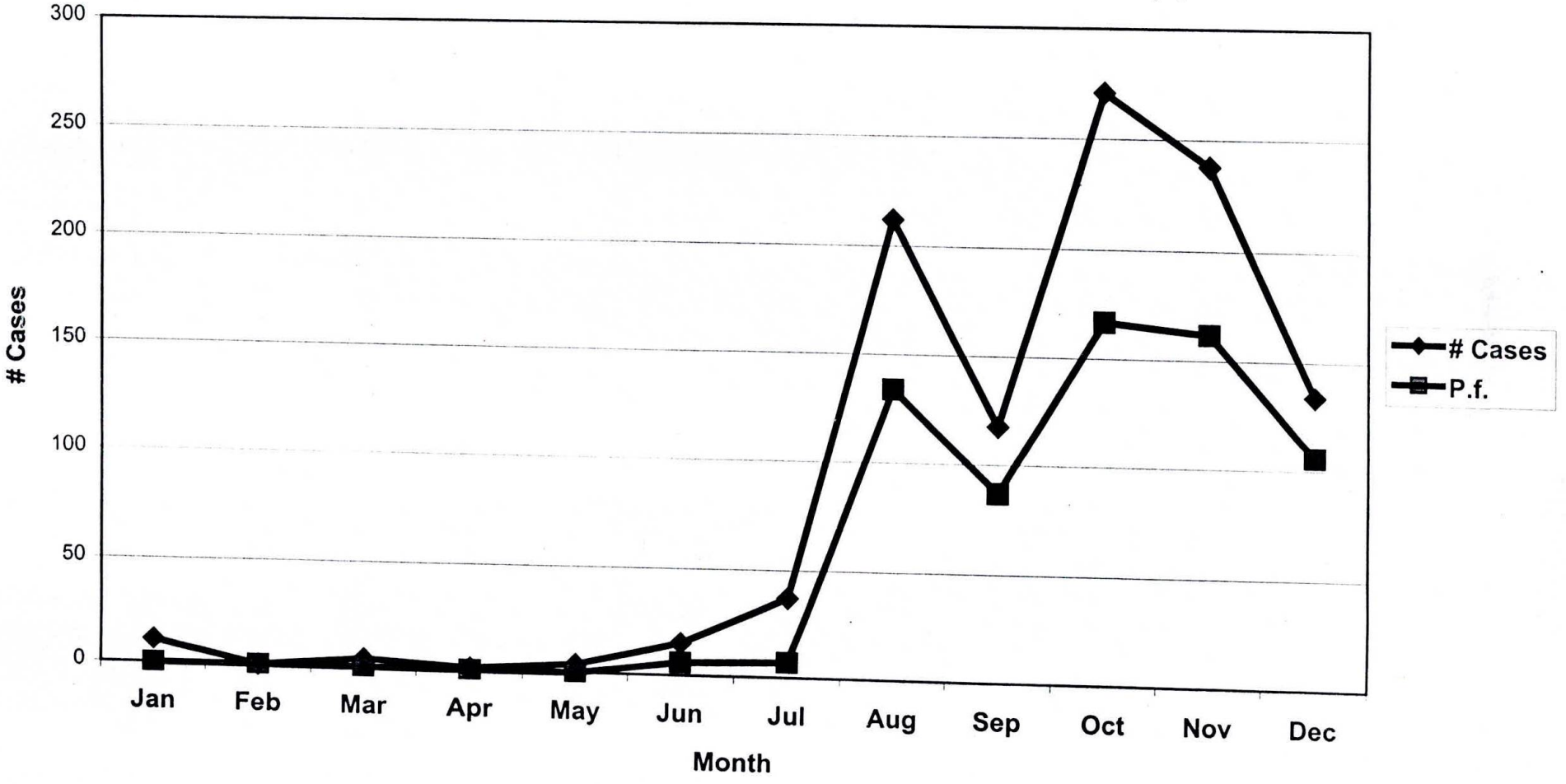




INDIA

- Ecology: Forest fringe; rice ecosystem with extensive network of irrigation channels, and presence of marsh land

Monthly Distribution of Malaria & P. falciparum Cases in Outbreak Area. Nawalparasi District, 1997.



DEVELOPMENT OF TOOLS FOR PREVENTION AND CONTROL OF EPIDEMICS (II)

<u>To be strengthened</u>:

1. Rapid Response Teams (RRTs) at district and regional levels

2. Epidemic Preparedness: buffer stock of drugs/equipment inventory in pre-epidemic season

3. Awareness on early warning signals among health staff and community

4. Clinical case definitions

5. Strengthening laboratory services at district level

6. Monitoring of therapeutic efficay of anti-malarials in use

IMPACT OF THE OUTBREAKS:

- **Population at Risk: Impoverished marginalized people of rural area who also suffer from other health conditions like malnutrition, concurrent bacterial and parasitic infections and infestations, compromising the immune system of the population at different levels.**

- **Death toll is low but politically sensitive**

- **Socio-economic burden on the community may have been subtantial**

CONTROL MEASURES

- Notification of the outbreak
- Parasitological &Entomological Investigation
- Immediate Vector Control (IRS)
- Decentralization of Laboratory facilities to the focal outbreak area
- Mass Drug Administration (MDA)
- Intensified case detection and prompt treatment
- Drug sensitivity testing
- Prompt recording and reporting

INSTALLATION OF SURVEILLANCE FOR PREVENTION OF RECURRENCE

- Follow-up surveillance of epidemic stricken areas for long term (ED/PT)
- Fever referral mechanism (severe cases to the hospital)
- Rational anti-malaria drug use training for health personnel
- Regular recording and reporting
- Supervision and monitoring

DEVELOPMENT OF TOOLS FOR PREVENTION AND CONTROL OF EPIDEMICS (I)

Existing:

1. Health Management Information System (HMIS): Health facility based

2. Early Warning Reporting System (EWARS): Sentinel, hospital based

PREDISPOSING FACTORS

- Migration to adjacent endemic areas
- Inadequate or not well organized surveillance system
- NO IRS activities for the last 5 years previous to the epidemics as there were NO cases of *P. falciparum* in affected areas
- untimely, or lack of, treatment
- inaccurate collection of information
- Ecology and physical environment

Malaria indicators used in SEA Region and the need for better standardization.

The problem

Since 1969, when the global strategy changed from eradication to control, to today's drive for the development of an integrated health service delivery strategy for children and adults, public health surveillance practices of the malaria eradication era have remained in place in various countries because of their wide spread use and acceptance for more than 30 years, and their relative simplicity and broad comparability.

As control strategies have modified, fragmented and adapted to local requirements and circumstances emphasis has shifted from the need to collect and analyze information at the central level for a vertical/categorical project to the need to define and use information that is more responsive to local needs in an integrated fashion.

There no longer is one definite single answer to all malaria problems i.e. eradication, rather local solutions are being developed for local problems. However this gradual and flexible approach to malaria control has yet to adopt a minimum set of common **SCDIs** able to ensure valid and meaningful comparisons between areas, countries and regions.

Standardized data are required on morbidity, mortality, efficacy of treatment with focus on clinical outcome of severe malaria and treatment failure malaria cases, drug consumption and the quality and coverage of health services and their reporting.

Core **SCDIs** relate to the first element of surveillance *to describe and measure the distribution of the disease malaria* in all situations and monitor the **impact, outcomes and process** of carrying out antimalarial activities. **These indicators and related case definitions will be the focus of this presentation.** Mention will be made of others as well. Core **SCDIs** are the "minimum interface requirement" in surveillance to ensure meaningful comparisons. Depending on the level of expertise and resources available to programs much more can and should be done depending on local needs.

Malaria Indicators and the present situation in SEA countries.

Malaria blood slide results and indicators have been at the center of the malaria eradication strategy worldwide and still are at the center of the malaria indicators used in SEA countries. The justification for this is enshrined in the definition of epidemiological surveillance adopted in malaria eradication programs.

Epidemiological surveillance consisted in "the detection of cases through a screening mechanism of the whole population; the screening criterion is the presence of fever, which leads to the microscopic examination of the blood of every subject having fever or having recently had fever". The cases found to have parasites in the blood were submitted to follow up and radical treatment while presumptive treatment with a single dose of chloroquine to suspicious "fever" cases was given at the moment of taking the blood.

Based on the above two main eradication mechanisms have been developed for blood slide collection:

Active Case Detection (ACD), that is "the process of case-finding by visiting at monthly intervals all houses in a designated area and taking blood specimens of any inhabitants who have, or have recently had, fever."

Passive Case Detection (PCD) defined as; "the finding of malaria cases through notification by medical personnel to whom fever cases and other suspected cases are reported."

Elements of both mechanisms (+ MBS, APCD) are still being implemented in the countries of SAE region. Blood slide results are normally pooled together for countrywide analysis.

Ref: Table I - MALARIA PROFILE OF SEA REGION 1970-1997
Blood Slide Results and Indicators

Malaria indicators used in SEA Region and the need for better standardization.

Blood Slide Based Indicators

Ref: Table I

Malaria POP.	:Mid-year estimates
BSE	:Blood Slides Examined
POSITIVES	:Microscopically diagnosed malaria positive slides.
Pf Cases	:Plasmodium falciparum infections (including mixed falciparum and vivax infections)
ABER	:Annual Blood Slide Examination Rate (Total Blood Slide Examined during a year over whole country population, expressed as a % rate).
SPR	:Slide Positivity Rate (Positive per hundred slides examined)
API	:Annual Parasite Incidence (Malaria positive slides per thousand population)
Pf %	:Pf infections per hundred malaria positive slides

Much of the rationale for the above indicators rests with the eradication strategy. In fact the laboratory component of the general health services has continued to act as the guardian of eradication gains and in so doing traditional eradication screening criterion have been maintained, long after the eradication strategy has been abandoned.

Table-I

MALARIA PROFILE OF SEA REGION, 1971-1997

Blood Slides Results and Indicators

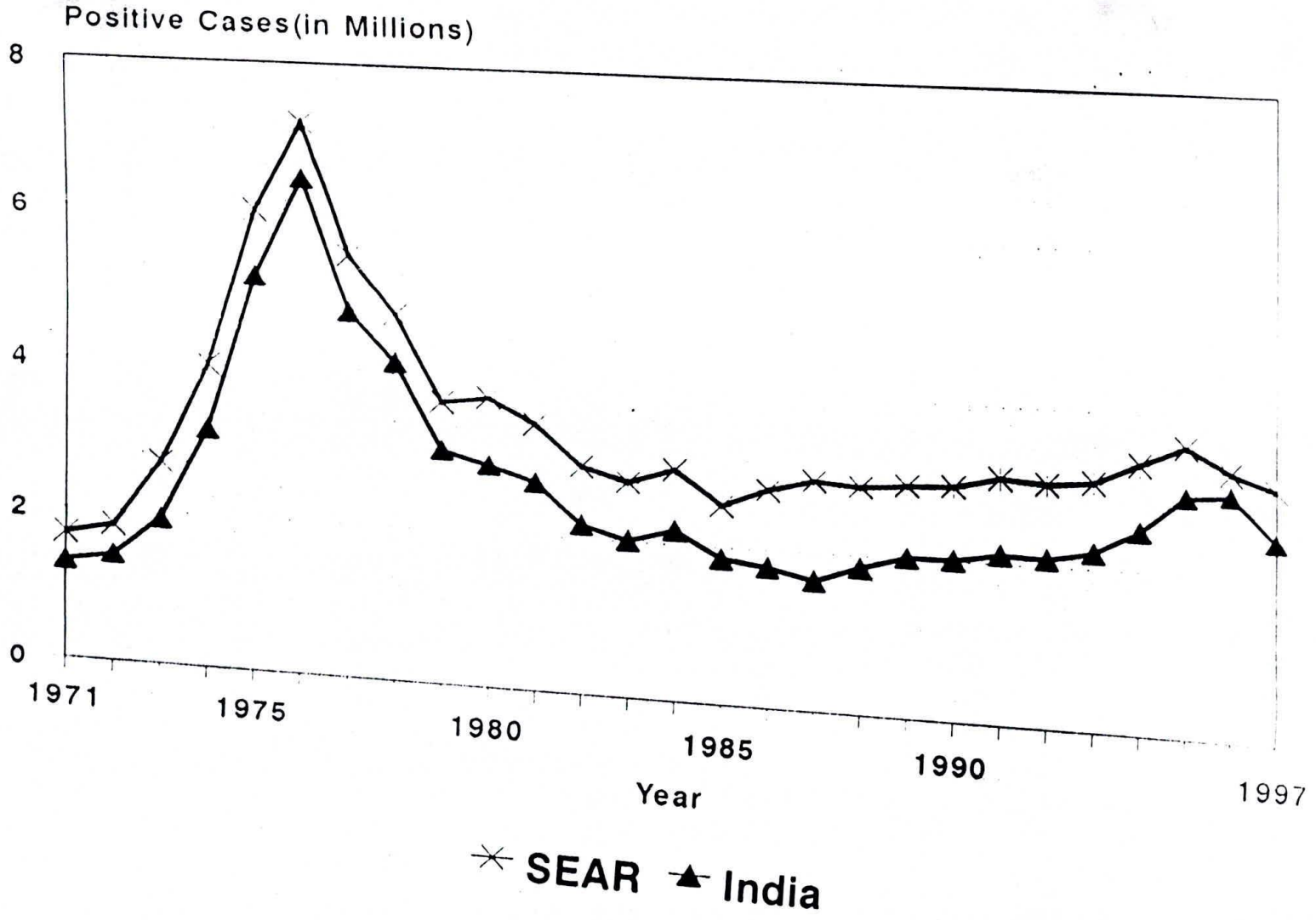
Year	Mal.Pop.	BSE	Positives	Pf Cases	ABER	SPR	API	Pf%
1971	743 227 000	55 385 967	1 688 466	309 709	3.05	2.27	0.56	18.34
1972	759 880 000	61 321 374	1 815 717	306 134	2.96	2.39	0.50	16.86
1973	782 629 000	59 863 554	2 684 969	514 750	4.49	3.43	0.86	19.17
1974	796 617 000	61 934 964	3 996 360	782 674	6.45	5.02	1.26	19.58
1975	806 398 000	69 992 611	6 024 143	1 042 634	8.61	7.47	1.49	17.31
1976	821 561 000	74 152 031	7 225 798	1 011 388	9.74	8.80	1.36	14.00
1977	839 408 000	73 400 856	5 488 999	709 776	7.48	6.54	0.97	12.93
1978	868 113 000	77 123 223	4 738 386	804 132	6.14	5.46	1.04	16.97
1979	939 458 000	78 348 432	3 681 406	801 360	4.70	3.92	1.02	21.77
1980	965 212 000	86 887 747	3 762 465	995 508	4.33	3.90	1.15	26.46
1981	901 348 000	79 135 272	3 461 918	972 403	4.37	3.84	1.23	28.09
1982	1 018 191 000	87 119 214	2 957 065	945 995	3.39	2.90	1.09	31.99
1983	1 043 780 000	86 421 840	2 782 292	901 977	3.22	2.67	1.04	32.42
1984	1 074 281 000	88 245 873	2 983 783	997 166	3.38	2.78	1.13	33.42
1985	1 098 409 755	90 662 396	2 564 448	857 607	2.83	2.33	0.95	33.44
1986	1 118 931 460	89 829 239	2 785 499	959 574	3.10	2.49	1.07	34.45
1987	1 142 664 814	94 653 815	2 944 302	1 070 846	3.11	2.58	1.13	36.37
1988	1 163 622 000	96 950 553	2 899 713	1 106 550	2.99	2.49	1.14	38.16
1989	1 187 290 000	93 267 092	2 951 269	1 149 034	3.16	2.49	1.23	38.93
1990	1 203 149 301	94 782 014	2 973 143	1 147 667	3.14	2.47	1.21	38.60
1991	1 184 284 680	94 939 029	3 109 771	1 283 587	3.28	2.63	1.35	41.28
1992	1 193 830 819	96 819 343	3 070 406	1 241 641	3.17	2.57	1.28	40.44
1993	1 210 112 233	93 518 816	3 119 182	1 179 360	3.34	2.58	1.26	37.81
1994	1 176 523 896	96 009 101	3 370 069	1 299 343	3.51	2.86	1.35	38.56
1995	1 196 168 676	95 878 683	3 622 595	1 412 713	3.78	3.03	1.47	39.00
1996	1 225 374 251	102 354 933	3 709 118	1 417 413	3.62	3.03	1.38	38.21
1997*	1 100 395 333	91 916 453	3 131 194	1 154 571	3.22	2.69	1.26	39.03

* : Provisional

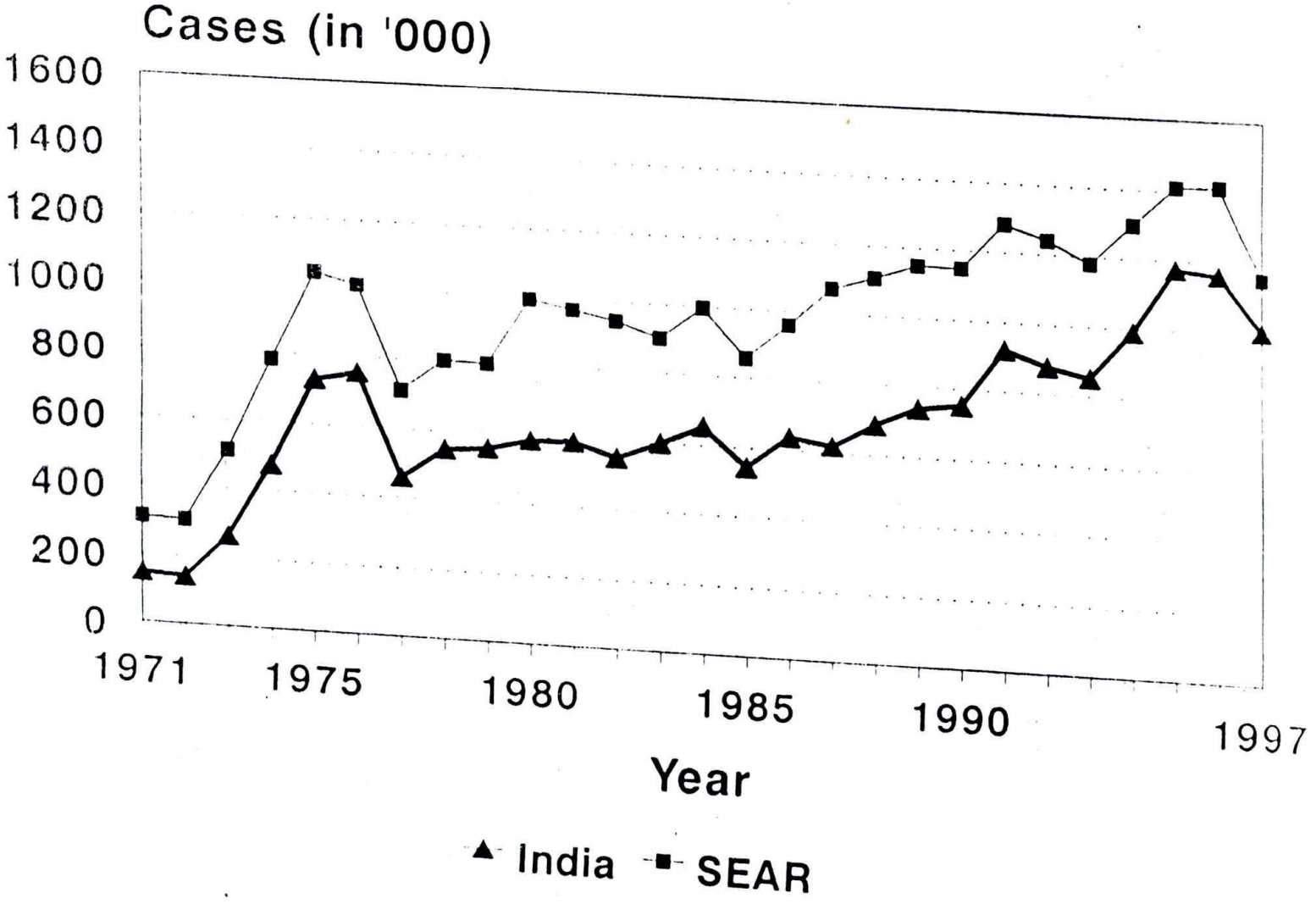
MALARIA PROFILE OF INDIA, 1971-1997
Blood Slides Results and Indicators

Year	Mal.Pop.	BSE	Positives	Pf Cases	ABER	SPR	API	Pf%
1971	535 000 000	40420000	1322398	148683	7.56	3.27	2.47	11.24
1972	547 000 000	42800000	1428649	142177	7.82	3.34	2.61	9.95
1973	559 000 000	42450000	1930273	265154	7.59	4.55	3.45	13.74
1974	568 000 000	45450000	3167658	476922	8.00	6.97	5.58	15.06
1975	571 000 000	51820000	5166142	729251	9.08	9.97	9.05	14.12
1976	575 000 000	55980000	6467215	753713	9.74	11.55	11.25	11.65
1977	587 000 000	57010000	4740930	461484	9.71	8.32	8.08	9.73
1978	609 000 000	60460000	4144305	548567	9.93	6.85	6.81	13.24
1979	625 000 000	61420000	3064697	558423	9.83	4.99	4.90	18.22
1980	643 000 000	67170000	2898140	588011	10.45	4.31	4.51	20.29
1981	658 000 000	67840000	2701141	589591	10.31	3.98	4.11	21.83
1982	678 000 000	65030000	2182302	551057	9.59	3.36	3.22	25.25
1983	689 000 000	64290000	2018605	600964	9.33	3.14	2.93	29.77
1984	710 000 000	66350000	2184446	655454	9.35	3.29	3.08	30.01
1985	726 000 000	68130000	1864380	545005	9.38	2.74	2.57	29.23
1986	737 000 000	67690000	1792167	639912	9.18	2.65	2.43	35.71
1987	753 550 000	72534799	1663284	620563	9.63	2.29	2.21	37.31
1988	766 921 000	75698256	1854830	688354	9.87	2.45	2.42	37.11
1989	782 259 000	71580000	2017823	740319	9.15	2.82	2.58	36.69
1990	800 000 000	74420000	2018783	755240	9.30	2.71	2.52	37.41
1991	801 660 000	75158681	2117460	921214	9.38	2.82	2.64	43.51
1992	824 016 000	78531151	2099154	879383	9.53	2.67	2.55	41.89
1993	832 616 000	77941025	2207431	852763	9.36	2.83	2.65	38.63
1994	861 723 000	82179407	2511453	990508	9.54	3.06	2.91	39.44
1995	878 957 000	85133349	2988231	1173599	9.69	3.51	3.40	39.27
1996	905 712 000	91536450	3035588	1179561	10.11	3.32	3.35	38.86
1997*	884719 000	84905988	2457127	930421	9.60	2.89	2.78	37.87

Laboratory Confirmed Malaria Posi ive Cases
WHO SEA Region & India 1971-1997



P.falciparum Laboratory Confirmed Cases WHO SEA Region & India, 1971-1997



Limitations of blood slide based indicators and related reporting practices.

- Laboratory resources have traditionally worked independently from the clinical needs of the patients as blood slide taking and examination has remained divorced from the provision of prompt and complete treatment to sick patients, with slide results often becoming available too late for treatment. (All programs measure backlog in slide examination in weeks not days)

- The Positive/Negative characteristic of slide results reporting cannot differentiate on the degree of severity (SM) or drug response (MTF) to antimalarials. This data has become essential to the stated program objective calling for a sustained reduction in malaria morbidity and mortality.

- Malaria deaths are clinical events and traditionally unrelated to laboratory reporting. For this reasons mortality data in the past are often missing or incomplete. Mortality data are now crucial and their accurate reporting needs alternative surveillance channels.

- Only a fraction of people sick with malaria are tracked through the laboratory reporting system. Most cases are invisible as they are treated on clinical grounds only. They will remain so until clinical practice and its reporting is brought into the surveillance system.

- Changes in slide collection mechanisms due to decreased outreach, limited supervision, and selective application of ACD and PCD are not easily reflected in the population denominator. This has created problems in ensuring comparability across time of indicators that were originally meant to be applied to entire populations being brought under eradication or control operations (e.g. ABER).

- Laboratory data have become of very limited use to help define antimalarial drug consumption and requirements as treatment regimens have multiplied with the spread of drug resistant strains and emphasis on morbidity control.

Better standardization of "core malaria indicators"

Drawing upon the latest recommendations of the 20th report from the WHO Expert Committee on Malaria, there is renewed agreement that a minimum set of **SCDIs** needs to be defined, endorsed and applied on a routine basis to malaria control programs world wide. To do so changes are required in the surveillance system of the countries of SEA Region. However even if changes are few in number they are not incremental i.e. they cannot be simply added to the present slide based reporting system. Their adoption and implementation is a **very major change** to the present surveillance system.

Core **SCDIs** should be moulded or built around existing health care and surveillance systems with clinical practice and clinical outcomes at the center of the reporting system in combination whenever possible, with blood slide results and indicators.

Formal and explicit links need to be established, between malaria laboratory reporting practices and reporting from health care providers responsible for patients for whom the usefulness of recording and reporting the disease is subordinated to successfully managing the disease in individual patients and documenting clinical outcomes.

Malaria indicators and the RBM Initiative

SCDIs are needed at all stages of the RBM Initiative to inform policy makers, planners, managers and all stakeholders and partners engaged in the movement and in particular during:

- in country consultations,
- situation analysis and needs assessment at various levels
- regular annual reviews

Core Standard Case Definitions and Indicators (SCDIs)

Case Definitions

Uncomplicated Malaria	UM
Severe Malaria	SM
Malaria Treatment Failure	MTF

Impact Indicators

- Morbidity attributed to malaria

a) number of cases of UM (clinical/confirmed) among target groups/unit population

b) number of cases of SM (clinical/confirmed) among target groups/unit population

c) number of MTF/per number of treated patients. Reported according to each drug used

- Mortality attributed to malaria

a) number of malaria deaths (clinical/confirmed) among target groups/unit population

b) proportion of clinical/confirmed deaths due to malaria among patients with SM admitted to a health facility

Outcome/Process Indicators

- Availability of antimalarial drugs (% of health facilities reporting no rupture of stock of antimalarial drugs during last 3 months)
- Reporting coverage (% of districts regularly reporting the above to the national programme on a monthly basis for the last 12 months)

Additional Indicators

- API
- Use of ITMN
- Performance of mothers/carers
- Protection of pregnant women
- Preparation for malaria epidemics
- Interdomiciliary spraying of insecticides
- Laboratory diagnosis
- Presence of foci of transmission

Malaria indicators used in SEA Region and the need for better standardization.

Core Malaria Indicators in P. falciparum endemic areas. Cox's Bazaar District - Bangladesh (A case study)

MALARIA RATE/1000 POPULATION (MR/1000) = $\frac{\text{Total No. of Malaria Cases}}{\text{Total Population}} \times 1000$

This rate per thousand population looks at the number of sick people seen at your health institution who are diagnosed as being sick because of malaria over the total number of people living in the area served by your health institution. The population (i.e. the denominator) of your Thana Health Complex should consider both the Thana Population (official figure) + the Catchment Area Population = Total Population.

UNCOMPLICATED MALARIA RATE (UMR) = $\frac{\text{No. of UM Cases}}{\text{Total N. of Malaria Cases}} \times 100$

This rate gives you, as a percentage, the proportion of sick people seen at your health institution who are diagnosed as being sick because of Uncomplicated Malaria.

TREATMENT FAILURE MALARIA RATE (TFMR) = $\frac{\text{N. of TFM Cases}}{\text{Total N. of Malaria Cases}} \times 100$

This rate gives you, as a percentage, the proportion of sick people seen at your health institution who are diagnosed as being sick because of TFM. These patients come back within a month after receiving a full course of anti-malarials.

Information for action

The TFM rate is very important because it gives you an indication of how serious is the problem of drug resistant malaria among the people living in your area. If you compare your TFM Rate month by month you will be able to notice changes and understand if the TFM situation is stable, improving or getting worse. TFM patients can be both Outpatients or Inpatients. In addition to calculating the TFM rate you should also check and compare your monthly actual number of TFM cases recorded as Inpatients and Outpatients. An increase in the number of TFM cases recorded as Inpatients is a very serious situation. It tells you that your malaria patients are coming back for additional treatment and are coming back in a serious condition that requires admission! This situation is serious and you need additional help to investigate what is happening. Inform your supervisor and seek advice from your District Civil Surgeon Office.

SEVERE MALARIA RATE (SMR) = $\frac{\text{No. of SM Cases (inpatients)}}{\text{Total N. of Malaria Cases}} \times 100$

This rate gives you, as a percentage, the proportion of very sick people admitted into your health institution who are diagnosed as being sick because of Severe Malaria.

Information for action

Whenever this rate goes up you may expect deaths due to Malaria also to increase. You may be facing a new very serious situation and this finding requires your urgent attention. Inform your supervisor and seek advice from your District Civil Surgeon Office. Also try to find out more about those patients:

- Who are those people becoming sick?
- How old are they?
- Where do they come from?
- Is the Malaria Rate also going up?
- Is this a malaria outbreak?

NOTE: You should remember that the percentage sum of the three rates always gives you a total of 100% (for example, UMR 80% + TFMR 18% + SMR 2% = 100%).

From *(21) Malaria Diagnostic Treatment and Recording Charts. A training module for Medical Officers. Tnal Edition.* Malaria and Parasitic Disease Control (M&PDC) Unit. DGHS, Dhaka. 1997.

MALARIA SURVEILLANCE DATA & INDICATORS 1995-97
COX'S BAZAAR DISTRICT (POP 1.5 M) BANGLADESH

YEAR	1995	1996	1997
Total Population	1,383,158	1,456,964	1,555,347
Total Slide Collected	80,141	79,225	55,976
Total Slide +ve Slide Positivity Rate **(SPR)**	24,540 (30.6%)	22,577 (28.5%)	11,280 (20.15%)
Total P. falciparum Slide +ve P.falciparum Rate (%)	15,385 (62.7%)	12,686 (56.2%)	6,665 (59.1%)
Total No. Patients (In + Outpatients)	467,337	565,200	618,052
Total Malaria Clinical Cases **TMCC** (100%)	40,437 (100%)	46,326 (100%)	37,463 (100%)
Malaria Rate **MR** TMCC/1000 Population	29.2/1000	31.8/1000	24.0/1000
Uncomplicated Malaria **UM** **UM Rate (%)**	32835 (81.2%)	37,799 (81.6%)	31,214 (83.3%)
Severe Malaria **SM** **SM Rate (%)**	4,574 (11.3%)	5,389 (11.6%)	3,518 (9.4%)
Treatment Failure Malaria **TFM** **TFM Rate (%)**	3,028 (7.5%)	3,138 (6.8%)	2,731 (7.3%)
Total Malaria **Deaths** **Case Fatality Rate (%)**	278 (6%)	234 (4.3%)	110 (3.1%)
Ratio of Slide Collected to Total Malaria Clinical Cases	1.98	1.71	1.49
Ratio of Total Malaria Clinical Cases TMCC to Total Slide +ve. (**Positive Predictive Value-PPV** of TMCC definitions with Total Slide +ve as true standard. Expressed as %)	1.65 (60.7%)	2.05 (48.7%)	3.32 (30.1%)

Conclusion

There is a need to develop and learn a new, basic, essential, shared epidemiological language to describe malaria trends and events in a manner that is consistent with the stated common, primary objectives and interventions of malaria control programs.

This language must be able to link in a meaningful way with the slide based reporting system.

We need:

- An alphabet = case definitions
- A grammar = indicators
- A single set of sounds & pictures = graphs & charts

To talk to each other in a more meaningful way.

References:

1) **Declich, S. & Carter, A.O.** Public health surveillance: historical origins, methods and evaluation. *Bulletin of the World Health Organization*, 1994, 72(2): 285-304.

2) *Implementation of the Global Malaria Control Strategy: report of a WHO study group on the implementation of the global plan of action for Malaria control.1993-2000.*Geneva, World Health Organization, 1993 (WHO Technical Report Series, No. 839).

3)*WHO Expert Committee on Malaria.* Twentieth Report (Draft), Geneva, World Health Organization, 1998.

4) *Terminology of Malaria and of Malaria Eradication. Report of a Drafting Committee.* Geneva, World Health Organization, 1963.

Malaria indicators used in SEA Region and the need for better standardization.

LABORATORY CONFIRMED MALARIA CASES DETECTED IN BANGLADESH. 1963-1997

YR.	POPULATION	B.S.EXD	ABER %	+VE	API	SPR %	Pf	SFR	Pf %	DEATHS	
										Sus	Conf
1	2	3	4	5	6	7	8	9	10	11	12
1963	1895000	86345	4.56	402	0.21	0.47	89	1.10	22.14		
1964	8962000	474569	5.30	756	0.08	0.16	279	0.06	36.90		
1965	12035000	975918	8.11	649	0.05	0.07	85	0.01	13.10		
1966	21203000	1715771	8.09	3137	0.16	0.20	357	0.02	10.39		
1967	26874000	2485901	9.25	4080	0.15	0.16	1702	0.07	41.72		
1968	47002000	2988322	6.36	6244	0.13	0.21	3069	0.10	49.15		
1969	59444000	4880511	8.21	7871	0.13	0.16	2575	0.05	32.72		
1970	62810000	6107144	9.72	6660	0.11	0.11	3307	0.05	49.65		
1971	63570000	2212660	3.48	2944	0.05	0.13	1556	0.07	52.85		
1972	65220000	5311988	8.14	18384	0.28	0.35	6397	0.12	34.80		
1973	69288000	3259190	4.70	14007	0.20	0.43	8023	0.25	57.28		
1974	71565000	1884109	2.63	15855	0.22	0.84	10726	0.57	67.65		
1975	72730000	2929935	4.03	31247	0.43	1.07	19510	0.67	62.44		
1976	73930000	3537269	4.78	48844	0.66	1.38	28408	0.80	58.16		
1977	76395000	1414731	1.85	29673	0.39	2.10	12923	0.91	43.55		
1978	78916000	1391055	1.76	33326	0.42	2.40	6717	0.48	20.16		
1979	81520000	1374104	1.69	49776	0.61	3.62	10408	0.76	20.91		
1980	84210000	2634773	3.13	67707	0.80	2.57	22184	0.84	32.76		
1981	88100000	2338853	2.65	45902	0.52	1.96	15375	0.66	33.50		
1982	90300000	2808765	3.11	46781	0.52	1.67	19059	0.68	40.74		
1983	92200000	2516110	2.73	42529	0.46	1.69	17546	0.70	41.26		
1984	94300000	2552513	2.71	32977	0.35	1.29	14876	0.58	45.11		
1985	96400000	2823028	2.93	31050	0.32	1.10	16211	0.57	52.21		
1986	98000000	2685529	2.74	93128	0.40	1.46	21064	0.78	53.83		
1987	99800000	2771577	2.78	35848	0.36	1.29	20472	0.74	57.11		
1988	101500000	2704563	2.66	33824	0.33	1.25	21565	0.80	63.76	15	14
1989	103800000	3152310	3.04	50738	0.49	1.61	35780	1.14	70.52	110	103
1990	106100000	2444415	2.30	53875	0.51	2.20	34061	1.39	63.22	67	60
1991	109900000	2081137	1.89	63578	0.58	3.05	30282	1.46	47.63	62	156
1992	112100000	1919349	1.71	115660	1.03	6.03	51775	2.70	44.76	69	378
1993	114500000	1635589	1.43	125402	1.10	7.67	54973	3.76	43.84	136	383
1994	117000000	1661701	1.42	166564	1.63	10.0	81015	4.88	48.63	582	696
1995	119000000	1461556	1.22	152729	1.28	10.4	75860	5.19	49.66	647	742
1996	120000000	1146736	1.00	100864	1.00	8.80	54307	4.73	53.84	50	447
1997	124300000	955542	0.77	68594	0.55	7.18	42342	4.43	61.73	22	457

NOTE:

POPULATION	:	Mid-year estimates
B.S. EXD.	:	Blood Slides Examined
POSITIVES	:	Microscopically diagnosed malaria positive slides.
Pf	:	Plasmodium falciparum infections (including mixed falciparum and vivax infections)
ABER	:	Annual Blood Slide Examination Rate (Total Blood Slide Examined during a year over whole country population, expressed as a % rate).
API	:	Annual Parasite Incidence (Malaria positive slides per thousand population)
SPR	:	Slide Positivity Rate (Positive per hundred slides examined)
SFR	:	Slide Falciparum Rate (Pf. infections per hundred slides examined)
Pf %	:	Pf Proportion (Pf infections per hundred malaria positive slides).
Sus. Deaths	:	Laboratory confirmation of malaria not available.

Source: M&PDC Unit, DGHS

Malaria indicators used in SEA Region and the need for better standardization.

MALARIA CLINICAL CASE DEFINITIONS

- **Patient Assessment:**

The chart has a starting point at the top left corner, this is where you should always start when using the chart, specially at the beginning, when you are not familiar with its contents. Apply the same rules every time a patient comes back. This means that with each individual patient, no matter how many times he/she returns, always start from the top left corner to assess the patient. The patient assessment section takes you to four different possible diagnosis:

- Other diseases
- Uncomplicated Malaria (UM)
- Severe Malaria (SM)
- Treatment Failure Malaria (TFM)

Please note the following:

1. The first question to ask the patient is: "What is making you sick?"

First listen to the patient's complaints, then take a routine history and perform a routine physical examination. If you find no evidence of another disease, then ask yourself: "Is malaria the reason for the patient's sickness?"

2. When you decide that the patient's symptoms and signs suggest malaria as the main reason for the illness you must ask yourself:

- is it Severe Malaria (SM)? C.R.
- is it Treatment Failure Malaria (TFM)? C.R.
- is it Uncomplicated Malaria (UM)?

Severe Malaria needs urgent diagnosis and treatment. Decide whether the patient has severe malaria by checking for any of the clinical findings in the box:

unconsciousness
OR convulsion
OR unable to stand or walk
OR vomiting or severe diarrhoea
OR severe pallor (anaemia)
OR confused or abnormal behavior.

Any one or more than one of these features is a sign of Severe Malaria. However, when recording the diagnosis, it is important to find out whether the patient has already been properly treated for malaria in the past month. If this is so, then, this is also a case of Treatment Failure Malaria. To check carefully whether the patient has received a complete antimalarial course in the last month, ask:

"was a full course of antimalarial drugs given?",
"was correct dose for weight given?",
"was malaria treatment (i.e.chloroquine or fansidar tablets) definitely swallowed and not vomited?"

To be sure about these things, you have to ask the patient or guardian carefully. If the answer to any of the 3 questions about a previous antimalarial course is "no" then this means the course was not completed and therefore the return of the malaria illness is not due to treatment failure but due to inadequate treatment. Such a case is recorded as severe malaria. However, if the answer to the 3 questions is "yes", then this is a case of treatment failure malaria and it must be recorded as T.F.M. even though the patient has symptoms and signs of severe malaria and is going to be admitted. In the same way, a patient who does not have any of the symptoms or sign of severe malaria should also be checked to find out whether he/she had a complete antimalarial dose in the last month by asking the same questions. If any of the answers is "no", then a full course was not given and so the diagnosis is recorded as Uncomplicated Malaria (UM). However, if the answer to all questions is "yes", this outpatient case is recorded as Treatment Failure Malaria (TFM). Always remember to ask each malaria patient the three questions on the PATIENT ASSESSMENT section of the MALARIA DIAGNOSIS AND MANAGEMENT CHART in order to make the correct diagnosis. Always check the patient's health records if available, to confirm the patient's history.

From: *(21) Malaria Diagnostic Treatment and Recording Charts. A training module for Medical Officers. Trial Edition.* Malaria and Parasitic Disease Control (M&PDC) Unit, DGHS, Dhaka, [illegible]

Malaria indicators used in SEA Region and the need for better standardization.

The context

Indicators are defined variables that applied to disease surveillance data in a systematic and regular fashion, help to measure, interpret and compare changes in the epidemiology of malaria. Indicators are tools that allow to group data in meaningful clusters that define a surveillance system.

The definition of **epidemiological or public health surveillance** has been subject to changes since 1950, when it was first proposed by Alexander D. Langmuir (1).

In the context of a malaria control program, public health surveillance is the ongoing systematic collection, analysis, interpretation and dissemination of health data required for public health action. Priority is given to collection of data to identify those at high risk and to detect changing disease patterns in order to plan and evaluate prevention and control actions. These data and their indicators are required to:

- *Describe and measure the distribution of the disease malaria*
- Explain the distribution by its determinant factors: biological, environmental, social, behavioral and economic
- Predict, monitor and evaluate changes in the distribution of the disease malaria in relation to the malaria control program objectives and interventions

Data collected locally need to relate to **"Standard Case Definitions and Indicators" SCDIs** accepted globally so as to ensure that essential comparisons are possible to assess disease trends across borders and regions world wide.

Role of Advocacy, Communication and Media in RBM

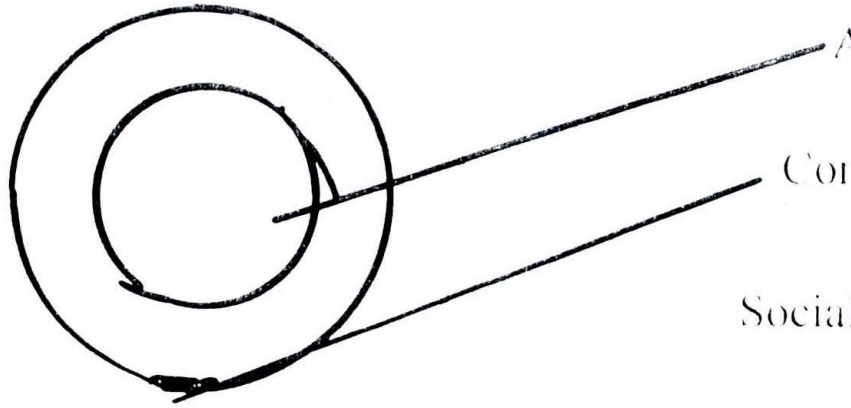
Mrs Harsaran Bir Kaur Pandey

Information Officer

WHO, SEARO

5 May 1999

Role of Advocacy, Communication and Social Mobilization



5 May 1999

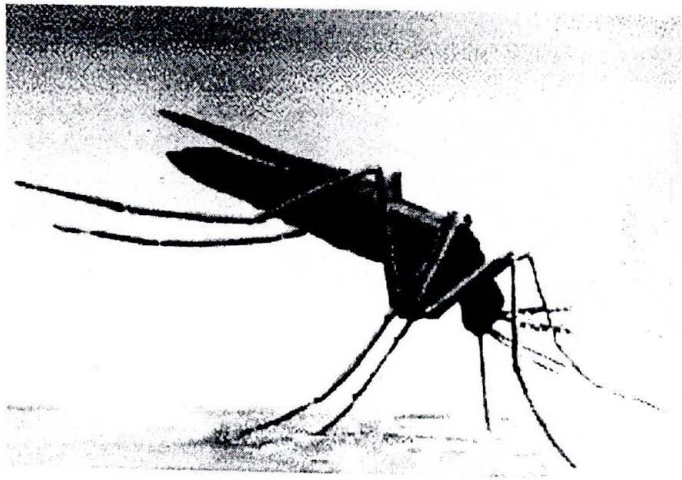
COMMUNITY LEVEL

- ✔ Inform/empower communities on how to tackle Malaria
- ✔ Need to monitor progress

  In EPI - demand was created and was closely linked to service delivery
- ✔ Simplify malaria control efforts to equate with vaccine

Roll Back Malaria

One Half of Malarial Deaths
can be prevented in
the next ten years



5 May 1999

UNDERSTANDING RBM

Malaria Eradication Programmes - are decades old

- ✔ So, What is new in RBM?
- ✔ What elements spell success?

5 May 1999

Malaria can be tackled only with:

- ✔ Combined Global Effort
- ✔ Very close inter-sectoral action
- ✔ Full community participation

GLOBAL - LEVEL

- ✔ Make Malaria an important issue
- ✔ Support research
- ✔ Develop new tools
- ✔ Raise funds

World Health Assembly's concern on Malaria

WHO DG's announcement on RBM

Four UN Agencies Joint launch

5 May 1999

NATIONAL - LEVEL

- ✔ Close inter-sectoral action needed
- ✔ Need for top political commitment at National/Planning Commission levels (UPE example)
- ✔ Mission mode? (e.g. Technology Missions)
- ✔ Make it a public/media issue
- ✔ Strengthen health delivery system
- ✔ Mobilize resources for the programme

5 May 1999

A FIVE YEAR COMMUNICATION/ ADVOCACY/MEDIA PLAN

- ✔ Time Line
  - Programme Landmarks for double action
  - Match Media Plan

5 May 1999

Re-charge Health Sector to take Malaria as a serious health problem

- ✔ Position it as a key cause of poverty
- ✔ Promote RBM as a social movement
- ✔ Focus on new tools
- ✔ Focus on community action

ADVOCACY STRATEGY

- ✔ Clarity on key messages
- ✔ Explicit on intervention
- ✔ Identify key audiences
- ✔ Develop basic advocacy materials (in partnership)

MEDIA PRODUCTS

- ✔ Stage 1:
  - Monograph on Malaria and Development or Malaria and Poverty
  - T.V. spots for Global/National release on key T.V. networks
  - Advocacy film - Create Ambassadors for Malaria (Nelson Mandela/ Sean Connery) as anchors
  - Borrow UNICEF idea of Fund raising on flights in to Africa, Asia and Latin America
  - Create media/malaria information/networks

MEDIA PRODUCTS

- ✔ Stage 2
  - – National Level:
    - Prepare policy paper for Cabinet
    - Documentary films
    - T.V. Spots
    - Radio series
    - Media Workshops

MEDIA PRODUCTS

- ✔ Stage 3
  - Sub-National Level
    - Workshops with State Information Bureaus and State/District Newspapers
    - Radio: Series in local languages focusing on area specific information tailored for local community action
    - Create malaria action networks

Network of Malaria/Information

WHO

UN PARTNERS
GOVERMENTS

NGOs

COMMUNITIES

MEDIA ---------- **Advocates**

-- ---------- **Questions**

---------- **Carries success stories**

---------- **Plays watchdog role**

---------- **Monitors Progress (+/-)**

---------- **Media Reports**

5 May 1999

MEDIA MESSAGES

To national leaders

- ✓ Malaria cause of suffering, death and poverty
- ✓ Can be contained using tools available
- ✓ Ensure health system delivers
- ✓ Empower Communities
- ✓ Can demonstrate achievements

Communities

- ✓ Can tackle Malaria at home
- ✓ Can organise themselves
- ✓ NGOs can help keep programme on line

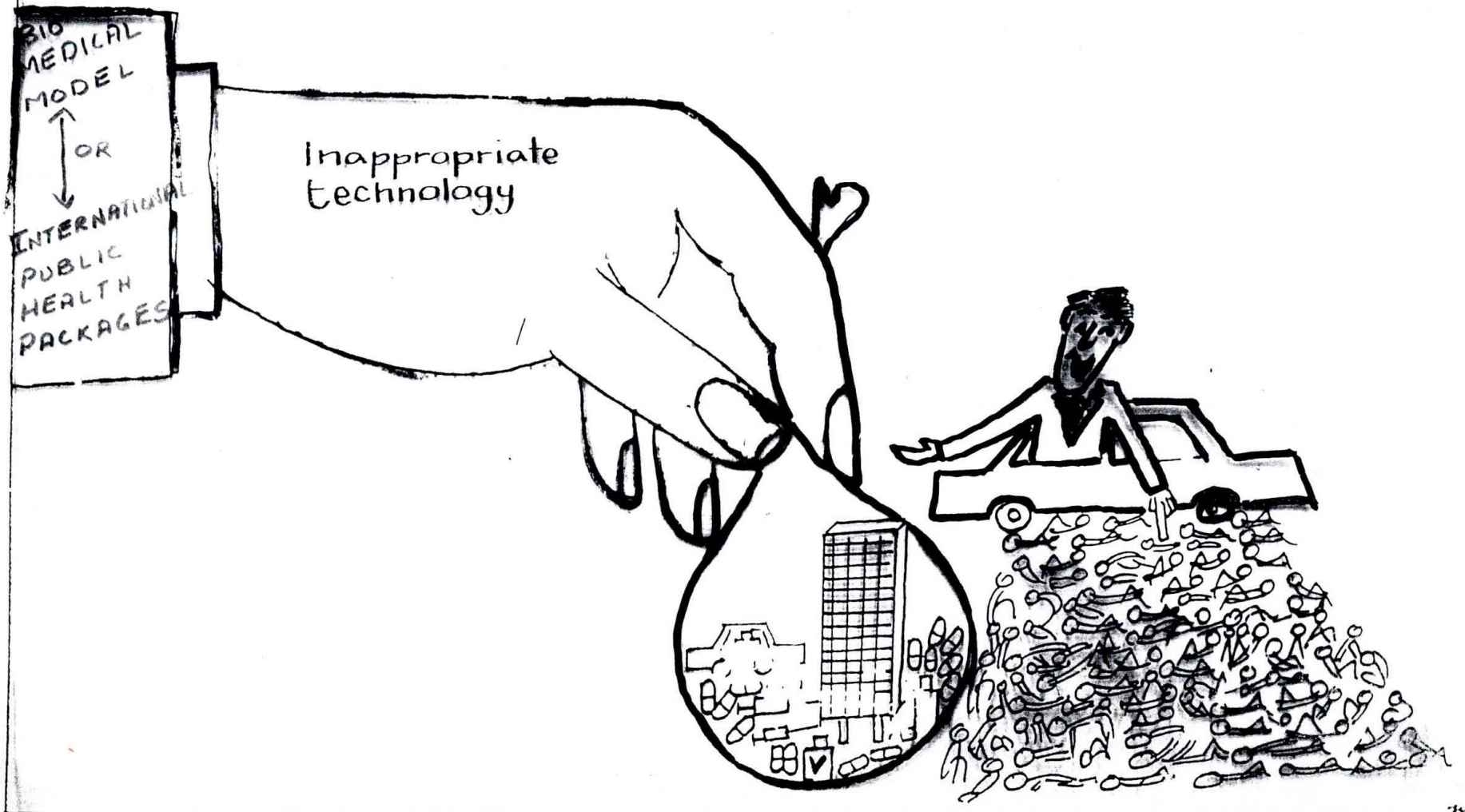
5 May 1999

PUBLIC HEALTH SYSTEM BREAKDOWN?

- SHORTAGE OF WORKERS / DOCTORS
- REDUCTION IN BUDGETS
- OVERBURDENED HEALTH WORKERS (ANMs - EXPLOITATION)
- CORRUPTION / SCAMS / MISUSE OF FUNDS
- POLITICAL INTERFERENCE
- DECISION MAKERS WITHOUT PUBLIC HEALTH COMPETENCE / ORIENTATION
- CENTRALISED TOP DOWN PLANNING
- CENTRE / STATE RESPONSIBILITY - AMBIGUITY
- INADEQUATE / UNREALISTIC PLANNING

Source : Secunderabad Meeting - August 97.

Is it relevant ??



MARKET ECONOMY IN HEALTH

* TOP DOWN PROM TION OF TECHNOLOGICAL FIXES!

* MARKET INTERESTS IN DECISION MAKING

* INTERNATIONAL PUBLIC HEALTH COLLABORATION / COOPERATION

  Often becoming subservient to:

  * AGENDAS OF VISITING CONSULTANTS
  * RESEARCH PRIORITIES OF COLLOBORATERS
  * "GUINEA PIGS" for Research
  * FUNDING AGENCY CONDITIONALITIES!

* GRANTS TO LOANS!!

* ILL HEALTH EFFECTS OF NEO-LIBERAL ECONOMIC POLICIES

(From Solidarity to exploitation!!)

Source: Secunderabad meeting - August 1997.

PEOPLES MOVEMENTS

CHIPKO
(Environmental Protection)

NARMADA BACHAO ANDOLAN

FISHERMAN STRUGGLE AGAINST TRAWLERS

ANTI LIQUOR MOVEMENT

PEOPLES SCIENCE MOVEMENT

TRADE UNIONS MOVEMENT

ANTI CHILD LABOUR MOVEMENT

(NATIONAL ALLIANCE FOR PEOPLES MOVEMENTS)

PARADIGM SHIFT

IN

MODEL OF MALARIA CONTROL - I

(URGENT NEED)

1.	BIO-TECHNOLOGY MODEL	SOCIAL/COMMUNITY MODEL
2.	INDIVIDUAL CASES	COMMUNITY PROBLEM
3.	PATIENT AS BENEFICIARY	PEOPLE AS PARTICIPANTS
4.	ILLNESS	HEALTH
5.	MOLECULAR BIOLOGY	SOCIO-EPIDEMIOLOGY

PARADIGM SHIFT

IN

MODEL OF MALARIA CONTROL - II

(URGENT NEED)

6.	DRUGS/VACCINES TECHNOLOGY	⟶	KNOWLEDGE TRANSFER & SOCIAL PROCESSES
7.	PROFESSIONAL CONTROL	⟶	DEMYSTIFICATION
8.	CENTRALISED NATIONAL HEALTH PROGRAMME (NMEP)	⟶	DECENTRALISED DISTRICT/LOCAL ACTION PLAN

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Malaria : A Socio-epidemiological Perspective

(Recognising the 'Social Paradigm' in Malaria Control : Beyond Technomanagerialism)

Invited Lecture at

Second Global Meet on Parasitic Diseases

at Secunderabad,

August, 1997

(ADAPTED FOR PRESENTATION FOR RBM MEETING - 4 MAY 1999)

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Resurgence of Malaria

"The time has come for health policy planners to move away from narrow biomedical approaches seking technological fixes to a much broader social and community-oriented paradigm shift in research, problem analysis and action initiatives. In the absence of this, malaria and the re-emerging communicable diseases will continue to represent not only a failure of our public health system but also of our research methods

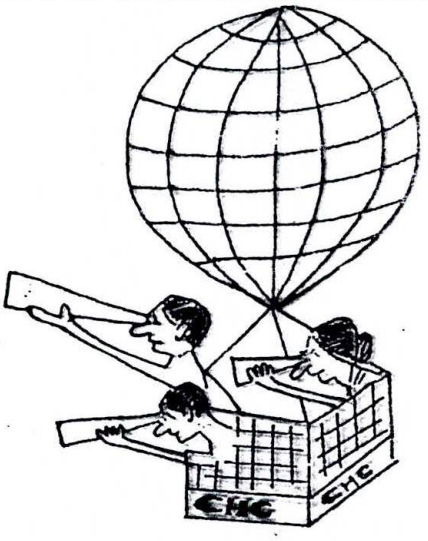
Source: Narayan R., 1997
NMJI Editorial

HEALTH FOR ALL

Indian Council Of Social Sciences Research & Indian Council Of Medical Research. (1981)

- *Reduce:*
  - ✓ poverty,
  - ✓ inequality and
  - ✓ spread education
- *Organise poor and underprivileged to* :
  - ✓ fight for their basic rights
- *Move away from* :
  - ✓ Counter-productive and
  - ✓ Consumerist Western Model of Health Care
- *Replace with*
  - ✓ Alternative based in the community.

Dr. Ravi Narayan, Community Health Cell



"Baloonist" Research

Participatory Reflection

magi

Alternative malaria control strategy

- REPORT
  - **Towards an Appropriate Malaria Control Strategy**
- WHAT
  - **Reflections / Recommendations**
- WHO
  - **An Expert Group (6) and a Reference Group (44) from the Voluntary / NGO sector.**
- WHEN
  - **Apr. '96 - Jan.'97.**

Dr. Ravi Narayan, Community Health Cell

Alternative Malaria Control Strategy (contd.)

- **WHY**
  - To provide an :
  - ✓ Alternative,
  - ✓ Community oriented
  - ✓ Socially relevant perspective.

- **HOW**
  - Interactive & Participatory
  - ☛ Individual contributions
  - ☛ Group reflections
  - ☛ Identification of Key issues and ideas through meetings

Dr. Ravi Narayan, Community Health Cell

RESURGENCE OF MALARIA

Causes ?

Agent Resistance

Vector Resistance

Technical Problems and limitations

'Public Health'

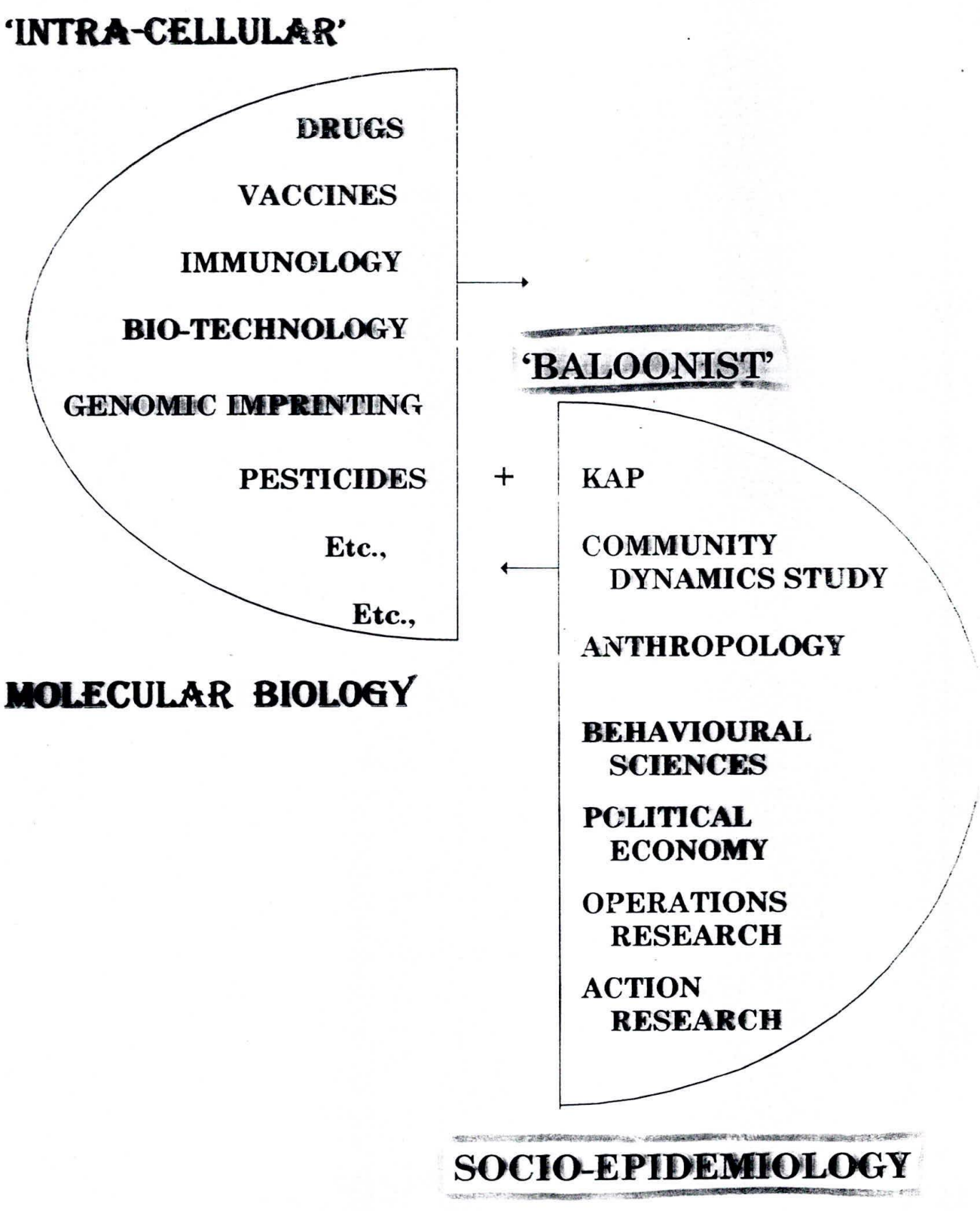
CRISIS

and

Health Care System

RESISTANCE

A PLEA FOR A BALANCE !



GOAL OF THE STRATEGY

BRINGING BACK THE COMMUNITY TO THE CORE OF THE MALARIA PROGRAMME

(A TASK AHEAD)

The Need For Socio-epidemioliogy

- Studying the COMMUNITY at risk & SOCIETAL CONTEXT - not only the Agent / Vector / Environment.

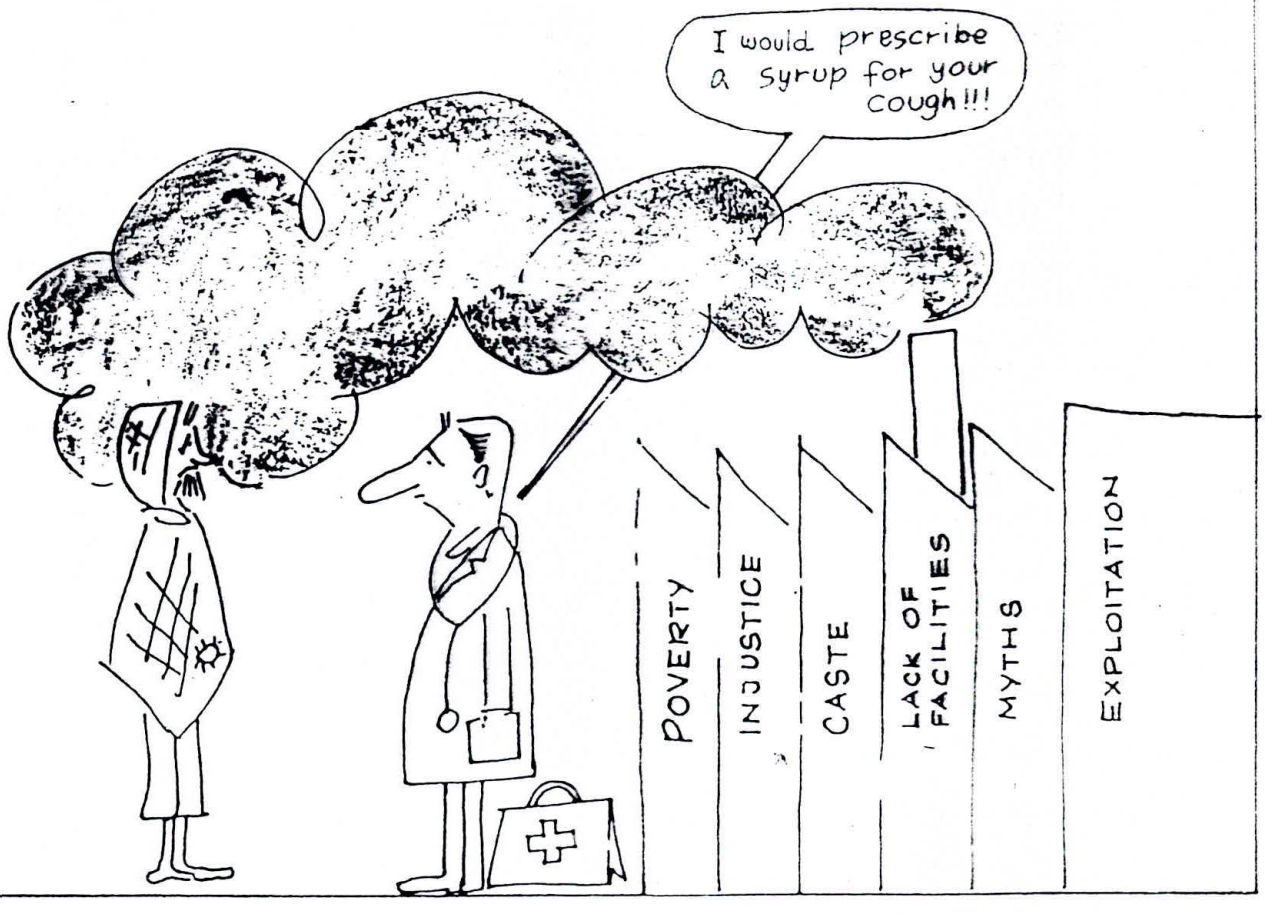
- From - TECHNO-MANAGERIAL problem analysis and assessment

- To - SOCIO-CULTURAL-POLITICAL BEHAVIOURAL issues.

Dr. Ravi Narayan, Community Health Cell

"I became poor because of my sickness"
"well, I became sick because of my poverty"

magi



ILL HEALTH = POVERTY
UNHEALTHY ENVIRONMENT

Tribal Population behaviour in Mandla (MP)
(in relation to bednet use)

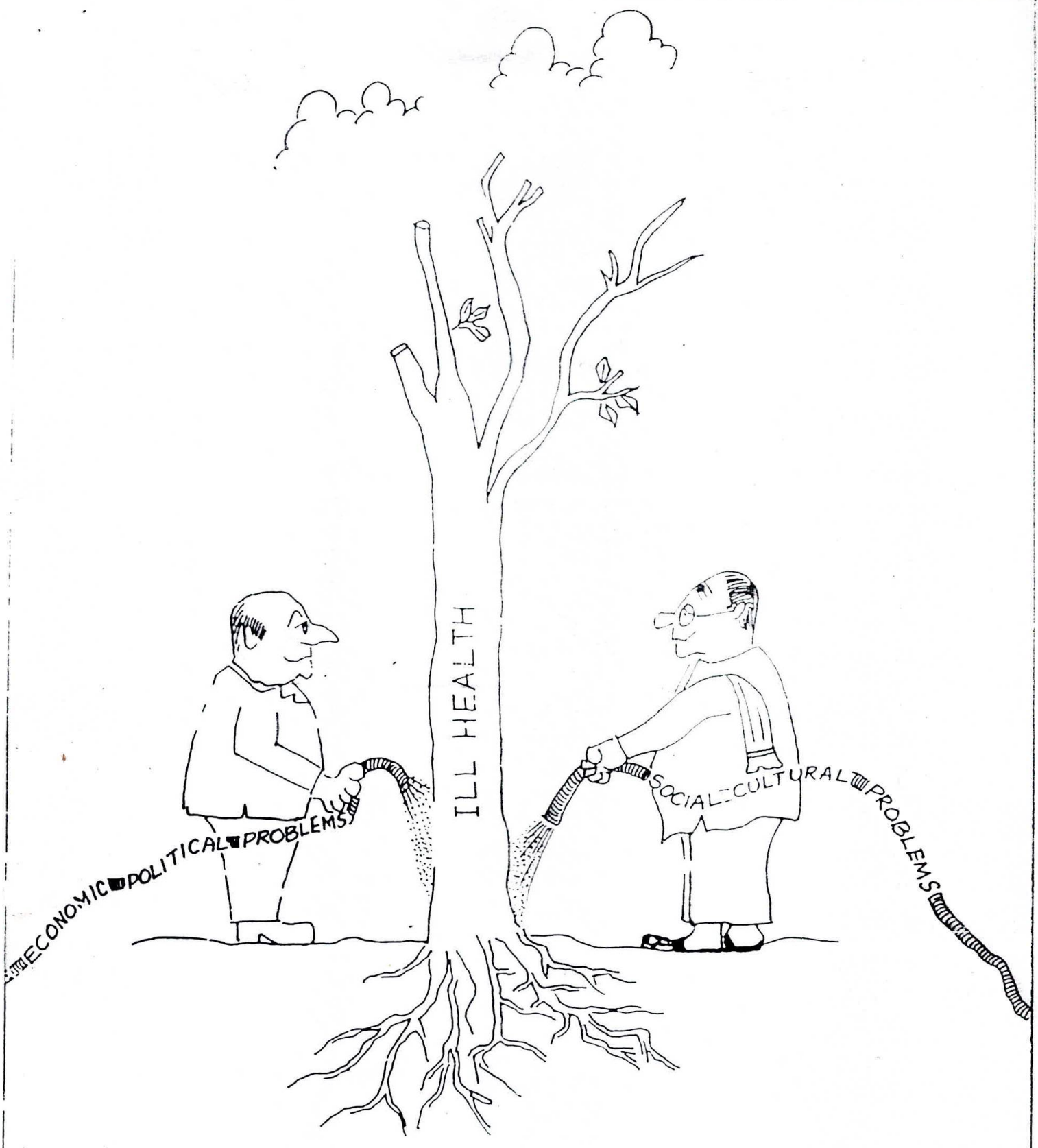
Community Survey	
Night Mahua collection	16%
Sleep in fields	12%
Tendu leaf collection	21%
Fishing	8%
(1,200 people out before dawn out of 2,000)	

Singh. N, Mishra, A.K., Khan M.T. 1992
in Community Participation in Malaria Control
V.P. Sharma (Ed) MRC (ICMR) 1993

Tribal Population behaviour in Mandla (MP)
(in relation to bednet use)

Reasons for Nonuse	
Fatigue due to hard field work	57.85%
Suffocation inside net	9.87%
Intoxication	1.92%
Spread on floor	1%
Wrapped round body	20.9%
Used as pillow	2.8%

Singh .N, Mishra, A.K., Khan M.T. 1992
in *Community Participation in Malaria Control*
V.P. Sharma (Ed) MRC (ICMR) 1993



ILL HEALTH = UNDERLYING CAUSES

Rediscovering the 'Community' in Malaria Control

- Enhancing **Community Participation**, **Capacity** and **Health Education**

✓ by involving :

- *Panchayat*
- *Local Community Organisations*
- *Voluntary Sector Projects*
- *Private practitioners*
- *ISM's and Folk Healing traditions*
- *Folk & local media*
- *School based programmes*
- *Creative , interactive - culture sensitive approaches*

Dr. Ravi Narayan, Community Health Cell

OPERATIONAL FACTORS

1. **GOALS:** Local Adaptation.

2. **PLANNING:**

+ i) Identify Bridges/Barriers in KAP

ii) Health Seeking behaviour

iii) Human/organisational resources

iv) Socio-Cultural Epidemiology

3 **PROGRAMME**

Inform/orient — Locals, Panchayat Schools, groups voluntary agencies health practitioners

Evolve guidelines for action /participation at all levels.

4. **FRAMEWORK**

PROJECT TO 'MOVEMENT'
(paradigm shift)

ARE WE WILLING?

We are already Health Activists....

magi

III. PROMOTING RATIONAL MALARIA CONTROL

- **ENHANCING / STRENGTHENING LAB DIAGNOSIS SKILLS AND SERVICES**

(from Fever programme to 'Malaria' programme)

RE-ESTABLISHING CLINICAL DIAGNOSIS SKILLS

(diagnosing Malaria, excluding other causes, diagnosing complications)

- **RATIONAL DRUG POLICY FOR MALARIA**
  - rational standard regimes
  - ▲ and Rx of 'RESISTANCE'
  - Restricting 'MEFLOQUIN'

- **PROMOTING PERSONAL PROTECTION**
  - multiple alternatives
  - preventing over emphasis of treated 'BED NETS'

(116)

ENVIRONMENT, ENVIRONMENTAL CHANGE AND THE OPTIONS FOR VECTOR CONTROL

Felix P. Amerasinghe
Department of Zoology
University of Peradeniya
Sri Lanka

There are many historical instances of malaria associated with environmental changes concomitant with human settlements, agriculture and irrigation. Equally, there are instances where all of these factors have not resulted in significant increases in malaria incidence. There does not appear to be a common link between malaria and environmental factors. Indeed, recent studies suggest that such links as do exist are complex and situation-specific.

In the Mahaweli project of Sri Lanka, for instance, one System (H) has been highly malarious over nearly the past two decades, while another (System C) has not. Thus different areas within the same overall project may react differently to development. Recent studies in the Mahi Kadana area of Gujerat, India, show higher vector densities in irrigated than non-irrigated villages, and that vector densities are related to irrigation water releases. In the canal-irrigated Pakistani Punjab, high water tables and a plethora of surface water habitats have not been associated with high malaria. Analyses of secondary health data have not been able to demonstrate any relationships between the disease and depth to ground water or percentage of land under rice cultivation.

Environmental Factors and their Management

Some key environmental factors relating to malaria are the sources of surface water, climate, topography and soil. One could also consider man-made structures that convey or store surface water (eg. reservoirs, canals, tanks) also as environmental factors, albeit artificial.

Environmental management seeks to modify such factors in ways that reduce the risk of generating malaria vectors. There is a mass of published literature detailing the technical aspects of such manipulations. Yet, environmental management as a practical tool has not got off the ground in any tangible way in most countries of the S-E Asian region.

To my mind, the primary problem is the enormity and complexity of the environment *per se*, and the consequent lack of focus that results from recommendations relating to its management. Added to this is a conceptual problem: malaria control agencies have been imbued with the "magic bullet" philosophy since the advent of the "miracle" of insecticides. This has been followed by miracle drugs, miracle vaccines and the prospect of miracle transgenic mosquitoes, all of which could be described as "smart" weapons. In contrast, environmental management is very much in the nature of trench warfare: slow, dirty, long term, and often involving co-ordination between several agencies.

The conceptual change back to "old" methods of malaria control (albeit with modern technology) may be difficult, but is increasingly being forced upon us. However, much can be done to improve the focus of environmental management by developing specific measures to address problems in specific situations. This is often described as an ecosystems approach: one may tackle the problem at the level of a watershed, or an irrigation command area, or a particular urban setting etc., and determine which of its components produce vectors.

Some of the key issues that need to be focussed on are:

- What is the major vector of epidemiological importance?
- What is its main breeding habitat?
- Are there identifiable components of the ecosystem that consistently generate the vector?
- Are these components amenable to management?
- What technical and organizational inputs are required from non-health agencies?
- Will managing these components have a local or system-wide impact?
- To what extent can local communities be involved in the effort?
- What are the estimated costs/benefits of the intervention?
- How do these costs/benefits compare with existing vector control strategies?

In the SE-Asian region, existing data may be amenable to analyses that yield answers to the above questions. However, it is a common experience that routinely collected data are not of sufficient reliability on which decision-making can be based. In which event, primary data will have to be obtained. However, such "research" will need to be geared to answer specific questions of practical applicability, rather than to indulge in questions of purely academic interest.

Case Study

A case study from Sri Lanka, in which I was fortunate to be involved, seeks to illustrate this approach. Malaria has been a serious public health problem in much of the north-central province for decades. A multidisciplinary team of vector biologists, parasitologists, social scientists, economists, irrigation engineers and a malaria control officer (representing the International Water Management Institute, University of Peradeniya and the Anti-Malaria Campaign, Sri Lanka) have been investigating this problem over the past 5 years in an area within this province known as the Huruluwewa Watershed. This is an area of mixed forest and agricultural land irrigated by an ancient tank-irrigation system, which more recently also receives issues of water from the Mahaweli system. Some 600 farmer families (approx. 3000 persons) inhabit the area, and data shows that in an outbreak year, at least 50% of them would suffer at least one episode of malaria. Our objective was to make a system-wide analysis of the factors contributing to malaria, with a view to implementing environmental management, if appropriate.

Briefly, our studies established conclusively that, despite the involvement of several anopheles species in malaria carriage, *Anopheles culicifacies* was the only vector of real epidemiological importance. We then established that a stream, which also served as an irrigation conveyance canal, was the primary breeding habitat. At the level of an index study village, distance of houses from the stream was a significant risk factor for malaria. At a system-wide level, villages further away from the stream had lower densities of the main vector, and concomitantly lower malaria. Thus, we were in a position to convince irrigation engineers that manipulation of the stream could

potentially impact on malaria throughout the watershed. Detailed analyses of water dynamics of the entire watershed area that influenced water flows in the stream followed, resulting in data that were used to model various water management practices that could reduce vector breeding in this key habitat. The most viable one was a redistribution of existing water flows in order to maintain a water depth sufficient to discourage the breeding of the vector. Costs analyses also were done, not only of the water management measures, but also of other vector control interventions such as indoor residual spraying, bednets and stream larviciding, as well as the costs of curative measures (hospital, mobile clinics, village-level treatment centres) in the area. We are now in a position to meet challenges relating to all aspects of the environmental management proposed, and to mobilize state agencies in the next phase: implementation.

This is a test case, but one that potentially has wider applicability, both within and outside of Sri Lanka, since small irrigation schemes (both old and new) are common throughout the region. What needs to be emphasized here is that vague concepts of the benefits of environmental management will not convince either malaria control or other agencies to participate in such ventures. Hard data from sharply focussed studies are often the only way to proceed, first to interest non-health sectors to get involved, and finally to convince policy makers and implementers that viable alternatives or supplemets to insecticidal control are available.

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Indoor residual spraying

\+ • millions of lifes saved
• malaria eradicated in large areas
• health services stretched to the community level

\- • flexible, intersectoral activities replaced by a monolithic, vertical programme exclusively relying on a blanket method.
• traditional multidisciplinary support declined
• research on vector ecology & biology greatly reduced.

- decentralized :

  local solutions to local problem

- health-sector wide :

  proper distribution of operational and regulatory responsibilities.

- intersectoral :

  ensure policy adjustment and legislation

- flexible :

  rapid response to changing risk levels

- integrated :

  an optimal combination of intervention tools meeting local needs, feasibility.

ENVIRONMENTAL MANAGEMENT

- A LONG TRADITION, RICH EXPERIENCE IN S., SE ASIA

- ECOSYSTEMS APPROACH IS VIABLE IN ASIA:
  - CLEAR ECOSYSTEM, VECTOR DISTRIBUTION BOUNDARIES
  - STRONG KNOWLEDGE BASE ON VECTOR BIONOMICS
  - GOOD RESEARCH CAPACITY

- ORGANIZATIONAL STRUCTURE AND MANAGERIAL PROCESSES REMAIN THE KEY HURDLE

THE FIVE STRANDS OF RBM :

- HEALTH SECTOR DEVELOPMENT AND INTERSECTORAL ACTION
  - DECENTRALIZATION
  - RATIONALIZATION

  LEADING TO :

  - A SHIFT FROM OPERATIONAL TO REGULATORY ROLES
  - LOCAL ACTION
  - INTERSECTORAL COLLABORATION

- MALARIA IN DEVELOPMENT PLANNING
  - IMPROVED POLICY FRAMEWORK
  - BETTER HIA PROCEDURES
  - INCREASED HEALTH SECTOR CAPACITY FOR THE INTER-SECTORAL DIALOGUE

THE FIVE STRANDS OF RBM :

- INVESTMENT IN NEW, MORE EFFECTIVE TECHNIQUES

- MAPPING, GIS, REMOTE SENSING FOR THE MONITORING AND ANALYSIS OF ENVIRONMENTAL RISK FACTORS

THE FIVE STRANDS OF RBM

- SOCIAL MOVEMENTS TO MOBILIZE COMMUNITY ACTION

  THE IPM EXPERIENCE, AGRICULTURAL EXTENSION, FARMER FIELD SCHOOLS

THE FIVE STRANDS OF [redacted]:

- COST-EFFECTIVE APPLICATION OF CURRENT TOOLS

  - THE METHODOLOGY FOR ECONOMIC EVALUATION IS AVAILABLE, BUT IT NEEDS TO BE BETTER INCORPORATED INTO GOVERNMENT DECISIONMAKING

  - Upgrading of BEST PRACTICE FOR PROFESSIONALS IN OTHER SECTORS

THE FIVE STRANDS OF RBM:

- PARTNERSHIPS

  . WITH THE ENVIRONMENT/ CONSERVATIONIST SECTOR

  . WITH GEF ON ISSUES OF BIODIVERSITY

BANDOENG CONSENSUS

- MALARIA IS A HEALTH & A SOCIAL PROBLEM; IT MUST BE ATTACKED SIMULTANEOUSLY FROM BOTH ANGLES.

- MALARIA ... FORMS A CONSIDERABLE BARRIER TO THE DEVELOPMENT OF OTHER WELFARE ACTIVITIES AND ... MUST BE CHECKED BEFORE OTHER TYPES OF WORK BECOME POSSIBLE.

- THE OPENING OF PUBLIC HEALTH WORK IN RURAL AREAS CAN OFTEN BE USED AS THE ENTERING WEDGE FOR THE DEVELOPMENT OF A BROADER PROGRAMME ... [OF] EDUCATION, ECONOMICS, ENGINEERING AND AGRICULTURE.

BANDOENG CONSENSUS

- SINCE MALARIA IS A FOCAL DISEASE IN ANY COUNTRY ... THE STRUCTURE OF, AND PROGRAMME FOR, RURAL HEALTH ORGANIZATION SHOULD NOT BE STEREOTYPED, BUT FLEXIBLE.

- OPERATIONAL RESEARCH IS NEEDED TO EXPAND OUR KNOWLEDGE OF NATURALISTIC MEASURES WHICH MAY BE INTERWOVEN... WITH AGRICULTURE, PISCICULTURE AND ANIMAL HUSBANDRY, AND IN LINE WITH THE ECONOMIC REALITIES OF THE RURAL AREAS OF THE WORLD ...

A century of malaria control

1898 • Ross discovers role of mosquitoes

EARLY DISCOVERIES
'NATURALISTIC' INTERVENTIONS
DEBATES OVER DEVELOPMENT VS MALARIA; MEDICAL INTERVENTIONS VS VECTOR CONTROL

• BANDOENG, CONFERENCE 1937

WW II
→ DDT

1950

WHO'S GLOBAL ERADICATION PROGRAMME

• PRIMARY HEALTH CARE (ALMA ATA, 1978)

• AMSTERDAM MINISTERIAL CONFERENCE 1992

1999 • Roll Back Malaria Initiative

RISK ASSESSMENT ,

RISK MANAGEMENT

- to reduce the burden of ill-health in communities
- to reduce the burden on the health services.

PRESENTED BY

Mr Robert BOS
WHO/HQ, GENEVA

POPs negotiations

- intergovernmental under auspices of UNEP
- one of the POPs is DDT; more pesticides may be added
- Schedule: Convention text 2000
  effective 2002 - 2003
- Exemptions: time limited ? or conditional phase out ?

(6)

MALARIA PROBLEMS IN INDONESIA
Challenges for Roll Back Malaria

Thomas Suroso

MEETING ON IMPLEMENTATION OF COLLABORATIVE
ACTIVITIES ON " ROLL BACK MALARIA "
NEW DELHI, 4-6 MAY 1999

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CONTENTS

MALARIA PROBLEMS IN INDONESIA

I. INTRODUCTION

Malaria control in Indonesia was conducted as early as 1919. The control activities included anti larvae measure (source reduction, larvivorous fish, irrigation works) and prevention of transmission (using bednet or mosquito proof housing etc) in limited areas. Quinine was widely used for malaria treatment as well as to control malaria epidemics. Between 1952 and 1958 malaria control programme with insecticide residual spraying was implemented in large areas of Java-Bali and certain areas of economic importance of other islands.

In 1959 malaria eradication programme (MEP) was launched in Java and Bali, the most densely populated islands of Indonesia, where 70 % of the total population lived. During the MEP, the other islands were on the preparation phase for eradication. The MEP Java-Bali was terminated in 1965 and the control policy has been revised turned back to malaria control programme (MCP).

The two anti malaria programme in Indonesia was successfully reduced malaria problem in Java-Bali. The malaria incidence in Java-Bali which was estimated 400 per thousand population in 1950, was significantly reduced to 0,023 in 1968. However, following termination of the MEP, malaria incidence increased up to 1.83 per thousand population in 1973.

During 1974-1997 the Malaria Control Programme had been continued to control malaria foci in Java and Bali and in the priority areas of the other islands i.e. : transmigration areas and development areas such as forestry, agriculture, mining and tourist area.

II. CURRENT MALARIA SITUATION

In Java-Bali, the annual parasite incidence (API) tend to decrease following the intensified MCP start than 1974. API was reduced from 1.83 per 1000 population in 1973 to 0,12 per 1000 population in 1997. However since 1995 API tend to increase.

At present, in Java-Bali where 65 % of the total country population live, malaria transmission is absent. Malaria incidence has been kept below one case per 1000 population since the last 8 years.

In the outer islands (Sumatera, Kalimantan, Sulawesi, Nusa Tenggara, Maluku, West Irian) the malaria prevalence remain high and malaria foci with high endemicity are scattered , mainly in the eastern part of the country

In urban areas and many cities of the outer islands mainly the capital of provinces, there is no malaria vectors found, except in the eastern part of the country i.e. Province of Irian Jaya and East Timor.

In outer islands, the parasite rate in the priority areas since 1988 is almost stable. Malaria epidemics/outbreaks in year 1997 occurred in 11 areas, mostly in transmigration areas, where non immune people entered malarious areas.

In Barelang Binkar where development program for industries and tourisms is intensively and extensively conducted, malaria elimination programme has been implemented in collaboration with the private companies. Malaria transmission continuous to occur in these islands, with the highest peak occurs during the end of rainy season, due to the increasing number of potential breeding places of An. sundaicus.

Two main factors causing malaria transmission were :

- Many workers come from endemic area and live together with non immune people.
- The increase of breeding places because of environmental change (construction of factory, resettlement , building, roads and other public works).

In Irian Jaya, where the potential malaria vectors are: A.punctulatus group, malaria is endemic in most of the province area. In 1997 during the El Nino, prolonged drought and forest burns caused malaria transmission in the highland (2000 m asl) and outbreaks in several localitis causing a high number mortality.

In copper mining area (Tembagapura), intensive malaria control has been implemented successfully by the private company (PT Freeport Indonesia). Malaria transmission occurs through out the year

III. PROBLEMS AND CONSTRAINTS

The problems for malaria control in Indonesia are as follows :

1. Lack of health personnel both in quantity and quality to carry out all malaria control activities at all administrative level from the central down to the village level.
2. Shortage of supplies, equipment and budget to support activities of malaria control.
3. Lack of management capability particularly in district level.
4. Poor inter sectoral collaboration and community involvement.
5. Lack of awareness on malaria among health providers, community and decision makers/administrators.

The constraints for malaria control in Indonesia are :

1. Environmental changes due to development projects, climatic changes or others.
2. Population movement due to improvement of transportation facilities and economic reasons.
3. Anti malarial drug resistance.

IV. FUTURE PLAN

To overcome the problems and constraints in the control of malaria in Indonesia, the malaria control strategy has been revised and improved. The strategy consist of 4 components as follows :

1. The capacity building of District level in malaria control management.

2. Decentralization of the management of malaria control program to District and HC level

3. Building linkages and develop collaboration with related institutions including private sectors and NGO's.

4. Promotion of community involvement in malaria prevention.

The above control strategies has been intensively implemented since 1997 in 6 provinces (South Sumatera, West Java, Central Java, South Kalimantan, Central Sulawesi and East Nusatenggara Provinces) under the intensified CDC Project supported by ADB.

As a follow up of the Intercountry Consultative Meeting of National Malaria Control Programme Management, held in Pattaya, February 1999, 3 areas with different malaria problems has been proposed for RBM pilot project i.e. transmigration in Kalimantan, collaborative malaria control with private sectors in development project in Barelang-Binkar; and promotion of community involvement and inter sectoral collaboration in refractory malaria area at the border of Central Java and Yogyakarta Provinces.

V. SUMMARY

During the last five years, resurgence of malaria occurred in some foci in Java-Bali, where as in outer islands malaria cases increased and several outbreaks were reported from areas of environmental changes due to development project and climatic change.

Existing malaria problems include the lack of health personnel in quality and quantity, shortage of supplies, equipment and fund, also lack of inter sectoral collaboration, community participation and diminishing awareness to malaria.

Malaria Control Policy has been revised to improve and strengthening the strategy to overcome problems and constraints include : building linkages and capacity, promotion of community participation and, decentralization to intensify the malaria control programme.

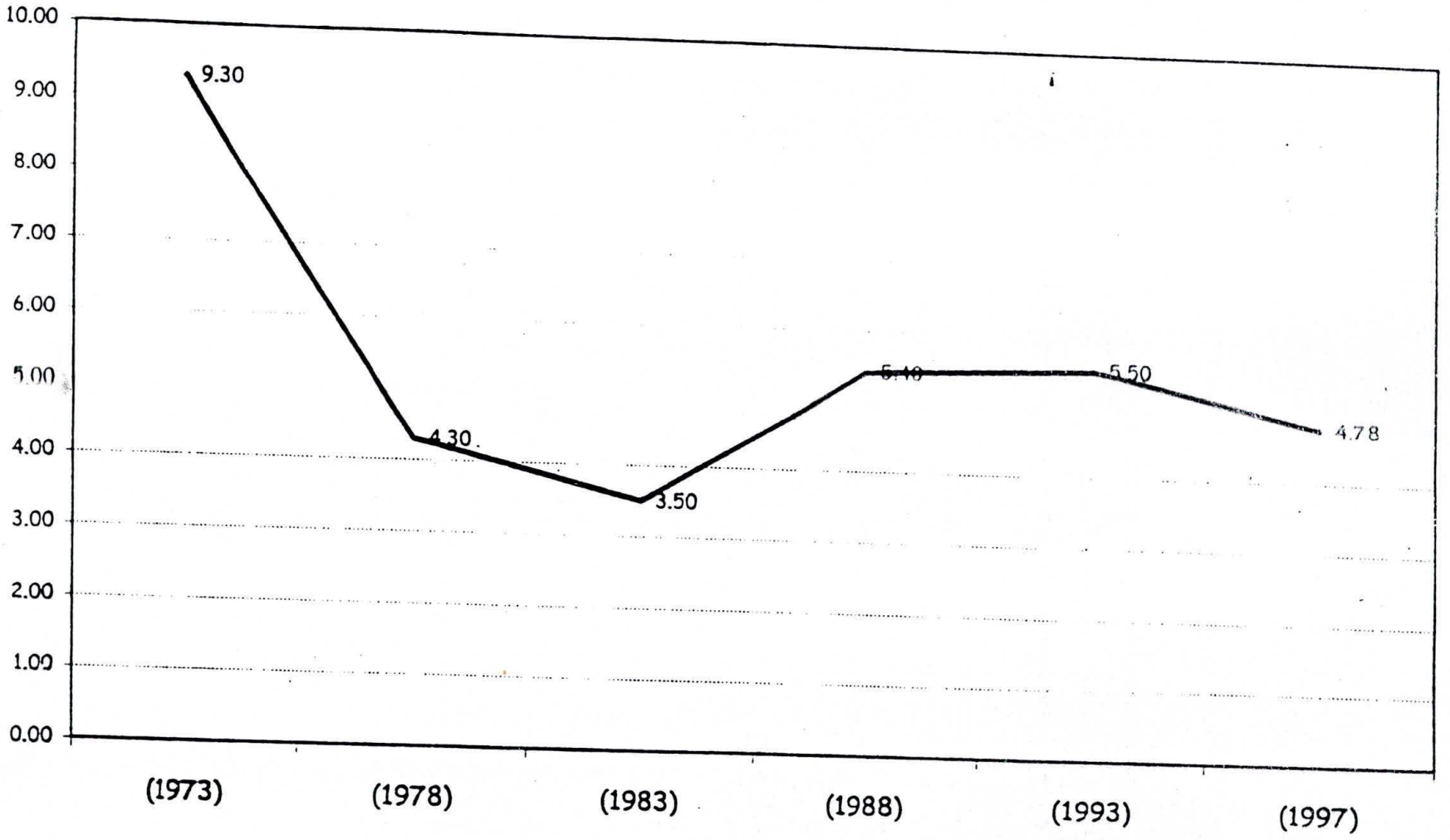
Three areas of different malaria problems have been proposed for pilot project to implement the RBM approach (development project area, transmigration area and refractory malaria foci).

EXISTING MALARIA SURVEILLANCE SYSTEMS AS A DECISION SUPPORT MECHANISM IN INDONESIA

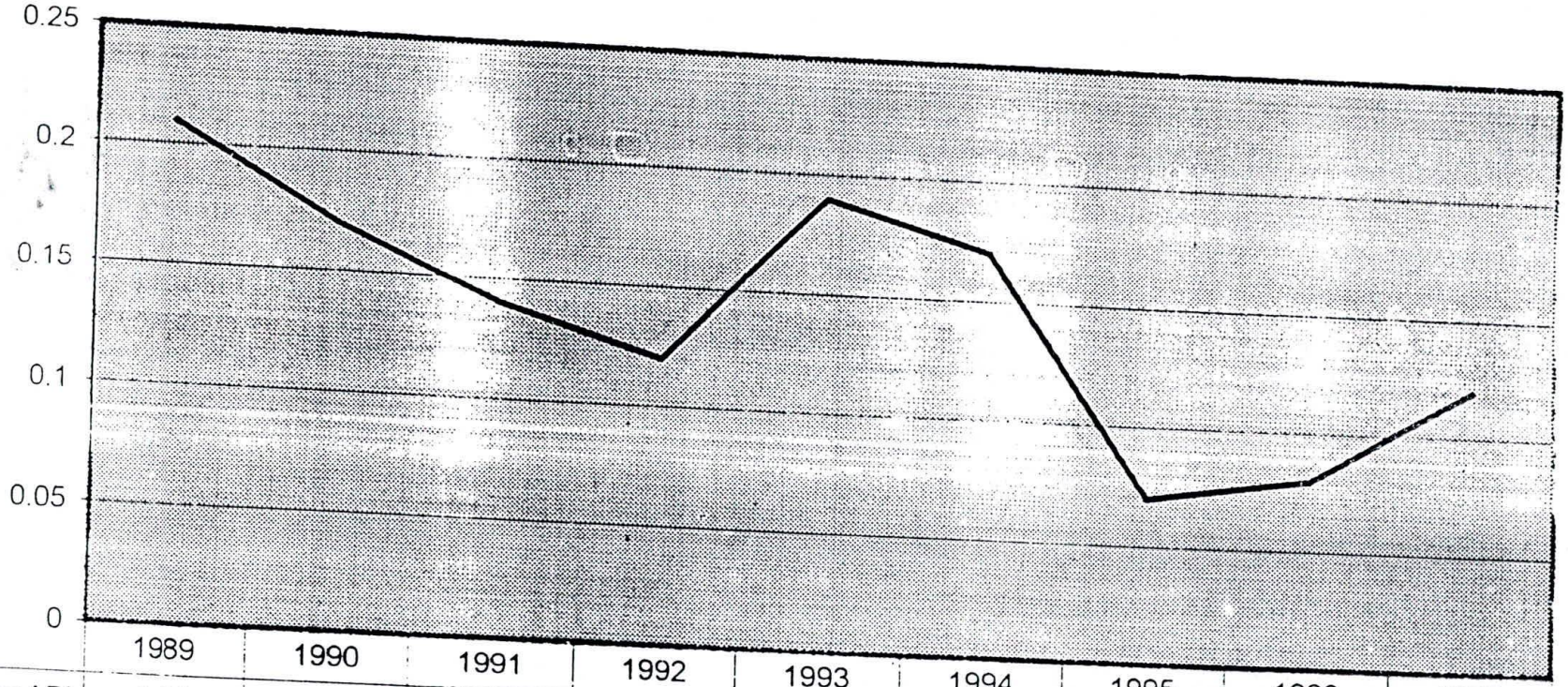
Thomas Suroso

MEETING ON IMPLEMENTATION OF COLLABORATIVE ACTIVITIES ON " ROLL BACK MALARIA "
NEW DELHI, 4-6 MAY 1999

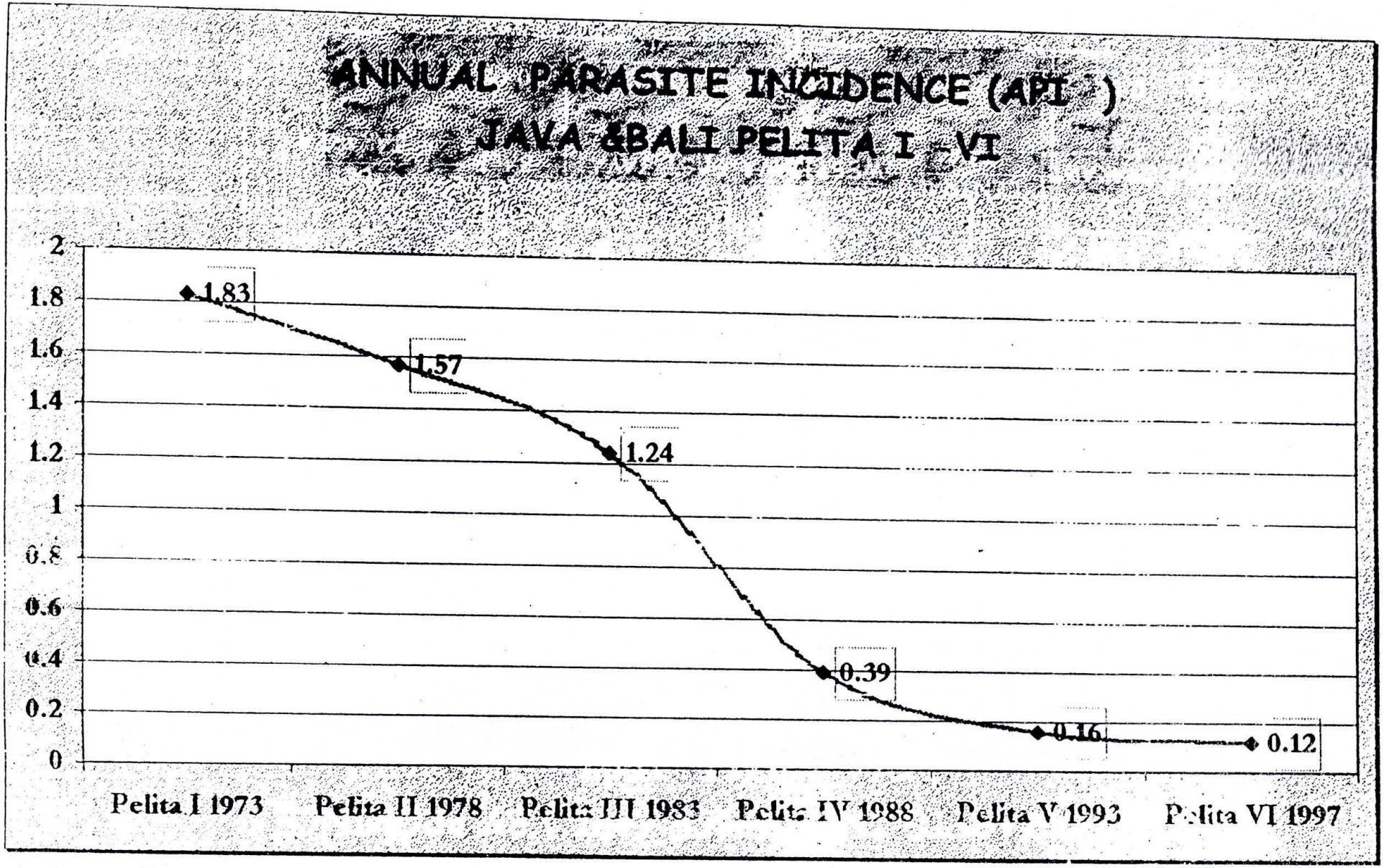
PARASITE RATES IN PRIORITY AREAS IN ISLANDS OTHER THAN JAVA - BALI
1973 - 1997



ANNUAL PARASITE INCIDENCE (API)
JAVA - BALI 1989 - 1997



	1989	1990	1991	1992	1993	1994	1995	1996	1997
API	0.21	0.17	0.14	0.12	0.19	0.17	0.07	0.08	0.12


ANNUAL PARASITE INCIDENCE (API)
JAVA &BALI PELITA I - VI
2
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
1.83
1.57
1.24
0.39
0.16
0.12
Pelita I 1973
Pelita II 1978
Pelita III 1983
Pelita IV 1988
Pelita V 1993
Pelita VI 1997

MALARIA VECTORS IN INDONESIA
(1919 - 1997)

Province	*An. aconitus*	*An. balabacensis*	*An. bancroftii*	*An. barbirostris*	*An. barbumbrosus* P	*An. farauti*	*An. flavirostris* P	*An. kochi*	*An. koliensis*	*An. letifer* P	*An. leucosphyrus*	*An. maculatus*	*An. minimus* P	*An. nigerrimus* P	*An. parangensis*	*An. punctulatus*	*An. sinensis* P	*An. subpictus*	*An. sundaicus*	*An. tessellatus*	*An. umbrosus* P	*An. vagus*
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
Daerah Istimewa Aceh																			P			
North Sumatra								V				P		P					V	V	P	
West Sumatra																			V			
Riau										P									V			
Jambi										P				P								
South Sumatra										P											P	
Lampung														P					V			
Bengkulu														P					V			
D.I. Yogyakarta		V										V							V			
West Java	V	V																	V			
Central Java	V	V										V							V			
East Java	V																		V			
Bali				V														P	V			
East Nusa Tenggara																		V	V			P
West Nusa Tenggara										P								P	P			
West Kalimantan		P																			P	
Central Kalimantan		V																	V			
East Kalimantan		V									V											
South Kalimantan				V				V							V			V				
North Sulawesi				P			P											V				
Central Sulawesi				V	P		P						P	V			P	V	V			
South Sulawesi				V													P					
South-West Sulawesi						P																
Maluku			V			V			V							V						
Irian Jaya																		V				P
Timor Timur																						

V = incriminated vector P = potential / suspected vector

INDONESIA

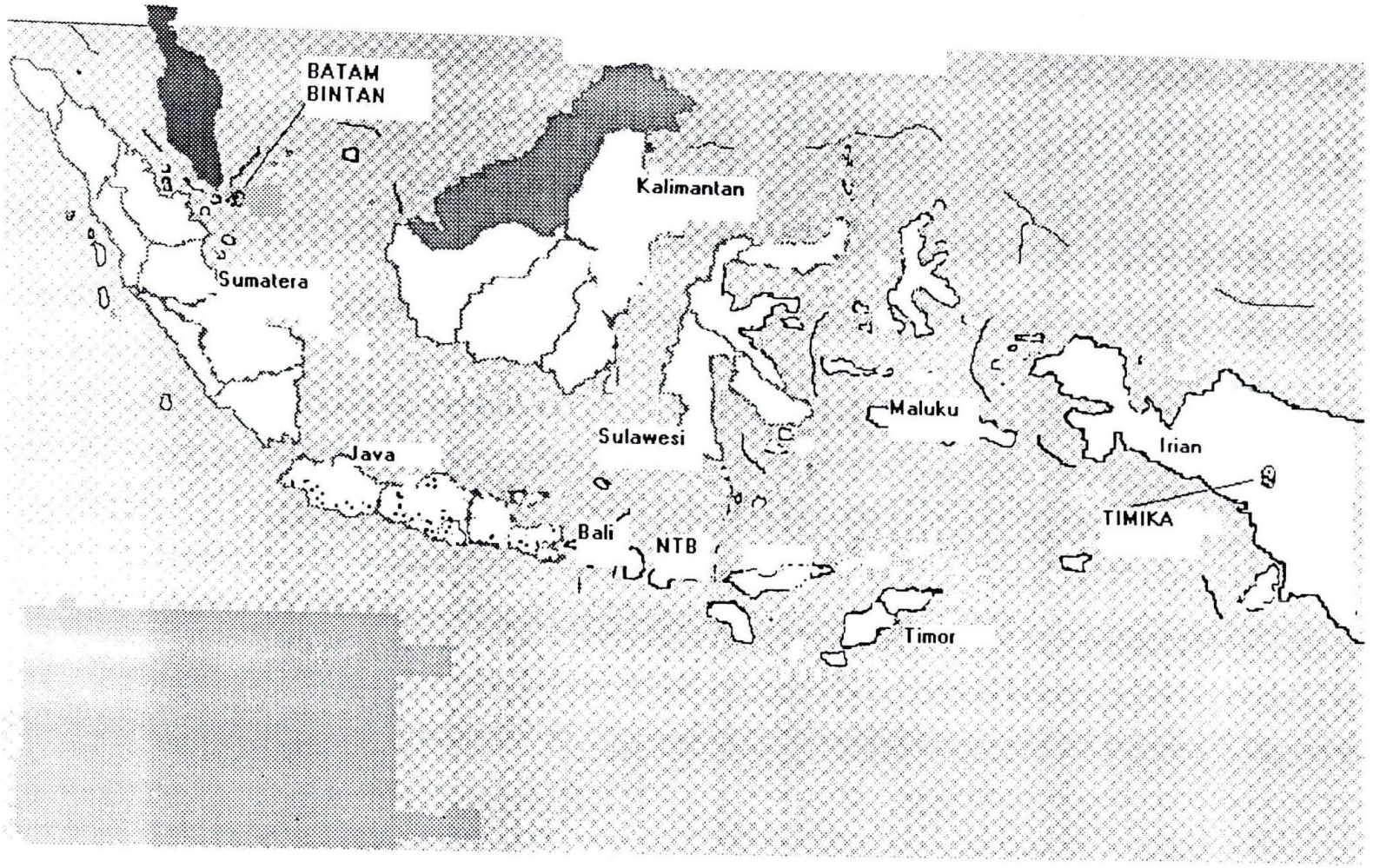

BATAM
BINTAN
Kalimantan
Sumatera
Sulawesi
Maluku
Irian
Java
TIMIKA
Bali
NTB
Timor

TABLE OF CONTENT

EXISTING MALARIA SURVEILLANCE SYSTEM AS A DECISION SUPPORT MECHANISM IN INDONESIA

I. INTRODUCTION

During the period of 1959-1968, when malaria eradication programme was implemented, the roll of PCD in malaria surveillance through hospitals was quite small, because most of the malaria cases could be detected through ACD by surveillance agents. At this time, the information on malaria status in outer island was collected mainly through malaria surveys.

In 1968 malaria eradication programme in Java-Bali was terminated. Since then the malaria control policy has been revised, and turned back to malaria control programme. The activities of malaria control are integrated into the general health service. Therefore malaria surveillance is carried out on the basis of the general health service system.

In 1977, 15.000 surveillance agents and malaria microscopist were recruited as government servants. Since then, there has been no recruitment of this filed personnel. The number of surveillance agents and microscopist has gradually decreased. Priority of malaria surveillance was given to villages high incidence of malaria. The shortage number of malaria surveillance agents and malaria microscopist were fulfilled by hiring daily workers, who work and paid on monthly basis. Malaria surveillance was no longer conducted on a total coverage basis.

II. THE EXISTING SURVEILLANCE IN INDONESIA

A. MALARIA CASE SURVEILANCE

Based on the activities malaria surveillance and control, Indonesia could be divided into two areas :

(1). Java-Bali, Barelang-Binkar and Timika and
(2). Other areas

1. JAVA-BALI, BARELANG-BINKAR & TIMIKA

In this areas ACD is carried out by malaria surveillance agent through regular household visit. The frequency of the visits depends on the seriousness of malaria incidence and other purposive consideration.

In the islands of Java, Bali, Batam and Bintan two weekly visit is applied in HCI areas (Villages with malaria cases more 5 per 1000 population), in MCI areas (villages with malaria cases between 1 up to 5 cases per 1000 population.) is conducted monthly, whereas in LCI the visit is perform on three monthly visit.

In Barelang and Binkar islands, all of the areas are covered by ACD, as there is no shortage in the number the surveillance agents. In Bintan Beach International Resort active malaria surveillance is conducted by the health division of the project, using worker-supervisors as the surveillance agent.

In Java-Bali and Barelang-Binkar, blood films collected by the surveillance agent from fever cases and sent to the Health Centers for microscopic examination.

In Timika, Irian Jaya Province, where intensive malaria control is organized by PT. Freeport Indonesia, daily house to house visit is performed by surveillance team.

In addition to the above active case finding, all clinical malaria cases detected by health centers and hospitals are to be bled for slide examination.

In all areas where ACD is conducted, all microscopic confirmed malaria cases are to be visited by senior surveillance agent for epidemiological investigation to classify the malaria cases into indigenous, imported, relapse or unclassified. Follow up actions is made by the HC based on the result of the investigation.

2. OTHER AREAS

Malaria surveillance in other areas of Indonesia is mainly based on the clinical finding in health centers and hospitals. This is due to the lack of microscopist and microscope in many of the health centers.

In the health centers with no laboratory facilities, all clinical malaria cases are treated with standard malaria treatment (Chloroquine 10 tablets and primaquine 3 tablets).

In hospitals and health center where laboratory for malaria confirmation is available, treatment of malaria cases is given according to the species of malaria parasite.

In transmigration and other priorities areas (industries, mining, forestry, tourism and other development projects), malaria prevalence is measured by conducting malariometric survey to children under ten years old, every year during the expected highest malaria transmission. Spleen examination is usually conducted to measure malaria endemicity at the beginning of each development project.

Malariometric survey in transmigration areas and the surrounding villages are conducted yearly by the district health offices together with the health centers, to monitor malaria prevalence. Whereas in the development projects and areas of 2 km radius outside the

project is the responsibility of the private companies usually provide clinic with doctors/nurses and anti malarial drugs. Report on the clinic attendants is usually sent to the District Health Office.

B. VECTOR SURVEILLANCE

Activities of vector surveillance include :

1. Monitoring potential breeding places of An. sundaicus (and An. subpictus).
   In west coast of Sumatera, south coast of Java, Bali and Lombok islands, monitoring Anopheles sundaicus breeding places is usually conducted every month during the malaria transmission season in each of the malaria foci.

   Larva control measure such as larviciding or cleaning algae on the water surface are immediately conducted to eliminate Anopheles sundaicus larvae and prevent malaria transmission and outbreak.
   In Bintan resort of Riau Province , larva monitoring and elimination is conducted weekly to prevent malaria transmission in these tourism areas by Malaria Division of Bintan Beach International Resort.

   Similarly in Timika, intensive monitoring and elimination of larva is conducted regularly by PT.Freeport Indonesia.

2. Monitoring insecticide for detecting early resistance of malaria vectors is conducted in areas with high suppression of insecticide residual spraying.

3. Monitoring fluctuation the vector density on a monthly basis is conducted in selected localities of malarious areas in several provinces.

C. MONITORING ANTI MALARIAL DRUG EFFICACY:

Monitoring anti malaria drug efficacy aims to detect resistance of anti malarial drugs to P.falciparum . At present the monitoring has been done in 3 provinces of Indonesia : Central Java, Yogyakarta and East Nusa Tenggara Provinces this will be expanded to 4 other provinces i.e. West Java, South Sumatera, Central Sulawesi and South Kalimantan Provinces.

III. PARTICIPATION OF COMMUNITY & OTHER SECTORS

In outer islands and in malaria foci Java-Bali, cadres in malarious areas is provided by a simple anti malaria drug (chloroquine) in their home to treat fever cases (Drug post). In addition, the cadres also take part in the regular activities of POSYANDU by reporting fever cases with chills and give anti malarial drugs. The cadres is guided and supervised by the health center.

In Java and Bali, head of villages in malaria potential areas (receptive areas) are requested to inform health center if any fever case coming from outer islands for blood examination.

Transmigration Department provides facilities for sub-health center including anti malarial drugs in each transmigration areas and operational cost for vector control.

Most of the private sectors in development project provide health facilities including anti malarial drugs and other facilities for personal protection such as distribution of bet-net and provision mosquito screen housing to prevent malaria transmission.

All hospitals and clinics of private and public are requested to sent monthly report to the District Health Office.

IV. PROBLEMS

1. Shortage of microscopist/laboratory technician and lack of microscope at the health center in outer island.
2. Diminishing number of surveillance agents has caused limited areas covered by malaria surveillance.
3. Limited quantity and quality of the entomologist at the province and assistant Entomologist at the district level as well as mosquito collectors in the field level.
4. Lack of legislation concerning the obligation of private sectors in the prevention and control of malaria.
5. Lack of sense of emergency on malaria among health providers from central down to the health center have caused unproper recording, weak analysis, delayed reporting and delayed response to anticipate malaria problem.
6. Lack health education activities to increase community involvement.
7. Lack of experience staff in malaria control at all administrative level.
8. No laboratory facilities for cross checking at the District level.

V. FUTURE PLAN

To improve the quality and coverage of the malaria surveillance , the following activities has been planned as follows :

1. Training of microscopist /laboratory technician at the health center and provision of microscope to health center in outer islands.

2. Training entomologist and assistant entomologist.

3. Training of Health staff at the Province, District and HC on malaria surveillance.

4. Improve waging and recruitment system of malaria surveillance agent in Java-Bali.

5. To strengthen and develop various components of surveillance system within the health sector (village midwife, sub-health center, private practice) and other sectors including private companies and the community.

6. Establishment of regulation for private sectors in malaria prevention and control.

7. To intensify information and develop health education program on malaria control.
8. To develop Vector Control Field Station (VCFS)

   In six Provinces under ICDC Project, the VCFS are being constructed to support the Malaria Control Program in providing reliable and accurate data for control activities. VCFS will carry out surveys and operational studies to solve the malaria and other vector borne diseases problems. VCFS will be established 6 provinces under ICDC project (South Sumatera, West Java, Central Java, South Kalimantan, Central Sulawesi and Eats Nusa Tenggara provinces).
   The VCFS will also involve in various training on malaria and other vector borne diseases to health staff of District Health Office and Health Center.

VI. SUMMARY

Since 1968 when Malaria Eradication Program (MEP) in Java-Bali was terminated the malaria control including surveillance activities has been integrated into general health services. However, up to the present, active case finding is still implemented in high case incidence of Java-Bali, and in Barelang-Binkar where the control program aims at elimination of malaria and in Timika where malaria transmission is extremely high and the vector is difficult to be controlled. Whereas, in other areas of Indonesia, malaria surveillance was conducted mainly based on the clinical malaria case finding.
In transmigration area malariometric survey is conducted by District Health Officers once a year during the expected highest transmission. Whereas in the development projects such as mining, forestry, tourism etc. malaria case finding and management is handled by the private companies clinic.

At present malaria surveillance in Indonesia has not achieved a total coverage as a consequences of limited number of surveillance agent in Java-Bali, and lack of microscopist and laboratory facilities at the health center in the outer islands.

To improve coverage and quality of malaria surveillance, several steps have been planned and conducted :

1. Improvement of policy and strengthen malaria surveillance system.

2. Training of microscopist and entomologist, provisions of microscope at the health center.

3. Training on malaria surveillance to the health staff from the province down to the health center level.

4. Develop and improve cross check system for microscopi work.

5. Strengthen and develop various component of surveillance system whit in health sector, other sector and the community.

6. Development of vector control field station in six provinces.

PAPERS PRESENTED

WORLD HEALTH ORGANIZATION
ORGANISATION MONDIALE DE LA SANTE

MEETING ON 'IMPLEMENTATION OF COLLABORATIVE ACTIVITIES ON ROLL BACK MALARIA, NEW DELHI, 4-6 MAY 1999'

TENTATIVE PROGRAMME

Tuesday, 4 May 1999

	0800 – 0830 hrs	Registration
	0830 – 0930	Inauguration - as per enclosed programme
	0930 - 1000	Introduction of participants Election of Office Bearers Announcement of administrative arrangements
1	1000 -1030	The Roll Back Malaria concepts, mechanisms and approaches *(Dr David Nabarro)*
2	1030 -1100	WHO / UNICEF partnership for rolling back malaria *(Dr Rudolf.Knippenberg)*
3	1100 -1120	Rolling Back Malaria in SEA Region through Health Sector Development *(Mr David Peters)*

4	1120 –1140	A brief overview of the malaria situation : The main types of malaria situation, the main problems in the region and the progress made *(Dr V.S. Orlov)*
5	1140 – 1200	Challenges for Rolling Back Malaria ▪ The malaria problem in India *(Dr Shiv Lal)*
6	1200 – 1220	Challenges for Rolling Back Malaria ▪ The malaria problem in Indonesia *(Dr Thomas Suroso)*
	1220 - 1330	*Lunch break*
7	1330 - 1350	Provision of health care for malaria (early treatment) in decentralised health systems *(MrRajiv Misra)*
8	1350 - 1410	Anti-malarial drug resistance patterns and monitoring systems in South Asia: a review of the situation in the region and an outline of the issues *(Dr V.S. Orlov)*
9	1410 –1430	The role of combination therapy for malaria *(Dr Francois Nosten)*
10	1430 –1500	Cost effectiveness studies on bed nets / house spraying in South Asia : The rational use of insecticides, monitoring of Resistance and national policies on insecticide use *(Dr V.P. Sharma)*
	1500 – 1530	*Tea / Coffee break*
11	1530 – 1610	Environmental changes and scope for transmission control *(Dr F.P. Amerasinghe and Mr Robert Bos)*
12	1610 – 1630	The role of the private sector in prevention and treatment of malaria: success stories, opportunities and potential mechanisms *(Dr Mohammad Asri)*
13	1630 – 1650	Involving donor agencies in country level action: a moderated discussion *(Moderator: DFID)*
14	1650 – 1710 ✓	Roll Back Malaria in the Community *(Dr Ravi Narayan)*

Wednesday, 5 May 1999

15	0800 – 0820	The role of media in advocacy for RBM, and the scope for social and political mobilization *(Mrs Harsaran Bir Kaur Pandey)*
16	0820 – 0840	Malaria indicators used in the SEA region, and the need for better standardization *(Dr R.M. Montanari)*
17	0840 – 0900	Lessons learnt from the recept epidemics with the region *(Dr M.B. Bista)*
18	0900 – 0920	Existing malaria surveillance systems as a decision support mechanism in Indonesia *(Dr Thomas Suroso)*
19	0920 – 0940	The use of GIS as a component of the surveillance system *Dr A.R. Wickremasinghe)*
20	0940 – 1000	Epidemic malaria in chronic emergencies *(Dr Francois Nosten)*
	1000 – 1030	*Tea / Coffee break*
21	1030 – 1050	Presentation of the Roll Back Malaria Technical Support Network on Malaria Epidemics *(Dr Charles Delacollete)*
22	1050 – 1130	Coordination of malaria control in border areas: status and needs *(Dr Shiv Lal)*
	1130 – 1230	Formation of Working Groups
	1230 – 1330	*Lunch Break*
	1330 – 1500	Group Work
	1500 – 1530	*Tea / Coffee break*
	1530 – 1630	Group Work

Thursday, 6 May 1999

0800 – 1000	Preliminary presentations by Groups
1000 – 1030	*Tea / Coffee break*
1030 – 1230	Group discussion as per enclosed details
1230 – 1330	*Lunch break*
1330 – 1500	Group Work
1500 – 1530	*Tea / Coffee break*
1530 – 1630	Adoption of Recommendations
1630 – 1700	Closure of Meeting

DIS-7.

Malaria Journal

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Case study

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A community-based health education programme for bio-environmental control of malaria through folk theatre (*Kalajatha*) in rural India

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Published: 15 December 2006

Malaria Journal 2006, **5**:123 doi:10.1186/1475-2875-5-123

Received: 13 December 2006
Accepted: 15 December 2006

This article is available from: http://www.malariajournal.com/content/5/1/123

Abstract

Background: Health education is an important component in disease control programme. *Kalajatha* is a popular, traditional art form of folk theatre depicting various life processes of a local socio-cultural setting. It is an effective medium of mass communication in the Indian sub-continent especially in rural areas. Using this medium, an operational feasibility health education programme was carried out for malaria control.

Methods: In December 2001, the *Kalajatha* events were performed in the evening hours for two weeks in a malaria-affected district in Karnataka State, south India. Thirty local artists including ten governmental and non-governmental organizations actively participated. Impact of this programme was assessed after two months on exposed *vs.* non-exposed respondents.

Results: The exposed respondents had significant increase in knowledge and change in attitude about malaria and its control strategies, especially on bio-environmental measures ($p < 0.001$). They could easily associate clean water with anopheline breeding and the role of larvivorous fish in malaria control. In 2002, the local community actively co-operated and participated in releasing larvivorous fish, which subsequently resulted in a noteworthy reduction of malaria cases. Immediate behavioural changes, especially maintenance of general sanitation and hygiene did not improve as much as expected.

Conclusion: This study was carried out under the primary health care system involving the local community and various potential partners. *Kalajatha* conveyed the important messages on malaria control and prevention to the rural community. Similar methods of communication in the health education programme should be intensified with suitable modifications to reach all sectors, if malaria needs to be controlled.

Background

The threat of malaria

Malaria is a major public health threat to the developing world, indirectly affecting the economic development. Nearly 40% of the world's population is at risk and 80% of the burden exists in sub-Saharan Africa. Almost all the remaining cases exist in tropical and subtropical Asia, Latin America and Melanesia [1]. In India, less than two million cases with few hundred deaths are recorded every year [2,3], but the estimated number is 15 million with about 19,500 deaths [4]. Karnataka state, south India contributes approximately 7–10% of India's annual malaria burden [5].

The need for health education in malaria control programme

Unlike HIV/AIDS, sufficient emphasis has not been given to health education in malaria control programmes. This has resulted in poor community acceptance and involvement in the various control strategies undertaken [6]. WHO under the Roll Back Malaria (RBM) initiative recognizes the need for community participation and inter-sectoral co-ordination involving various like-minded partners for effective programme implementation [7]. Community being the stakeholder, it is essential that information about diseases and their control methodologies should be made available to them [8].

There is no standard format for delivering health education messages. Many conventional methods such as posters, pamphlets, hoardings and electronic media, have limited effects on the rural community due to their low literacy rate. In such situation, *Kalajatha* (folk theatre) as a medium of mass communication has been experimented to assist the malaria control programme.

Background to the study

Each year, nearly 50% of malaria cases in Karnataka were reported from the districts of Tumkur, Hassan, Chickmagalur and Chitradurga [5]. *Anopheles culicifacies* is the primary malaria vector, which breeds mainly in wells, streams and irrigation ponds [9]. The traditional method of malaria control using indoor residual spraying with insecticides even with synthetic pyrethroids did not produce the expected result. A kind of frustration was prevailing in the local community. In a silk producing area of Kolar district, local farmers were reluctant to the use of DDT spaying because of the perceived deleterious effect on silk worms. In this area, bio-environmental control of malaria especially larvivorous fish is very effective in controlling *An. culicifacies* [10,11]. Tumkur was one of the five districts in India selected for situational analysis under RBM. The expert committee recommended the need for health education in malaria control [12]. Based on this, the present programme was initiated with the following objectives:

i. to assess the operational feasibility and communication efficacy of *Kalajatha* in health education programme for bio-environmental control of malaria.

ii. inter-sectoral co-ordination and involvement of all potential partners in health education.

Methods

Population and the area served

The *Kalajatha* programme was organized in Primary Health Centre (PHC) Mathigatta under Chikkanayakanahalli taluka, Tumkur district which was badly affected by malaria [5]. This *taluka* (secondary revenue division) has 264 villages covering an area of 112,998 hectares with a population of 215063 in 2001. The villages are administered by 28 *Gram Panchayats* (village elected representation). Health care services are provided through eight PHCs. PHC Mathigatta has 58 villages with a population of 28253. The literacy rate was 63%. The male to female sex ratio was 0.97. Infant mortality rate was 50 per 1,000 live births. The birth rate is double the death rate. Agriculture, horticulture, and animal husbandry are the main economic activities, which engage almost 80% of the workforce. Coconut is the main cash crop. Agriculture provides only seasonal employment and the returns are low. Non-agricultural economic activities are poorly developed. The annual rainfall ranges from 600 to 800 mm while temperature is between 13°C and 39°C. The peak malaria transmission period is in the months May and June.

The partners and planning

The National Institute of Malaria Research (NIMR) and Community Health Cell (CHC), Bangalore, jointly initiated the programme. An inter-sectoral co-ordination committee was formed involving ten governmental and non-governmental organisations for smooth functioning. The district health committee headed by the District Commissioner approved the proposal of the *Kalajatha* programme. NIMR and CHC, Departments of Health, Education, Child and Women's Welfare, Rural Development and *Panchayat* Raj, Tumkur Science Forum, local political and religious leaders actively participated in this programme.

Thirty local artists (15 males and 15 females) from different occupational background were selected. A local scriptwriter wrote 8 songs, two dramas and 4 *rupakas* (musical dramas). The scripts were based on various aspects of malaria namely signs and symptoms of sickness, treatment, health facilities, processes of transmission, role of anopheles mosquitoes and names of the malaria vectors,

breeding grounds of mosquitoes especially the vectors, its control strategies focusing especially on larvivorous fish (*Poecilia reticulata* and *Gambusia affinis*) and environmental management. Other control strategies like insecticide-treated nets, adopting measures for maintaining general hygiene, keeping cleanliness in and around houses, and the role of the community were also included in the script. These were then translated into skits using local dialects, musical styles and theatre traditions. In the beginning, the artists underwent orientation training on the entire processes. Two troupes consisting of 15 artists each were formed. Before the actual performances, they rehearsed the events in the evening for two weeks in a religious trust of *Kuppur Mutt* (Figure 1). Each troupe was equipped with a set of musical instruments and a performing wardrobe.

The Kalajatha *events*

The *Kalajatha* events were performed in December 2001. One week before the events, wide publicity was given through the local village administration (*Gram Panchayat*) and the community consent was obtained from the village headmen or *Panchayat* presidents (Figure 2). The Minister-in-Charge of the district and the local elected legislative assembly members inaugurated the programme (Figure 3). The events were performed in the evenings so that maximum number of people could witness. Every day, each troupe visited two villages and spent two hours in each village. Villagers voluntarily attended the programmes (Figure 4). Local health officials and *Gram Panchayats* provided all the necessary logistics and hospitality. A valedictory function was held at the end, which was presided over by the Director of Health Services, Karnataka (Figure 5). Local media covered the events and helped in spreading the key messages.

Figure 1
Rehearsal of the *Kalajatha* programme in the evening at the *Kuppur Mutt* (religious trust). A trainer was directing the artists.

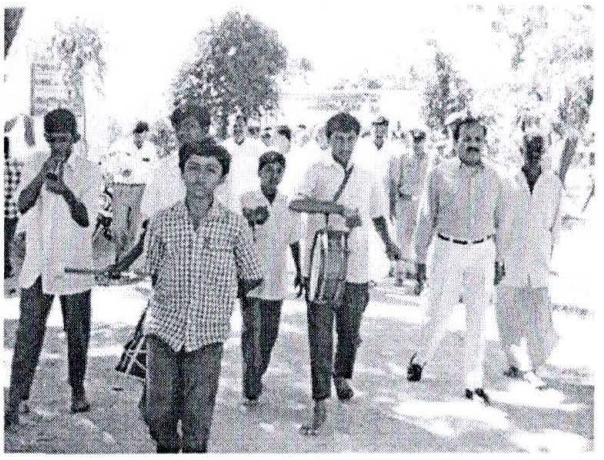

Figure 2
Public awareness campaign for the *Kalajatha* programme. Local high school children, teachers and *Gram Panchayat* members took part in the campaign.

Impact assessment

Two months after the events, impact was assessed in five villages of PHC Mathigatta (exposed) and in another five villages of PHC Dasaudi (non-exposed) chosen at random. Semi-structured interviews based on eight questionnaires were conducted with individual households. In each village, households were selected randomly and considered as one unit. All the individuals in the house

Figure 3
Inauguration of the *Kalajatha* programme, December 2001. The Minister-in-Charge of Tumkur district, local *Gram Panchayat* members, Head, *Kuppur Mutt*, district health officials, members from NIMR, CHC, Bangalore and others were present.

Figure 4
A glimpse of the *Kalajatha* programme performed by the artists. The artists are presenting the various sings and symptoms of malaria.

present at that time were interviewed. Children below eight years were excluded. Responses between the exposed and the non-exposed respondents were analyzed following Fisher Exact and χ^2 tests, wherever applicable.

Results

Data on the Kalajatha responses are shown in Table 1. Of the total 87 households interviewed 48 were from PHC Mathigatta (exposed) and 39 from PHC Dasaudi (non-exposed). In the exposed households, 152 (23 children and 129 adults) and in the non-exposed households 137 (17 children and 120 adults) respondents respectively were interviewed. The exposed respondents significantly gained new knowledge about malaria, its symptoms, transmission and control methodologies ($P < 0.001$). They could easily associate clean water with anopheline breeding and recall the names and the role of larvivorous fish guppy (*Poecilia reticulata*) and *Gambusia affinis* in control of malaria vectors. However, immediate behavioural changes especially in maintenance of general hygiene were not observed. The budget breakdown of the events is summarized in Table 2. The per capita cost for conducting the programme was INR 3.0 (US $ 0.064; 1 US $ = 47 INR).

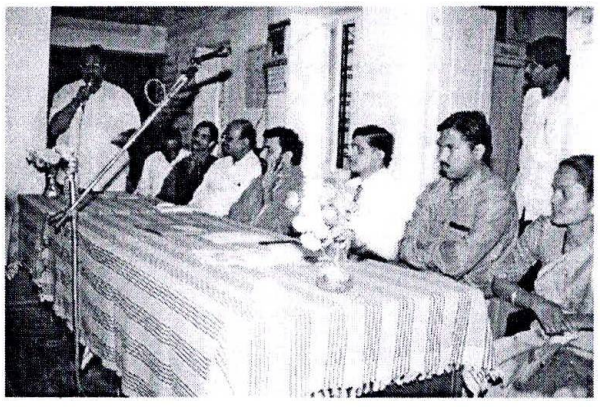

Figure 5
Sharing the experience of the *Kalajatha* programme in the valedictory function. The Director, Health and Family Welfare Services; Head, *Kuppur Mutt*, members from NIMR, CHC and local *Gram Panchayat* members and other local health officials participated in the function.

Discussion

There are many forms of theatres for delivering health messages. Street theatre, folk theatre forum theatres etc. are being used in many countries. In the Indian sub-continent *Kalajatha* is a very lively and highly powerful traditional art of dance and drama (folk theatre) which delivers key messages of the life processes in local dialects and cultural settings. This is slightly different from street theatre. Street theatre is utilized for mobilizing people to participate in controlling tuberculosis, HIV/AIDS, polio, diarrhoeal diseases and also malaria [13-16]. Puppet shows and street theatre is being used extensively in HIV/AIDS control programme [17,18]. In Africa and in North America, in both rural and urban settings, forum theatre is an effective means of health promotion. Projects on women's health, care for patients with mental disorders, and AIDS prevention show the usefulness of this medium for community action programmes [19]. Theatre was used for mobilizing and sensitizing the community for tsetse control in Uganda [20]. In a cross-sectional study, an impact of IEC campaign for tuberculosis and health seeking behaviour was assessed in Delhi and was used as programme performance indicator [21].

Attempts were made to explore this strong medium for bio-environmental control of malaria under the primary health care system. The performances were very lively and motivating and many spectators even offered to act along with the actors. In some events many had reacted and also agitated for not providing the proper treatment and correct information to the community earlier. The biggest information delivered to the community was that Anopheles and Aedes mosquitoes breed in clear water as against the general belief of polluted water where Culex mosquitoes generally breed. Use of biocontrol agents, source reduction of opportunistic breeding of vector mosquitoes, treatment, health education, environmental management, maintenance of cleanliness and personal hygiene are important components of bio-environmental control strategy. This method is very effective in Indian situations [22]. Besides this, various other methods of malaria con-

Table 1: Responses of the *Kalajatha* events performed in December 2001

S. No	Questionnaires	Respondents		P
		Exposed	Non-exposed	
1	Any new learning	17 children and102 adults responded that they had learnt new information about malaria	None responded correctly	< 0.001[a]
2	Signs and symptoms of malaria	6 children and 93 adults could describe the three stages of malaria; chill, fever and sweat	None could tell correctly	< 0.001[a]
3	Knowledge of malaria transmission	9 children and 57 adults specified correctly	Only 4 school children	< 0.001[b]
4	Name of the malaria vectors	11 children and 61 adults. Children clearly specified female Anopheles mosquito	Only 4 school children	< 0.001[b]
5	Breeding grounds of malaria vectors	19 children and 102 adults clearly specified clear water sources	3 children and 10 adults specified clear water	< 0.001[b]
6	Larvivorous fish in malaria control	19 children and137 adults clearly specified	Only 13 adults specified	< 0.001[b]
7	Names of larvivorous fish	8 children and 18 adults correctly responded	None responded	< 0.001[a]
8	Any physical improvement/ changes after the events	All responded positively to change in their attitude towards cleanliness and hygiene. However, no change in practice was observed	Negative response	

[a] Fisher Exact test; [b] Chi-square test; % Effectiveness could not be found due to some responses were 0 (none) in the non-exposed respondents.

trol including insecticide treated nets were also incorporated in the messages, but the focus was on larvivorous fishes since they are, at the moment, the main intervention in malaria control in the area.

The present study set an example of inter-sectoral co-operation between various heterogeneous groups. Apart from the impact, the process was itself a model of governmental and non-governmental partnership which was timely especially when the government is seeking examples of public-private partnership in health education activities. The education department deputed five teachers while the Child and Women's Welfare Department deputed ten *Anganwadi* (female resident staff) workers for one month. Fifteen members from the local community, with various occupational backgrounds ranging from carpenter to barber, and having artistic acting and singing talent came together as a team. The Government of Karnataka through the Department of health partially funded the programme. Politicians and ministers played their role by accepting the invitation to inaugurate the programme thereby providing wider visibility to the health education programme. Religious leaders contributed by offering free accommodation and hospitality for the period of one month as a token of solidarity in the fight against malaria.

The press and radio helped in wider dissemination of health education messages and analyzing the malaria situation of the district. Female artists were involved in the team, which resulted in good responses from the women community. Currently, all the developmental programmes including health are directly executed by the *Panchayat Raj Institution*. The local *Gram Panchayat* members provided maximum support to this programme. Subsequently these members played a major role in disseminating the messages and generated awareness in the entire area. In the following year (2002), the community co-operated actively in a WHO funded project in releasing larvivorous fish for malaria control. The mid-term report revealed that in Chikkanayakanahalli taluka malaria cases have declined from 10,136 in 2001 to 66 (up to September 2006) [23].

The present study was aimed to sensitize and mobilize and its impact on the community using folk theatre to control malaria especially on bio-environmental measures for which no comparable baseline data were available. The data between the exposed and non-exposed respondents indicated that there was no perceived information on the present campaign. In rural areas many festivals and socio-cultural programmes are performed that

Table 2: Budget breakdown of the *Kalajatha* programme

Item
Grant provided by the State Health Department, Government of Karnataka towards honorarium for 30 artists; local transport from their houses to the PHC head quarter; wardrobes; event management and incidental expenditures for two organisers from Community Health Cell
Approximate amount received in kind:
Kuppur Mutt for in-house one-week training of the artists
Taluka Health Office for providing transport facility from PHC to the respective villages for 15 days
Gram Panchayats for providing refreshments
National Institute of Malaria Research, Bangalore
Total amount spent to cover 58 villages (population 28253) was INR 85000.00 Per capita cost was INR 3.0 (US$ 0.064); 1 US$ = INR 47.

Table 3: General steps, in chronological order for conducting a *Kalajatha* programme

Target: Local community suffering from a specific disease for which they can contribute in the control programme.
Partners and planning: Select the problematic area. Identify the related partners. Form a co-ordination committee involving all potential partners. Arrange funding for the programme. Identify the artists. Conduct the programme in an appropriate season and time. Give wide publicity and seek political and religious support. Rehearse the programme.
Content: Compose music and drama based on the local dialects and tradition carrying the key messages of the disease and its control methodologies. Emphasis should be given on their specific role in the control programme.
Logistics: Materials for event management e.g. wardrobe, light and sound systems, refreshments, honorarium and transport etc. for the artists should be made available in time.
Precautions: Prior consent of the community should be obtained. Other programmes should not coincide in the same area. An orientation workshop is necessary for the collaborating partners before launching the programme. Co-ordination should be maintained at all levels and time.

may have some counter effects on such events. Such issues were taken into consideration while organizing the *Kalajatha* events.

Conclusion

Health education aims at behavioural changes in individuals and the community. *Kalajatha* was found to be a very effective medium in promoting health education and possibly behavioural changes to the rural community. The immediate behavioural changes especially on maintenance of general hygiene was not observed. However, the first essential step towards achieving behaviour change communication in the community was achieved by providing correct and scientific information on malaria control and prevention through the innovative and traditional medium that the rural community best identified. Implementation of control measures by the authorities would enhance the community's acceptance and bring about major behavioural changes so as to avoid mosquito borne diseases [24]. Efforts were made to convey the correct messages to the community, because wrong messages may have disastrous after-effects. Many still believe two kinds of environmental modifications which are effective against malaria and are unfortunately frequently included in health education posters as anti-malaria measures. These are (a) cutting grass and bush clearance which was shown to be completely ineffective [25]; (b) clearing of garbage to prevent rainwater accumulation that supports breeding of *Aedes* mosquitoes which need to be controlled for dengue outbreaks, but these mosquitoes do not transmit malaria.

Webber [26] has rightly advocated 'a multiplicity of simple methods, carried out by many people who are likely to be more successful in the long term than more complex methods. It will be the community who will finally control malaria, but health authorities must advise and assist them in the ways of achieving this'. In the study area bio-control of malaria programme is being maintained routinely. People still refer to the *Kalajatha* events and the messages delivered to them earlier. Thus this made indelible marks in the people's mind for a long period. This programme is now utilized for other diseases also. A detailed account has been described in Table 3 for carrying out a *Kalajatha* programme with suitable modifications. Based on the results described in the present paper, the State Health Department is conducting such events for the prevention of HIV/AIDS.

Authors' contributions

SKG and RRP conceived and arranged the entire programme. SNT assisted in conducting the events. APD reviewed and edited the paper. All authors helped write, read and approved the final manuscript.

Acknowledgements

We would like to thank Dr. Ravi Narayan and Dr. CM Francis and other members of the CHC, Bangalore team for guidance and encouragement; the teachers from government schools and the Tumkur Science Forum in helping us with detailed field arrangements; the Deputy Commissioner, the District Health Officer, the District Malaria Officer of Tumkur District, the Taluka Health Officer, Chikkanayakanahalli taluka, the PHC Medical Officer, Mathigatta, the Indian Council of Medical Research, New Delhi for their support. A special acknowledgement to the students of the Indian Institute of Management, Bangalore for data collection and all the artists of *Kalajatha* for active participation. We are grateful to the Director, Health and Family Welfare Services, Government of Karnataka for providing financial assistance and his keen interest in the programme. Special thanks to Prof C.F. Curtis, London School of Hygiene and Tropical Medicine, London for reviewing and valuable suggestions.

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DIS-5A.

INT J TUBERC LUNG DIS 14(10):1215–1221

2010
THE YEAR OF THE LUNG
Series editor: John F. Murray

In this month's 2010: Year of the Lung series, readers are privileged to have the views of two groups of experts from different parts of the world who agree that extreme poverty and all its accompaniments—malnutrition, overcrowding or homelessness, addiction, and lack of access to health care—is the major driving force underlying the presence and spread of tuberculosis, including the current increases in tuberculosis caused by multiple drug-resistant and extensively drug-resistant strains. Doctors Benatar and Upshur reach this conclusion by taking an historical route from the distant past to the present and suggest 'a new mind set' for the future. By contrast, Doctors Keshavjee and Farmer review the more recent treatment strategies that have worked and those that have failed, and propose ways to 'put boots on the ground' to finally control this eminently treatable scourge. Tuberculosis will continue to flourish as long as the poverty that fosters it remains uncontrolled. Moreover, experience has taught us how to mobilize resources in ways that have proved effective in controlling drug-resistant strains in previous high-burden, low-income regions. The time has come to apply these lessons.

JOHN F. MURRAY, *Series Editor*
e-mail: johnfmurr4@aol.com

Tuberculosis and poverty: what could (and should) be done?

S. R. Benatar,*† R. Upshur†

***Faculty of Health Sciences, University of Cape Town, Observatory, South Africa, †Joint Centre for Bioethics, University of Toronto, Toronto, Ontario, Canada**

HISTORICAL BACKGROUND

Four eras can be identified within the history and trajectory of tuberculosis (TB) in the world. In each of these eras, different sets of circumstances have contributed to the amelioration or aggravation of the burden of this disease (Table 1).[1]

We are now at a crucial and determining point in our global experience with tuberculosis, and we may well ask what the fifth era will hold for humanity. We face the spectre of either having to deal with more drug resistance or collectively making a concerted effort to face, realistically, the global challenges posed by tuberculosis. The persistence of poverty will ensure ongoing complexity in providing effective treatment. As severe poverty is the result of a global political economy deliberately structured by humans, we have the potential to control the scourge of tuberculosis.

WHAT IS POVERTY?

Poverty means being deprived materially, socially and emotionally. It includes lack of economic resources, lack of education, lack of access to basic life resources such as food, water and sanitation, and lack of control over one's life and reproductive partners. Absolute

Previous articles in this series, Int J Tuberc Lung Dis 2010 Editorials: Murray J F. 2010: The Year of the Lung. 14(1): 1–4; Castro K G, Bell B P, Schuchat A. Preventing complications from 2009 influenza A (H1N1) in persons with underlying lung diseases: a formidable challenge for 2010 Year of the Lung. 14(2): 127–129; Barker K. Canadian First Nations experience with H1N1: new lessons or perennial issues? 14(2): 130; Annesi-Maesano I. Why hasn't human genetics told us more about asthma? 14(5): 521–523; Billo N E. Good news: asthma medicines for all. 14(5): 524; Goodman P C. Computed tomography scanning for lung cancer screening: an update. 14(7): 789–791; Price K A, Jett J R. Advances in treatment for non-small cell lung cancer. 14(7): 792–794; Kumaresan J, Enarson D A. Inequities in lung health: challenges and solutions. 14(8): 931–934. **Unresolved issues:** Lalloo, U G. Drug-resistant tuberculosis: reality and potential threat. 14(3): 255–258. **Review articles:** Murray J F. The structure and function of the lung. 14(4): 391–396; Daley C L, Griffith D E. Pulmonary non-tuberculous mycobacterial infections. 14(6): 665–671. Perez-Padilla R, Schilmann A, Riojas-Rodriguez H. Respiratory health effects of indoor air pollution. 14(9): 1079–1086.

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Table 1 Four eras of tuberculosis

First era: eighteenth century Europe
- Tuberculosis accounted for 20% of all deaths, and killed about 500 people per 100 000 population every year in the United Kingdom. The cause of the disease was unknown then and there was no specific treatment.
- With improved living conditions associated with the industrial revolution, the annual death rate in the United Kingdom fell progressively to 200/100 000 by 1882 (the year in which Koch discovered the tubercle bacillus), and further to 50/100 000 by the time the first anti-tuberculosis drugs were introduced in the 1940s.
- These trends made clear the social underpinnings of the disease—an insight that needs to be more consciously appreciated and acted upon today.

* *Second era*: mid 1900s
- Development of effective treatment regimens.
- Sophisticated medical skills allowed development of drugs and the clinical trials required to show the effectiveness of short-course chemotherapy.
- Medical, managerial and political skills facilitated widespread application of such regimens in the United Kingdom and other countries, leading to a further fall in mortality to about 5/100 000 in wealthy nations.

* *Third era*: late 1900s and early 2000s
- Recrudescence of tuberculosis and the rise of multi- and extensively drug-resistant strains. This is the saddest era and the beginning of a reversion to the inability to treat the disease effectively.
- The possibility of drug resistance was recognised immediately upon the discovery of effective tuberculosis chemotherapy, yet warnings for great vigilance and care with regard to resistance went largely unheeded (World Health Organization 2010 report[1]).
- The emergence of drug resistance is also an indictment of political and global health institutions that have shamefully neglected to make the resources available to implement curative regimens worldwide.
- So, since the 1960s and 1970s, when it was potentially possible to eliminate tuberculosis globally, the global economy has fostered widening disparities in wealth and in health globally, and in the process ignored the global challenge of tuberculosis.

Current era
- Beginning in the 1980s, the HIV pandemic has resulted in the life-time incidence of active tuberculosis, rising from 5% in those who had been infected but remained HIV-negative, to over 50% in those who are HIV-positive.
- As a result the global annual load of new cases of tuberculosis increased from 6.6 million in 1990 to 9.3 million in 2007. As long as HIV continues to spread, so will HIV-related tuberculosis.
- The added complication of MDR- and XDR-TB (up to 100 times as costly to treat per patient, with much longer and more toxic regimens) is now making tuberculosis potentially untreatable in poor countries where the incidence and prevalence are highest.

HIV = human immunodeficiency virus; MDR = multidrug-resistant; XDR = extensively drug-resistant; TB = tuberculosis.

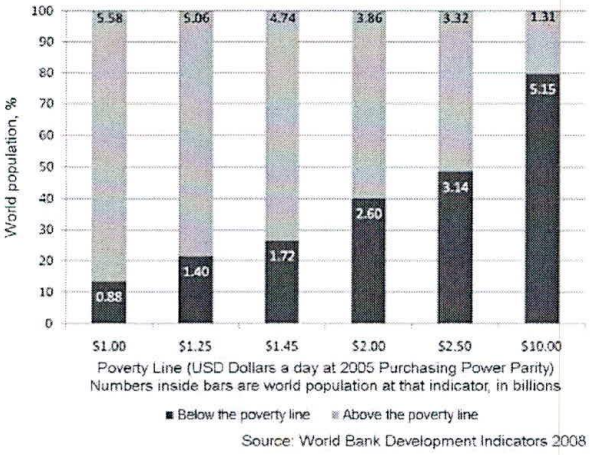

Figure 1 Percentage of people in the world at different levels of poverty. From Shah.[3] © Copyright 1998–2009, under a Creative Commons License.

poverty is defined as a condition of life severely limited by malnutrition, illiteracy, disease, squalid surroundings, high infant mortality and low life expectancy. Poverty brings not only material disadvantage but also social exclusion, which in turn is associated with discrimination across a wide range of social activities that adversely affect health and wellbeing.

Relative and absolute poverty have been constant characteristics of the human condition. With rapid increases in the wealth of the elite over the past 50 years, relative poverty has become more pronounced. At the beginning of the twentieth century the wealthiest 20 per cent of the world's population were nine times richer than the poorest 20 per cent. This ratio has grown progressively—to 30 times by 1960, 60 times by 1990 and to 140 times by 2009.[2]

Absolute poverty remains a problem, and its extent has increased. The number of extremely poor people in the world more than doubled between 1975 and 1995. Over half of the world's population live on less than $900 a year, and more than a quarter of the world's population live (on less than $1 a day) under conditions of absolute poverty (Figure 1).[3] Of the 4.4 billion people in developing countries, over half lack access to sanitation, over 30 per cent lack access to clean water and essential drugs, and almost a quarter are inadequately nourished. Five per cent of the world's population (who live in the United States) account for 50% of annual global health expenditure. Annual per capita expenditure on health care ranges from over $6500 in the United States (17% gross domestic product [GDP]) down to less than $15 in the poorest countries in Africa (<3% GDP). While notions of poverty that go beyond economic considerations have been suggested, these will not be further discussed here.[4]

POVERTY AND HEALTH

Absolute wealth and relative wealth both affect health. Among industrialised countries it is not the richest that have the best health but those with the smallest income differentials between rich and poor.[5] Despite the non-linearity of the relationship between wealth and health above annual per capita gross national products (GNPs) of $5000, the existence of this relationship and the effect of wide income differentials underscore the need to see health and disease as intimately linked to social and economic conditions.

Poverty directly accounts for almost one third of the global burden of disease. Poverty leads to poor health, which in turn aggravates poverty and reduces

* **Revised in online publication, November 2010.**

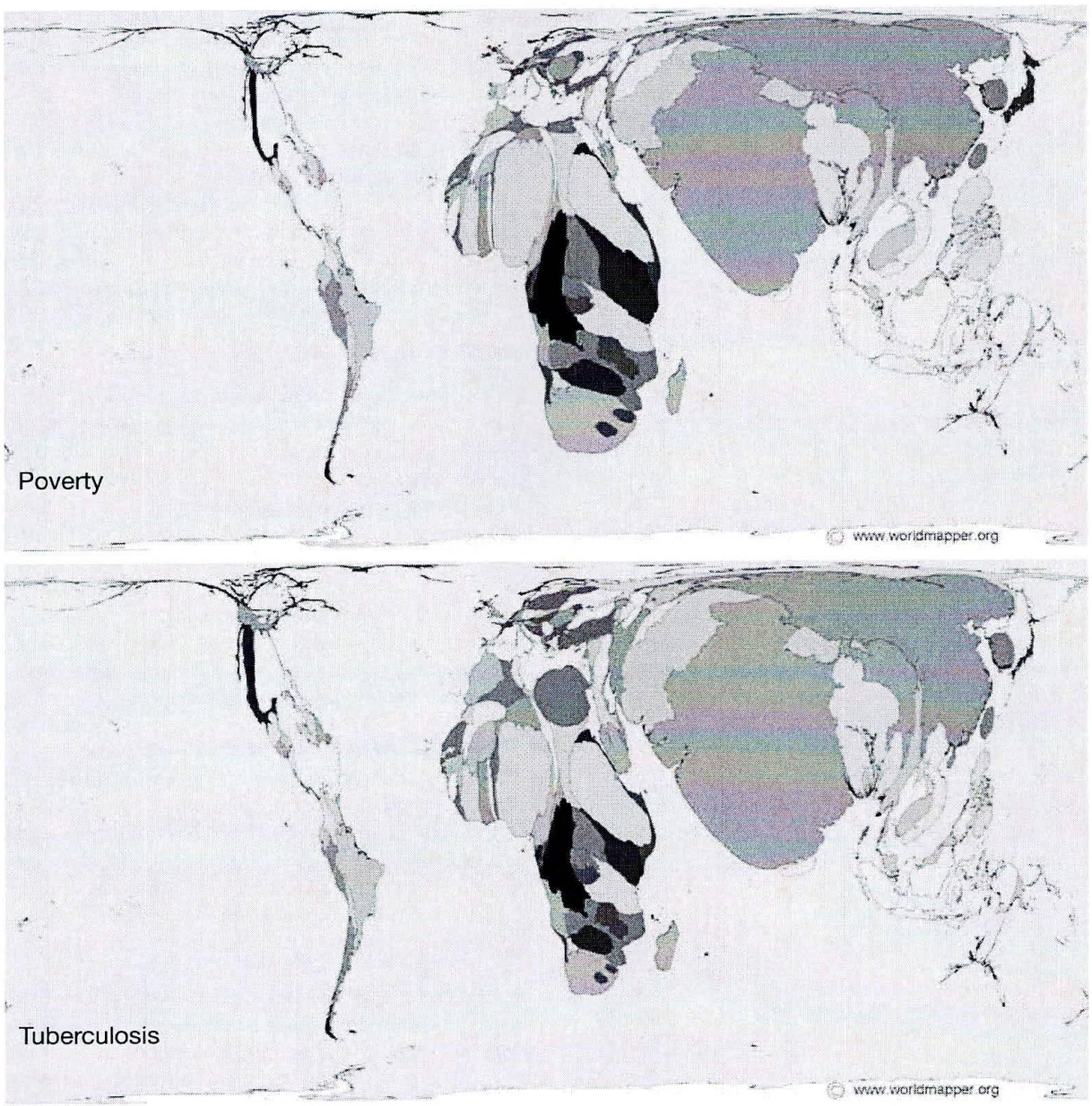

Figure 2 Top: World map of poverty with size of areas in proportion to degree of poverty. Bottom: World map of tuberculosis with size of areas in proportion to extent of tuberculosis. From WorldMapper, maps 228 and 174.[6] © Copyright SASI Group (University of Sheffield) and Mark Newman (University of Michigan). This image can be viewed online in colour at http://www.ingentaconnect.com/content/iuatld/ijtld/2010/00000014/00000010/art00001

human productivity. Ninety-five per cent of TB cases and 98% of TB deaths are in developing countries (Figure 2).[6] TB has a direct bearing on the economies of poor countries, as 17% of those who die from this disease are in the economically productive age group of 15–49 years. Poor adherence to treatment is a major problem.

Some of the reasons for poor adherence and loss to follow-up involve the competing priorities faced by poor populations: the need to earn money on a daily basis, duties towards family members, and substance misuse as a coping strategy for impoverishment. Overcoming these problems requires a level of social support that is rarely available in overburdened and understaffed health systems.[7]

Diagnosis: social, not medical failure

We can argue from the above that the correct answer to why the burden of morbidity and mortality from tuberculosis is increasing in many poor countries, and why multidrug-resistant TB emerged, lies more in the failure of how human society is structured and functions than from failures of medical practice.[4,5,8] When living conditions for millions of people remain at the

level of pre-industrial revolution England/Europe and health care services are so inadequate that easily affordable treatment cannot be provided for all who need it in good time and for the full duration required, we should not be surprised that the burden of suffering from tuberculosis can only get worse.[9]

How is poverty conceptualised in current policies responding to tuberculosis?

It is instructive to examine how poverty is understood and discussed in current documents from major global policy actors. Are interventions to remedy poverty viewed as important in their own right as a means to control tuberculosis? Is poverty alleviation seen as an adjunct to new biomedical interventions? If poverty is a causal determinant of tuberculosis, then it should be considered as an important focus for intervention studies.

While current policy documents tend to acknowledge poverty as a core determinant of health, recent policy documents have not explicitly stated that alleviation of poverty should be part of the response to control tuberculosis.

For example, in the World Health Organization (WHO) 6-step approach to addressing poverty in national tuberculosis programmes (see Table 2),[10] poverty is seen as a barrier to successful implementation of tuberculosis programmes, rather than a cause of tuberculosis amenable to direct influence. The Stop TB action plan (see Table 3) mentions mobilisation of resources, but does not explicitly address the issue of poverty.[11]

Table 2 Addressing poverty in TB control: options for national TB control programmes[8]

Step 1	Identify the poor and vulnerable groups in the country/region served by the national TB programme.
Step 2	Determine which barriers prevent access of the vulnerable groups to services that provide TB diagnosis and treatment.
Step 3	Assess potential actions to overcome the barriers to access.
Step 4	Review the situations and population groups requiring special consideration.
Step 5	Explore possibilities for harnessing additional resources.
Step 6	Evaluate the impact of pro-poor measures.

TB = tuberculosis.

Table 3 Stop TB action plan[9]

1	Strengthen quality of basic TB and HIV/AIDS control
2	Scale up programmatic management of MDR-TB and XDR-TB
3	Strengthen laboratory services
4	Expand MDR-TB and XDR-TB surveillance
5	Develop and implement infection control measures
6	Strengthen advocacy, communication and social mobilisation
7	Pursue resource mobilisation at all levels
8	Promote research and development of new tools

TB = tuberculosis; HIV = human immunodeficiency virus; AIDS = acquired immune-deficiency syndrome; MDR = multidrug-resistant; XDR = extensively drug-resistant.

The Beijing call to action against multidrug-resistant and extensively drug-resistant tuberculosis recognises poverty as a cause, yet omits any mention or discussion of interventions designed to alleviate poverty as a means of controlling tuberculosis.[12] The May 2009 World Health Assembly resolution on the prevention and control of drug-resistant tuberculosis also neglects any mention of poverty.[13] So, current major policy documents lack a systematic and explicit focus on poverty in relation to the control of tuberculosis, thus implicitly relegating it to secondary status.

WHAT COULD BE DONE?

Global poverty fuels TB. To create communities that work towards health for all and therefore contribute to humans flourishing in the long run, the causes of poverty and the social determinants of health must be addressed on an equal footing with medical approaches. The onus is on the global community to change perceptions and create conditions where, through solidarity, a united approach can be developed to alleviate a grave threat to human health. This will require addressing the root causes of poverty, which are so intimately linked to the social determinants of health, as an explicit goal of TB control strategies.

A new mind-set about ourselves and how we live

Efforts to address many pressing global problems, such as tuberculosis, are dominated by a development agenda that we know has been failing for many decades.[14,15] It is not surprising that the new poverty agenda that surfaced in the 1990s, and was embodied in the Millennium Development Goals (MDGs) 20 years later, 'stresses the importance of market-led growth itself as the most important method to address poverty'.[16] While global institutional efforts have been stepped up in support of the international development targets,[17] current global economic trends are sustaining privilege, poverty and abuse of our environment, while fostering inequality, intensifying starvation and promoting violence. Such global trends are devastatingly unsustainable and threatening to global health.[4,8,9]

The state of global health calls for new ways of thinking and acting. Among many shifts in metaphors that could encourage such progress is a shift from the idea of sustainable development to developing sustainability.[14] Like many others, we share the view that the dominant development paradigm (based on individual rights—mainly civil and political—and the acquisition/consumption of increased quantities of goods and services) does not itself create a harmonious world community, nor does it develop sustainability. In its place, a new paradigm of development has been proposed to facilitate progress towards the goals of sustainability through promotion and respect of rights, and by protecting basic needs.[14,18,19]

As we have argued elsewhere, an expanded discourse on ethics and human rights, more broadly conceived, could act as a wedge to new ways of thinking about ourselves and how improved health and security could be achieved for a greater proportion of the world's people.[20]

Endeavours to bring bioethics and human rights activities closer together in the quest for better global health provides an opportunity to reflect both on the content of the Universal Declaration of Human Rights (UDHR)—and of subsequent supportive covenants and declarations— and on the extent to which these aspirations have not yet been met.[21] Pessimism and optimism have been expressed regarding the fulfilment of these declarations to date, and what may be achieved in the future. The despair of some at the extent of the continuing and even escalating human rights abuses and violations throughout the world—even in highly privileged societies—is countered by the hope of others that with the development of international law and other human rights instruments, coupled with intensified educational efforts, the impact of the UDHR will spread more widely.[21] The General Comment on the Right to Health by the United Nations Committee on Economic, Social and Cultural Rights is viewed as a significant milestone.[22]

MAKING PROGRESS

In seeking to pursue an ambitious agenda for improving global health there are two main questions to be asked and answered. First, what resources are required in the short term to achieve immediate beneficial effects? Second, how can the global political economy be changed to result in longer term and more enduring amelioration of poverty?

What resources are required in the short term and are these available?

The poorest 1 billion people in the world live on less than $1 dollar per day and have health care packages in the region of $15 per year. It has been calculated that a tax of 1 cent on every $10 earned by the wealthiest 1 billion in the world could provide the additional $35 billion required per year to give the poorest 1 billion people a $50 annual per capita health care package.*

If $35 billion per year sounds a lot, we should recall that annual global military spending was $780 billion in the late 1990s, and that the annual cost of providing basic education for all in the world at that time was estimated at $6 billion, while that of providing access to reproductive health services for all women in the developing countries was about $12 billion. It is of somewhat morbid interest that industrialised countries spend on average 5.3% of GNP on the military (global military expenditure in 2007 amounted to US$1.339 trillion), but only about 0.3% on economic aid to developing countries.[23] Between 1998 and 2007, world military expenditure increased by 45%.[24] Most recently, up to $17 *trillion* has been raised worldwide to rescue financial institutions from their fraudulent activities that led to the currently evolving global financial disaster. This is 22 times more than the $750 *billion* required over 5 years to achieve the MDGs,[25] and it has not yet been possible to raise this amount!

Two more statistics are revealing of potential resources. First, in 2007, about $100 billion was provided to developing countries in the form of Official Development Assistance, of which much is used to pay donor country staff who assist in delivering aid. In the same year, developing countries paid $590 billion in debt repayment—mostly interest on debt.[26] (In addition to this there is extraction of mineral and other wealth, as well as active recruitment of trained professionals). Second, annual farming subsidies of about US$350 billion in industrialised countries and trade protectionism cost developing countries about US$100 billion annually in lost export earnings.[27] Allowing farmers in developing countries to sell their products at a fair price and not in competition with massive subsidies could largely eliminate the need for 'development' aid. Recent acknowledgment that the efforts of the Canadian International Development Agency (CIDA) have been less successful than desired and that the agenda should be liberated and reinvented provides welcome recognition of the limitations of so-called development aid:[28]

> The Canadian International Development Agency (CIDA) has failed to make a foreign aid difference in Africa. Since its inception in 1968, CIDA has spent $12.4 billion in bilateral assistance to sub-Saharan Africa, with little in the way of demonstrable results. CIDA is ineffective, costly and overly bureaucratic. Approximately 81% of CIDA's 1500 employees are based in headquarters in Ottawa. Field staff has little authority to design and implement projects or to allocate funds. This top-heavy system has perpetuated a situation where our development assistance is slow, inflexible, and unresponsive to conditions on the ground. (Segal H, Stollery P. Overcoming 40 years of failure: a new road map for sub-Saharan Africa. 2007. Quoted in reference 25.)

These facts and interpretations are not intended to imply that the wealthy, productive and fortunate in the world bear the total burden of blame for the economic activities that polarise the world. Failure of development is the result of complex interactions, many of which are not discussed widely.[29] Political realities within developing countries, including corruption, ruthless dictatorships, ostentatious expenditure

* Jeffrey Sachs during a video conference presentation at the Canadian Conference on International Health, Ottawa, October 2009.

by elites and under-investment in education and health, have contributed greatly to the suffering of billions.[30]

However, it is vital for privileged people to be cognisant of the extent to which these deficiencies in many developing countries have been facilitated by the policies of wealthy nations in pursuit of their own interests (characterised by ongoing, often fraudulent, extraction of natural and human resources). Insight into how favoured lives are sustained by overt and covert exploitation of unseen others could allow those of us who live comfortable lives anywhere in the world to appreciate that we do not have a monopoly of entitlement to the benefits of progress.[31,32] We should be capable of understanding that there is no real shortage of resources to improve the lives and health of the poorest in our world.

Changing the global political economy

While the concept of poverty can be broadened beyond a narrow definition of income to include other dimensions of human development,[4] both the issues and the strategies of current anti-poverty programmes are rooted in market-oriented policies—reflecting and reinforcing the dominant neo-liberal discourse.[8] Thus the first issue to be acknowledged is that alleviating poverty is not about charity or so-called official development assistance, but rather about fostering independence. Whether or not current policies can be changed, and how this may be done to make the world a better place, is now a topic being addressed by many.[33–36] The proposal for a 'Social Offsets' fund to supplement the biomedical approach to neglected tropical diseases is an example of a practical first step towards promoting new ways of alleviating poverty.[37]

Recent research in development economics has emphasised the importance of randomised interventions to build an evidence base for effective responses to poverty.[38] On this view, poverty is a condition that can be approached via the rigorous application of scientific method in the same way the modern evidence base has been built for medications.[39] Medications are typically evaluated in randomised controlled trials. Where are the controls in randomised poverty interventions? This means that poverty is not a background condition over which little influence can be exerted, but a condition that interventions can directly address. It is time to put interventions dedicated to alleviating poverty on an equal footing with interventions to evaluate new medications. The direct effect of poverty reduction interventions on rates of tuberculosis, then, should be seen as a major research priority.

CONCLUSIONS

In the absence of measures that could begin to reduce poverty, improve living conditions and enable the poorest in our society to achieve their potential as productive working citizens, the problems of tuberculosis, HIV/AIDS and other infectious diseases will surely get steadily worse in many countries. As these diseases know no boundaries and as they have profoundly adverse social and economic effects, we shall all pay the price—and a heavy one it will be for both individuals and society.

We can either begin to gear ourselves now towards the mind-set required to face the challenge of alleviating poverty and improving health, and in the process achieve meaningful social progress beyond only political emancipation and enrichment of privileged elites, or we can 'continue with business as usual' and pay the price later—losing much that has been gained and forgoing future gains. We are free to choose, and we shall be condemned to live with our choices. Whether or not we can avoid the errors made 40 years ago will mark the extent of our resolve as a species to eradicate tuberculosis as a disease that is potentially totally under human control.

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