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PERSISTENT MALARIA TRANSMISSION DUE TO OPERATIONAL AND
ENTOMOLOGICAL FACTORS AND METHODS TO BE RECOMMENDED

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From experience gathered for over a decade during malaria control and eradication campaign in the country, it is generally agreed that operational failure contributes largely towards continuation of transmission, though under certain circumstances entomological factors may also be responsible for persistent transmission.

I. Some of the major operational factors which may militate against prompt interception of transmission are grouped as follows:

- (1) Terrain, topography and communication difficulties.
- (2) Emergency conditions.
- (3) Lack of suitable training of spray crew as well as the supervisory staff.
- (4) Defective logistics.
- (5) Failure to maintain the correct time schedule.
- (6) Inadequate supervision.
- (7) Aggregation of labour and moving population.
- (8) Resistance from the people.

Terrain, topography and communication difficulties

As to the terrain, topography and communication difficulties etc. it should be borne in mind that inadequate or defective planning and failure to provide adequate staff are primarily responsible for incomplete coverage during spray operation. Normally every country is able to draw up estimates for the normal output per pump per day in a short period. In the plains areas and where population live in compact areas the output in India per pump per day is in the region of forty to fifty houses or about eighty to one-hundred houses for a five-man team working with two pumps. With H.C. sprayer the output is somewhat lower. However, in hill sectors or in forest areas as well as during heavy monsoon when movement is slow, obviously the output will be considerably reduced. Of necessity, therefore, suitable provision of staff should be made in respect of all such areas after taking into consideration the expected output of work. It would also be necessary to look into the accommodation facilities for the team for night halts, or else there will always be the tendency of the staff to return to base even without completing the assigned task. Although it is true everywhere it is much more important in operationally difficult areas. Also the fear of wild animals in forest areas, may goad the crew to return early before night fall. Incomplete coverage is the inevitable result. As such communication factors etc. should not be contributory factors for operational failure provided necessary provision is made for such areas.

Emergency conditions

Normally during emergency conditions like floods etc. the spray schedule is disrupted. If immediate provision is not made for application of spray soon after the flood recedes transmission cannot be intercepted. In many parts of this country there are areas which are affected by periodic floods and therefore, suitable provision has been made to meet such emergency. All areas affected by floods are sprayed again (irrespective of the height of the water) even though the houses may have been sprayed only recently. In other words the flood affected areas are sprayed all over again. Suitable provision should, therefore, be made in the plan of operation to meet such contingencies.

Lack of training

It is the general experience that unless the spray crew are fully conversant with the spray technique, proper formulations and the necessity of spray operation in every sprayable surface, the performance is generally sub-standard. Therefore, sufficient stress should be

given for adequate training and programme at the time of calendar of activities are prepared. Normally a period of one week should be sufficient for such training. The Malaria inspectors would also require intensive training for one week prior to the actual spray operation.

Defective logistics

It is not enough to procure adequate quantities of insecticides, material and equipment but what is more important is to ensure that these are delivered to the periphery well ahead of time. Quite often break down of supply of insecticide or equipment particularly during heavy monsoon may militate against complete coverage. Therefore, all aspects of logistics including maintenance of vehicles etc. should be ensured prior to the commencement of spray operations.

Failure to maintain time schedule of spray operation

Even though all requirements have been met with and spray operation has attained the desired standard both in quantity and quality, transmission may still continue if the proper time schedule is not maintained. Initiation or continuation of spray operation beyond the peak transmission period could not possibly serve the purpose as the people remain unprotected during the main transmission season.

It is, therefore, highly essential that the transmission period for each area should be worked out in detail and spray time schedule be so strategically adjusted that all structures receive the number of rounds of spray required prior to the peak transmission season. Under the Indian programme, the programme is so adjusted that the first round is usually completed before the beginning of the transmission season, and the second round before the peak transmission so that a total of 200 mgm DDT per sq. ft. has been applied before this period.

Where transmission is prolonged the necessity of an additional round of spray will have to be considered. But this will depend on the sprayable surface the temperature and humidity factors and the duration of the biological effectiveness of insecticide applied under such conditions.

Inadequate supervision

It is needless to mention that in a programme of this nature the most important factor is supervision at all times and at all levels. Inadequate or defective supervision is the single most important factor for continued malaria transmission in an area where spray operation has been in progress for several years. Further, it may also be

stressed that unless supervision is both consecutive and concurrent the performance cannot reach the desired standard. It is the universal experience that during concurrent supervision the squads put up the best show possible, as is natural. Therefore, concurrent supervision by itself could rarely ensure the desired coverage and quality of spray operation. Further, it is the general experience that the standard of spray coverage in areas which are generally approachable on foot are generally far below the standard observed in road side villages or those easily accessible. These therefore, emphasize the need of consecutive supervision more than concurrent particularly in areas which are not approachable by motor transport. Under the Indian programme, therefore, the main emphasis has been given to consecutive supervision though concurrent supervision is necessary to ensure that the personnel are fully conversant with the proper method of spray, formulations and rate at which spray should progress.

It is also essential that supervision be ensured from the highest level through all echelons.

Aggregation of labour and moving population

In construction, engineering and power projects labour is drawn from various parts of the country and it is likely that some of them may already be infected. Further in many areas lack of suitable building materials used for huts and shanties make spray operation difficult.

In the absence of adequate coverage transmission can continue unabated. Suitable provision should, therefore, exist to establish static squads in such areas not only to spray such huts etc. at periodic intervals but also institute spray operation as soon as the new structures are built. These steps as well as chemotherapeutic measures often meet the desired results.

Resistance from the people

Resistance to accept spray operations in many areas has posed a serious challenge to the success of the programme. The factors responsible are mental attitude of the people in areas where incidence of malaria has gone down very considerably. In such areas people are generally reluctant to be disturbed by spray squads. Other factors responsible are bed bugs nuisance, religious belief etc. Added to this the problem becomes more formidable when people resort to frequent mud plastering particularly immediately after spray operation. Need of health education and mass contact could not be over-emphasised under such circumstances particularly in areas where bed bug nuisance is acute. Occasionally judicious use of a mixture of DDT and Diazinon may help in areas where refusal rate is extremely high.

II. Entomological factors:

The more common factors involved for persistence of malaria transmission are:-

(a) Development of resistance in vectors to the insecticides in use. However, it should be borne in mind that this need not necessarily be responsible for persistent transmission. In this connection it may be mentioned that a focus had been located in India in 1959 where the local vector, A.culicifacies, had developed high degree of resistance. But continuation of spray operation up to 1961 had not interfered with the programme so far. On the other hand, in a few other foci in other parts of the country the phenomenon of resistance had been attributed for the continuation of transmission. In such areas switching over of insecticides from DDT to BHC had considerably eased the programme. If such foci are small judicious chemotherapeutic measures and use of sporontocidal drugs should help considerably.

It should, however, be borne in mind that before one attributes continued transmission to phenomenon of resistance in any particular area, repeated trials would be necessary before one should give credence to such factors.

(b) Secondary vectors:

There have been some controversy regarding the use of this expression. However, it is essential to know in all areas the role played by different vectors and the time of transmission. It should also be determined as to the part played by each during the main transmission season and the subsidiary ones. Unless the bionomics of the vectors are different and vectors have developed resistance, judicious timing of spray operation should meet the problem.

(c) Feeding and resting habits:

Where the vector is both exophilic and exophagic like A.nuneztovari in Venezuela insecticide spray would be of little help. Special measures would have to be adopted under such circumstances.

In India, A.leucosphyrus plays secondary role in certain parts of the country. Although the vector is exophilic, it is usually endophagy and therefore, this should not pose any serious challenge. However, a special WHO team has been established in this sector for detailed investigations.