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INTEGRATED DISEASE VECTOR CONTROL AND COMMUNITY PARTICIPATION

Report of a Regional Workshop, Pondicherry, India, 3-8 October 1983

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ANNEXES

1. INTRODUCTION

1.1 Inauguration

The Workshop on Integrated Disease Vector Control and Community Participation was held at the Vector Control Research Centre, Pondicherry, India, from 3-8 October 1983. It was inaugurated by His Excellency Mr Kona Prabhakara Rao, Lt. Governor of Pondicherry. Mr R. Badrinath, Chief Secretary, Government of Pondicherry, and Dr V. Sambasivan, Director of Health and Family Welfare, also addressed the inaugural session. A message from Dr U Ko Ko, WHO Regional Director, South-East Asia Region, was read out by Dr Y.H. Bang, Regional Entomologist, WHO, in which it was mentioned that the workshop was sponsored by the World Health Organization (WHO) with support from the United Nations Development Programme (UNDP).

In his message, the Regional Director referred to the importance of vector-borne diseases in the South-East Asia Region and pointed out that in the countries of this region, malaria continued to be a major public health problem. Of the other vector-borne diseases, filariasis, dengue/dengue haemorrhagic fever, Japanese encephalitis and cutaneous and visceral leishmaniasis had varying degrees of endemicity. Chemical control continued to be the mainstay of many operational disease control programmes. An incresing number of vector species had either become resistant to the insecticides or shown refractory behaviour. The high cost and toxicity of many of the alternative insecticides, and opposition by environmentalists to their use, were some of the other limiting factors to their continued use. A gradual shift was, therefore, necessary for evolving a new methodology with greater emphasis on environmental management and integrated methods of control involving community participation.

It was necessary not only to review and identify existing methodologies, but also evolve innovative strategies incorporating multi-disciplinary and inter-sectoral approaches which might fit into the cultural practices and beliefs of the community to ensure their acceptability and participation.

1.2 Objectives

The main objectives of the workshop were:

(1) To review and identify the various existing and innovative methodologies of disease vector control that may be applicable at community and primary health care level.

(2) To indicate ways of promoting multi-sectoral involvement and participation of the community in the implementation of the integrated vector control strategy.

(3) To identify types of field research in the integrated vector control approach.

(4) To determine the types of manpower that are required for the implementation of the integrated methodology, and revise the contents of training modules appropriately.

There were ten participants from four Member Countries of the Region, eight WHO resource persons and seven observers attending the Workshop (see Annex 1). Mr N.P. Maheswary was elected as Chairman and Dr N.L. Kalra as Rapporteur. The programme of the workshop (Annex 2) was adopted unanimously. There were 26 working papers in all.

For each agenda topic, there were presentations of working papers followed by open discussion. At the third session on the role of primary health care system and community participation, emphasis was laid on identifying (a) the activities to be expected from communities, and (b) the ways and means to approach the communities in the implementation of the integrated vector control strategy (Annex 3). On the basis of these identifications and discussions, an attempt was made to outline general guidelines for public health authorities and vector control personnel on the integrated disease vector control strategy which can be implemented at PHC level. The workshop was able to draw up ten practical recommendations for promoting and improving vector control services in national vector-borne disease control programmes in respect of the integrated approach with community involvement.

2. CURRENT STATUS OF NATIONAL ANTI-VECTOR PROGRAMMES

2.1 Malaria Vectors

Bangladesh: Malaria continues to be the major vector-borne disease problem. The country can be divided into three regions according to the endemicity of malaria. The most endemic region includes vast forested tracts of Chittagong hills and north-eastern parts including tea garden belts. *Anopheles minimus* and *A. dirus* (*A. balabacensis*) are the principal vectors. The situation is further aggravated due to the presence of R.III level of chloroquine-resistant strains of *Plasmodium falciparum* to the extent of 16 per cent of *falciparum* cases detected during 1982. Control measures comprise DDT spraying on a total coverage basis. Both the species continue to be susceptible to this insecticide. Next is the adjoining plain area where *A. philippinensis* is the main vector. Sometimes sporadic outbreaks occur due to migration of people from the eastern region. One round of DDT spraying and focal spraying has been found to be sufficient to take care of the problem. The third area includes the southern coastal plain, where *A. sundaicus* is the vector. There is not much malaria. The problem is taken care of by focal spray of DDT as and when warranted.

India: The National Malaria Eradication Programme (NMEP) is one of the largest disease control programmes in the world. Nine vector species, viz., *A. culicifacies*, *A. fluviatilis*, *A. minimus*, *A. philippinensis*, *A. stephensi*, *A. sundaicus*, *A. balabacensis*, *A. varuna* and *A. annularis* transmit malaria singly or in association with varying intensity in both rural and urban areas. The Programme achieved spectacular success in the beginning and the number of malaria cases declined from 75 million a year to 0.1 million with no recorded death during 1965. However, due to various reasons the Programme suffered setbacks year after year so much so that during 1976 approximately seven million cases were recorded.

During 1977, the Government decided to change the strategy of malaria eradication to effective containment with a view to: (i) preventing deaths due to malaria, (ii) consolidating the gains already achieved, and (iii) maintaining the industrial and green revolutions.

The salient features of the modified strategies include: (i) residual spray in areas with more than 2.00 API and P. falciparum areas, (ii) establishment of drug distribution centres (DDCs) and fever treatment depots (FTDs) throughout the country to reduce morbidity. Currently, 237 390 DDCs and 102 402 FTDs are functioning in the country through community participation. The programme is further supplemented by a special campaign of P. falciparum containment to prevent deaths due to malaria and to arrest the spread of chloroquine-resistant P. falciparum strain to other areas. Under this programme, 110 districts with a population of 117 million are covered. The Government has also sanctioned Rs. 300 000 under the NMEP budget to intensify research on malaria to evolve new strategies of malaria control. These measures have proved very effective and, after five years of operation, the incidence of malaria declined to approximately two million cases in the whole country during 1982.

Maldives: Malaria constitutes the major public health problem in Maldives. A survey carried out in 1965 revealed a slide positivity rate (SPR) of 16.0 per cent. Vector species recorded included A. tessellatus and A. subpictus. DDT spraying covered one round or two rounds depending upon the intensity of malaria. This had a spectacular effect on malaria prevalence and in 1983 the SPR recorded was only 0.2 per cent with the complete absence of P. falciparum.

Nepal: The Nepal Malaria Eradication Organization (NMEO) started in 1958 and until 1970 recorded spectacular success when the incidence of malaria came down to only 2 518 cases. Thereafter there was a resurgence of malaria due to various technical and operational problems. In 1982, a total of 16 907 cases were reported and 50 per cent of these cases came from the nine plain cultivating districts where A. annularis is playing a major role in maintaining the endemicity. In the revised strategy adopted by the Government from the eradication concept to control strategy, the flexibility offered by the programme is being exploited. In the Terai area, the spraying programme is being supplemented by antilarval methods (chemicals) and by the introduction of larvivorous fish wherever feasible and practicable.

2.2 Filariasis Vectors

Bangladesh: Bancroftian filariasis transmitted by Culex quinquefasciatus is restricted to the northern parts of the country, especially in Dinajpur and Rangpur districts. The microfilariae rate varied from 7.9 per cent to 14.8 per cent. Recently the infection has been detected in the Mirpur area of Dhaka city. Control measures against filariasis are yet to be organized. However, the antilarval measures undertaken for malaria vectors by the municipal authorities include control of the filariasis vector.

India: Filariasis is next to malaria as a public health problem. Nocturnally periodic *Wuchereria bancrofti* transmitted by *Culex quinquefasciatus* covers 97.8 per cent of the population exposed to the risk of filariasis in urban and rural areas. According to the lastest study, out of the 304 million people at risk, 222 million people live in rural areas. Control measures include recurring anti-larval measures through 171 filaria control units. Larvicidal oils, pyrethrin-based kerosene oil, temephos and fenthion are the larvicides recommended for use. As a biological control agent, use of *Poecilia reticulata* has been recommended for every possible breeding site. In spite of these control measures, the problem is on the increase, due to the haphazard growth of towns/cities without corresponding facilities of drainage.

Brugia malayi transmitted by *Mansonia annulifera* affects a few pockets in the rural areas of the country covering about 3 million population. According to a recent study, the infection is showing a downward trend. The control of rural filariasis through recurrent anti-larval measures, though technically feasible, was not adopted because of the high cost-benefit ratio. However, the National Institute of Communicable Diseases carried out a trial study to assess the operational feasibility of vector control through the active involvement of the community in East Godavari District of Andhra Pradesh. The essential features of the scheme included (i) supply of equipment and chemicals by the Regional Filaria Training Centre (RFTC), Rajahmundry, (ii) health education by the local medical officer and staff of RFTC, (iii) training of field workers and panchayat officials for dispensing larvicides and supervision, and (iv) source-reduction methods wherever feasible. The experiment, evaluated at the end of 18 months, proved a great success. It brought down the man/hour density from 18.7 to 8.5 against 19.2 in the control village. The average density of larval stages during the 18-month period was 10.2 and 28.0 per/dip in the experimental and control villages.

The Vector Control Research Centre, Pondicherry, has carried out a highly successful filariasis control programme through vector control using a completely integrated vector control methodology in the urban areas of Pondicherry. A combination of environmental, biological, physical and chemical methods was used.

Maldives: Nocturnally periodic *W. bancrofti* infection transmitted by *C. quinquefasciatus* is the only infection in the country. Mf varied from 0.9 to 15.0 per cent and is found in all inhabited islands. A control programme initiated in 1970 included anti-parasitic measures and temephos application in Malé and only anti-parasitic measures in the other islands. After nine years of operation the mf rate declined to 0.06 per cent in Malé. Biological control of *C. quinquefasciatus* was undertaken using two species of local fish in wells. However, the programme suffered a setback when chlorination of wells was undertaken as an anti-cholera measure which killed the fish and not the larvae.

2.3 Dengue and Dengue Haemorrhagic Fever (DF/DHF)

Bangladesh: Dhaka fever has now been established as dengue fever in Bangladesh. The dengue antibodies have, however, been detected on several occasions in Dhaka and Chittagong city areas. Aedes aegypti, the known vector, is also found in these two areas in good density. Susceptibility studies showed A. aegypti to be resistant to DDT. No special control measures for the Aedes mosquitoes are employed at present.

India: A. aegypti is the known vector of dengue fever in India. This species continues to be essentially an urban mosquito and rural areas are completely free barring a few high density areas in Rajasthan where the species penetrates into smaller hamlets due to scarcity of water. Mountainous areas and areas with a height of 500 metres above sea level are generally free. Even in urban areas the species depicts a phenomenon of "annual pulsation", i.e., the species remains in the central parts of the city and spreads out during the monsoon period when secondary breeding sites become available, and gets replaced by A. albopictus and A. vittatus at the periphery. Since breeding is restricted to containers holding stored water in domestic and peridomestic areas, the most effective method of control is source reduction by the elimination of breeding sites. In places where elimination of breeding water is not possible temephos granules are used.

The outbreak of dengue fever in Delhi during 1982 was controlled largely through community participation. This was achieved by telecasting a TV feature film on mosquito breeding sites commonly found in domestic and peridomestic situations.

Maldives: Maldives experienced an outbreak of dengue/DHF during 1979 when about 223 cases showing signs and symptoms of classical dengue fever were detected. Since then similar fever cases have occurred year after year. However, in early 1983 several such cases were reported in Male among resident foreigners. Blood samples revealed the presence of dengue virus. The suspected vector of dengue is mainy A. aegypti and is amenable to control by the use of temephos EC or granules.

2.4 Japanese Encephalitis (JE)

Bangladesh: The first outbreaks of JE in Bangladesh were recorded in 1980 and 1981 in Tangail district. Only 1.9 per cent of 1 046 healthy persons tested showed HI antibodies against group B arboviruses. Since then no further cases have been detected and it is believed that the infection has died out.

India: Japanese encephalitis affects large areas in the country, particuarly the eastern, southern and central parts. Recently the disease appeared not only in the western part of the country, but has also affected urban towns (Deoria, Basti, Gorakhpur and Goa). C. tritaeniorhynchus is the main vector of JE in India and shows variable susceptibility to DDT. However, the species continues to be susceptible to HCH and malathion which help considerably in the control of the species. The typical breeding places are rice fields but in the northern part of the country also include swamps and stagnant waters located at the peripheral areas of urban areas.

Nepal: Since 1977, Nepal has experienced outbreaks of JE in several districts. Control of C. tritaeniorhynchus is being undertaken by ULV and fogging of malathion in and around the affected areas.

2.5 Visceral Leishmaniasis

Bangladesh: Kala-azar, which was endemic in the thirties and forties, disappeared from the scene but reappeared in the northern part of the country, especially at Shahjadpur upa-zila of Pabna district. The known vector of the disease, *Phlebotomus argentipes*, has been detected in good density. However, the species continues to be susceptible to DDT.

India: Resurgence of kala-azar was first noticed in the DDT withdrawal areas of north Bihar and West Bengal. The infection is also endemic in Madras city and the coastal rural areas of Tamil Nadu. Sporadic cases have recently been reported from the hilly areas of Uttar Pradesh, Jammu and Kashmir and Gujarat on the western coast. *P. argentipes*, the vector species of kala-azar, continues to be susceptible to DDT and was found effective in controlling the infections.

3. INTEGRATED DISEASE VECTOR CONTROL

3.1 Definition

Integrated disease vector control (IDVC) has been defined as "the utilization of all appropriate technological and management techniques to bring about an effective degree of suppression in a cost-effective manner" (WHO 1983[a]). This requires the designing and appropriate use of scientifically sound methods which are locally effective and acceptable to the community in which they are used. They should be simple and safe so that some or all vector control activities can be transferred to the community level.

The concept of IDVC is gradually replacing the single-method approach to vector control, with its dependence on chemical pesticides, applied in "vertical" public health programmes. Resistance to some of the commonly used insecticides has been detected in almost all important vector species, and new cases continue to be reported. Alternative insecticides are more expensive and more toxic, and there is a serious concern about their effect on the ecosystem. The refractory behaviour of vectors and large-scale refusal to permit spraying indoors are other problems facing residual spraying programmes.

3.2 Priority Areas and Species

Priority areas for IDVC should be those situations in which adult vector control using the conventional approach is impracticable for economic or operational reasons. In some communities it may be possible to adopt a multi-disease approach, in which the control programme is simultaneously directed against vectors of several diseases; for example, this could be done for malaria and filariasis vectors in cities such as Madras. Priority areas would need to be stratified into urban, periurban

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[a]WHO (1983) Integrated Vector Control, Seventh Report of the WHO Expert Committee on Vector Biology and Control. Technical Report Series No. 688.

and rural communities and further sub-divided according to variations in ecology and/or endemicity. It is essential for the community to participate in the sequence of any priorities which may be assigned.

The selection of priority target species will depend on local conditions, but the following criteria may be used: (i) vectorial status, (ii) insecticide resistance, (iii) exophilic and exophagic behaviour, making indoor residual spraying inappropriate, and (iv) vector breeding habitats restricted and well-defined, as in urban and semi-arid conditions. Some important vectors amenable to this approach are - malaria vectors A. stephensi in urban wells and reservoirs, A. culicifacies in irrigation canals and pools, A. minimus and A. fluviatilis in streams, A. sundaicus and A. subpictus in lagoons and swamps; filariasis vector C. quinquefasciatus in polluted urban habitats, as has been demonstrated in the Filariasis Control Demonstration Project at Pondicherry, and A. aegypti, the vector of DH/DHF, in domestic containers. In some situations, the vector of Japanese encephalitis could also be controlled using this methodology.

3.3 Appropriate Methodologies

Methods for IDVC include (1) environmental management and source reduction by draining, channelling and land-filling, improvement of water margins and water level management, (2) personal protection by use of bednets, repellents, etc., to reduce man-vector contact, (3) the use of insecticides as adulticides and larvicides, (4) the use of biological control agents (fish and microbial pathogens), and (5) health education and training.

The following factors are important in the selection of methodology: (i) the desired degree of control. Simple and inexpensive methods should be selected to give low effectiveness over a long period. Greater initial investment, using chemicals, is required for quick results. (ii) cost-effectiveness, taking into consideration long-term and auxiliary benefits, (iii) feasibility and local acceptability, and (iv) simplicity and safety so that the community can be involved in their application.

3.4 Implementation

IDVC strategies are based on ecosystem management, for which a sound knowledge of vector population dynamics, natural mortaltiy factors and risk factors for disease transmission are essential. Many vector breeding habitats are man-made. Therefore multisectoral coordination through a committee consisting of officials from the highest level, and including administrators, city planners, civil engineers as well as public health officials and entomologists, is necessary in order to eliminate existing breeding habitats and prevent creation of new ones through proper planning. Research on innovative and appropriate technology which can be incorporated into the programme should continue and the integrated strategies which are involved should be tested by undertaking pilot demonstration projects such as the Pondicherry Demonstration Project. In order to facilitate efficient implementation it might be necessary to establish at the national level a core group of vector control specialists who would act as consultants to operational programmes. Finally, adequate training programmes on the concepts and techniques of IDVC should receive high priority if this approach is to succeed.

4. COMMUNITY PARTICIPATION IN DISEASE VECTOR CONTROL

4.1 Tasks of Disease Vector Control

Since community participation is the central consideration in the primary health care approach, the disease vector control programmes become part of this health care delivery system. Malaria, which is the major public health problem of countries of the Region, takes priority in such an integration programme to the fullest possible extent. Since most of the countries of the Region have converted their time-limited malaria eradication programmes into long-term containment programmes, this strategy brought out radical changes in objectives and flexibility in its approach which made assimilation of the programme into the primary health care system much easier. Similarly, other disease vector control programmes could be integrated at PHC level.

Disease vector control forms a part of the element relating to prevention and control of locally endemic diseases. Therefore, the task involved at various levels of the programmes may be visualized as follows:

(1) Central Level (national level): Planning, policy formulation, definition of objectives, targets, budgeting, logistics, technical guidance, evaluation, training and intersectoral linkages.

(2) Intermediate Level (province/district): Assistance in planning, administrative support and resources to peripheral level, organization and deployment of staff for anti-vector measures. Laboratory management, supervision of anti-vector measures, assessment of peripheral level, operations, investigation and remedying of breakdowns in the training of staff, and health education.

(3) Peripheral (PHC level): Case detection, blood examination, presumptive and radical treatment, conduct and updating of geographical reconnaissance, education and motivation of the people towards acceptance of the programme. Assisting the intermediate level in spray operations, mass surveys and mass chemotherapeutic measures, periodic reporting to the higher sections.

4.2 Technology Adopted for Disease Vector Control Programmes

Success of the disease vector control programmes with community participation would depend upon the technology adopted for the programme. The simpler the technology the greater the success. A technology which would take minimum time of the people will find ready acceptability. For example, the guinea-worm control programme would require (i) motivation to use filtered water, and (ii) prohibiting entry to the step wells, which will be more successful than house spraying with DDT and taking drugs in the case of the malaria programme. Therefore, technology(ies) offered for disease vector control programmes should be such that may find ready acceptability with the people.

4.3 Selection of Disease Vector Control Programmes for Integration with PHC

Selection of disease vector control programmes for integration with the PHC system involving community participation would require complete evaluation of the morbidity and mortaliy factors. Diseases with nil, or low fatality, i.e., filariasis control, guinea-worm control, cutaneous leishmaniasis control, do not pose any problem and could be conveniently integrated into the PHC system. But diseases with high mortality rates, viz., malaria, plague and Kala-azar, would require careful study by policy makers. In this case, only the low risk areas could be considered for integration.

4.4 Approaches for Community Participation in Disease Vector Control Programmes

Approaches for community participation in any disease vector control programme could be achieved in the following ways:

(1) Active participation: Active participation will involve use of inputs provided by the government, by the people themselves for the elimination of the disease. It would include elimination of breeding sites, house spraying, distribution of drugs, etc. However, the success of the programme will depend upon its duration for which peoples' services are required. Any programme involving short durations (i.e., *Aedes* control programme) can be successfully achieved. Programmes of longer duration may not sustain the interest of the community.

(2) Active income-linked participation: Any disease control programme, if linked with economic upliftment of the people, will find ready acceptability even if the duration is long. Removal of algae for the elimination of mosquito breeding linked with the production of paper and prawn rearing, adopted by VCRC, Pondicherry, are classic examples.

(3) Active incentive-linked participation: A programme which is of longer duration, would require some incentives. In this case panchayats[a] may be given the necessary inputs, i.e., equipment, chemicals and drugs, and they may employ local workers for carrying out the vector control operations. The PHC level can provide the necessary guidance and training for the execution of the programme, as the workers so employed will not only be the beneficiaries of the programme, but will also have extra income. Such an incentive can sustain the interest of the community in the disease vector control programme over a longer period. The experiment conducted by NICD, Delhi, for rural filariasis control at Rajahmundry, India, is an example.

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[a] Elected local administrative body as in India.

(4) Passive participation: Passive participation will include complete cooperation on the part of the community in the implementation of the programme to its fullest extent. Such participation is also essential in achieving the objectives and targets set for the success of the programme. The PHC level can undertake public health education and motivation activities for completion of the tasks.

5. RESEARCH AND TRAINING NEEDS

5.1 Field Information

Integrated vector control will not be possible without precise and detailed information on the biology or ecology of the vector species and their exact role in the transmission of disease, with the objective of developing cost-effective control techniques which the community can utilize. It, is not possible to elaborate here all aspects of the research required, but the following may need special attention.

(a) Exact identification of the vector and its role in disease transmission;

(b) Geographical distribution and seasonal abundance;

(c) Life cycle and time required for developmental stages;

(d) Habitats of larval stages, predators and natural enemies which may exercise control naturally;

(e) Location of adult forms, their mating, feeding, resting and oviposition sites;

(f) Feeding patterns; and

(g) Flight, dispersal, longevity and migratory behaviour.

Other areas which need investigation are the socio-economic and cultural factors, way of life and habits of people which may inadvertently create more breeding habitats and which may lead to more exposure to the vectors and result in increased man/vector contact, leading to an increased vectorial capacity.

5.2 Research Priorities

Within this context research on control methods or refinements of the available techniques will be continuously required. Amongst the vector control methods requiring continued research are the following:

(a) To devise, integrate and continuously revise the joint use of complementary methods for the reduction of vector densities and to minimize man-vector contact in order to optimize the cost-effectiveness of continuous vector control programmes;

(b) To define vector target population in terms of identity of species, their behaviour, ecology, seasonality, and spatial distribution;

(c) To search for new pesticides of high efficacy against vectors but low mammalian toxicity and causing minimal harm to non-target organisms;

(d) To produce more effective and more easily applied formulations of pesticides;

(e) To monitor the vector status in relation to pesticide susceptibility or resistance;

(f) To search for biological control agents, i.e., pathogens, parasites, and predators, that can be used for reduction of vector population density or survival and that can be safely applied through community participation;

(g) To develop new ecological methods for vector control;

(h) To develop measures for vector control by means of environmental management;

(i) To improve methods of sampling vectors and measuring their infectivity, for the purposes of monitoring natural population trends and estimating the impact of all types of intervention measures; and

(j) To develop trapping methods for use in vector control.

5.3 Research on Community Participation in Vector Control

Priority should be given to the encouragement of laboratory and field trials to test simple and appropriate vector control measures that could be used at the community level. The greatest need is to develop simple, safe and inexpensive pesticide application techniques, adapted to local social and ecological conditions in order to supplement environmental management activities. For instance, in mosquito control, larvicidal granules containing 10 g of temephos per kg can be applied to potable and other water.

Vector control methods which are worth consideration for use by the community should meet the following criteria:

(1) The equipment, materials and agents required to initiate and continue the programme should be readily made available.

(2) The skills involved in the maintenance of vector control programmes can be easily acquired.

(3) The expenditure involved should not be too high for the community.

(4) The proposed approach should benefit other local enterprises.

(5) The proposed approach should be without risk to the environment.

(6) There should be no unacceptable toxicity or other health hazards associated with the proposed measure.

(7) The proposed measure should be compatible with the local practices and attitudes.

(8) The proposed technique should be well tested, proved to be efficient, and need only minimum evaluation from the community involved.

5.4 Training Requirements

In order to make substantial progress in planning and implementing programmes utilizing techniques of integrated vector control, the training of personnel must be given high priority. There is a need for training in the concept of integrated vector control as well as in vector control techniques at all levels from the national headquarters to the region of each country and to urban and rural communities. Professional academic training is required for the central core group at headquarters and at the regional level in large programmes. If adequate training in vector control is not available within countries, then international or regional training programmes should be utilized.

An adequate training programme should be established within each country to provide basic and job-orientated training to the field workers, whether they be vector control service workers or primary health care workers. Appropriate training in vector control concepts and methods should also be given to other health workers, such as sanitarians, health educators, nurses, and doctors. Training at the community level should be aimed, first at providing an understanding of the need for vector control and thus promoting cooperation, and, secondly, at providing information as to what the individual villagers can do to help, including special instructions on appropriate vector control methods for village volunteers.

A long-range, continuous, in-service refresher-type training programme should be established in order to take advantage of new developments. Basic and job-orientated training should be considered as a continuing programme in order to ensure the future supply of trained technical workers.

The following constraints should be noted:

a) Lack of experience and understanding of the use of integrated vector control in general and its adaptation to the needs of primary health care.

b) Lack of appreciation of the need for training as a continuing activity.

No vector biologists are produced or trained in any of the universities of South-East Asia, although mosquito biology and the diseases transmitted by them and their control are taught as a passing subject. One of the main reasons for this is the lack of adequate career opportunities for entomologists in disease control organizations, as these organizations primarily employ medical doctors as their heads. Individual scientists are generally employed by the universities or the private sector. This lack of career structure for medical entomologists is often a great stumbling block to the training programmes. Thus there is a great need to create sufficient career opportunities for medical entomologists within the disease control organizations of the government.

WHO has attempted to increase the number of fellows to be trained in these general areas by holding seminars, workshops and training courses and supporting some universities and institutions in conducting M.Sc.-level courses in the general areas of medical entomology. One such course already operates at Bogor, Indonesia, and plans are afoot for starting another one at VCRC, Pondicherry, India.

6. RECOMMENDATIONS

(1) In view of the fact that integrated disease vector control with community participation through primary health care calls for better skills, the existing entomological and vector control activities should be modified and the entomological infrastructure strengthened at all levels with better career prospects.

(2) In order to promote multi-sectoral involvement in the implementation of the integrated vector control strategy, a professional "core group" should be formed at the central level composed of public health officials, including administrators, entomologists, sanitary engineers, operational control personnel, ecologists, public health educators, etc.

(3) Implementation of an integrated anti-vector programme for disease control must be preceded by considerable ground work on reorientation of officials, entomologists and public health workers. Though the concept itself is not new, it has become very necessary to have a multi-sectoral approach. A series of national travelling seminars on a multi-sectoral basis is recommended to promote this idea at various levels.

(4) Studies on the ecology, biology, behaviour, etc., of vector species breeding in paddyfields and other habitats are essential in order to formulate suitable and simple control measures including chemical, environmental and biological measures which can be used by the community in the integrated control of diseases, and it is recommended that these should be among the research priorities.

(5) It is recommended that indigenous technology should be developed by scientific evaluation of herbs and other products used by many rural communities and trials for avoidance of mosquito bites, cure of malaria, etc. Such technology, if evolved, will fit into the cultural practices of the community and can be more easily integrated into the programme.

(6) Pilot projects should be initiated in each country within various endemic and ecological situations to assess the effectiveness of innovative, or in some cases, well established integrated disease vector control activities.

(7) Due to rapid urbanization without adequate waste water and sewage disposal systems in many towns and cities of the Region, there is a tremendous increase in the urban mosquito population. In view of this, the workshop recommended that: (i)the appropriate health authorities should be the final authority approving expansion of any town; (ii) existing laws and bye-laws, particularly those directed at reducing mosquito breeding, should be strictly implemented by prosecution of householders, if necessary; (iii) resident welfare organizations, if present, may be approached for cooperation and active participation in anti-mosquito measures (material and equipment being supplied by the government) and to take up the matter with higher authorities. They may also help in health education of the community; and (iv) there should be inter-sectoral coordination to maintain existing drains, to undertake both major and minor engineering works to correct defects, and to provide better drainage facilities for sewage disposal.

(8) Recognizing that the use of larvivorous fish in integrated vector control is potentially the simplest, most economic and effective supplementary measure, the group recommended that: (i) an authentic review of work on the operational use of larvivorous fish in the countries of the Region should be made by a recognized institution; (ii) a newsletter should be published periodically for the purpose of flow and exchange of up-to-date information; (iii) in view of the few systematic trials which have been documented, research in this area should be supported; (iv) a simple manual for the use of all categories of health personnel, including PHC staff and community leaders, should be prepared; and (v) active involvement of the community in all phases of larvivorous fish operations should be encouraged.

(9) Further refresher training courses on disease vector control for entomologists and public health workers from different levels to implement integrated vector control with community participation through primary health care are of paramount importance. Training of public health authorities and health workers should be designed and provided as needed. Country and inter-country workshops should also be organized for participants at various levels to review and promote the concept of integrated disease vector control and community participation.

(10) In view of the emphasis being placed upon integrated disease vector control at PHC level and considering its complex nature, general guidelines should be provided to public health authorities and entomologists in the context of the primary health care delivery system.

LIST OF PARTICIPANTS, WHO RESOURCE PERSONS AND SECRETARIAT

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2. Mr Touhiduddin Ahmed
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3. Mr Md. Ilias
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INDIA

4. Dr P.K. Das
   Assistant Director
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5. Dr N.L. Kalra
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6. Dr M. Das
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7. Dr M. Swaminathan
   Epidemiologist
   Health Department
   Corporation of Madras
   Madras

MALDIVES

8. Mr Mohamed Hameed
Community Health Worker
Department of Public Health
Malaria Control Programme
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Male

NEPAL

9. Mr S.R. Shrestha
Chief of the Research and Training Section
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Ministry of Health
Kathmandu

10. Mr R.G. Vaidya
Head, Medical Entomology
Nepal Malaria Eradication Organization
Ministry of Health
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II WHO RESOURCE PERSONS

1. Mr Chen Kuo
Chief, Equipment Planning and Operations
World Health Organization
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2. Dr V.K. Sharma
WHO Medical Officer (PHC)
WHO Regional Office for South-East Asia
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3. Dr K.M. Nushin
WHO Malariologist
Project NEP MPD 001
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4. Mr G.P. Joshi
WHO Entomologist
Project SRL MPD 001
Colombo

5. Dr Lim Boo Liat
WHO Ag. Project Leader
Project IR VBCRU-2
Jakarta

6. Mr R.T. Collins
   WHO Entomologist
   Project IND MPD 001
   Bhubaneswar, India

III SECRETARIAT

1. Dr C.P. Pant (Consultant)
   Chief, Ecology and Vector Control
   World Health Organization
   Geneva

2. Dr P.K. Rajagopalan (WHO Temporary Adviser)
   Director
   Vector Control Research Centre
   Pondicherry
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3. Dr Y.H. Bang (Operating Officer)
   Regional Entomologist
   WHO Regional Office for South-East Asia
   New Delhi

4. Mr T.R. Toteja
   Sr. Administrative Secretary
   WHO Regional Office for South-East Asia
   New Delhi

PROGRAMME

Monday, 3 October 1983

Introduction and purpose of the workshop Election of Chairman, Rapporteur Adoption of Agenda	Y.H. Bang
Disease vector control problems and programmes in the countries of SEA Region (WP.2)	Y.H. Bang
Vector control at community level by Dr J. Mouchet (WP.12)	C.P. Pant
Presentation of country vector control programmes by all participants	M. Das
Presentation of country vector control programmes by all participants	M. Das

Tuesday, 4 October 1983

Principles of integrated vector control (WP.14 and WP.15)	Y.H. Bang
Organization, administration and management of integrated vector control by Dr D.A. Muir (WP.5)	C.P. Pant
Environmental management in integrated vector control (WP.3)	Chen Kuo
Use of larvicides including microbial agents in integrated vector control at the PHC peripheral level by Dr N. Rishikesh (WP.4)	C.P. Pant
Operational use of larvivorous fish in integrated vector control (WP.8)	K.M. Nushin
Disease vector control in Maldives with particular reference to the use of larvivorous fish (WP.16)	M. Hameed
Priority species for integrated vector control by VBC/ECV (WP.17)	C.P. Pant
Priority areas for integrated control of malaria vectors in SEAR by Dr I.A.H. Ismail (WP.6)	C.P. Pant

Demonstration of integrated vector control programmes: Urban vector control project in Pondicherry, India (WP.11)	P.K. Rajagopalan P.K. Das
Ecology of disease vectors breeding in rice fields in South-East Asia (WP.9)	Y.H. Bang
Group discussion on feasibility of integrated vector control programmes (Agenda 3)	Md. Ilias M. Hameed

Wednesday, 5 October 1983

Primary health care and integrated disease vector control (WP.19)	V.K. Sharma
Participation of primary health workers in urban malaria/mosquito control programmes, by Dr Tsun Hsing Yang (WP.13)	Chen Kuo
Health education for vector control at PHC level, by Dr I.S. Mochny (WP.20)	Lim Boo Liat
Role of the community in vector control (WP.22)	C.P. Pant
Role of the government in community participation for vector control (WP.10)	P.K. Rajagopalan K.N. Panicker
Community participation in the control of malaria vectors in coastal villages near Pondicherry (WP.10)	P.K. Rajagopalan K.N. Panicker
Control of malaria vectors in foothill areas in Nepal through community participation (WP.21)	R.G. Vaidya
Problems and constraints of community participation in vector control (WP.24)	R.T. Collins
Mass application of 1% temephos SG for *Aedes aegypti* control through community participation in Yogyakarta, Indonesia, by Dr Thomas Suroso (WP.23).	Y.H. Bang
Group discussion on the role of community participation in vector control (Agenda 4)	S.R. Shrestha

Thursday, 6 October 1983

Manpower and training needs in integrated vector control (WP.7)	P.K. Rajagopalan
Research priorities for integrated vector control at the PHC/peripheral level (WP.1)	C.P. Pant

Epidemiological significance of sibling species in malaria control (WP.25)	G.P. Joshi
Group discussion on research and training needs in vector control (Agenda 5)	M. Swaminathan
Field trip to coastal villages and Pondicherry project areas	P.K. Das K.N. Panicker

Friday, 7 October 1983

Urban vector control in India	N.L..Kalra
Control of malaria vectors in India	M. Das
Group discussion on recommendations	
Guidelines for integrated control of malaria vectors	P.K. Rajagopalan Chen Kuo
Final discussion on working groups' proposal and recommendations	C.P. Pant P.K. Rajagopalan
Course discussion	Y.H. Bang
Closing ceremony	P.K. Rajagopalan

PLAN OF ACTION FOR COMMUNITY SUPPORT IN THE CONTROL OF MALARIA VECTORS BREEDING IN RICE FIELDS

Specific objectives	Methodologies (avialable)	Expected activities from communities (what, who, where)	Ways and means to approach the communities (how)
Larval reduction in rice fields	1. Release of larvivorous fish	Active prticipation	Pilot demonstration project
	2. Larviciding with 1 per cent temephos s.g./Paris Green/ slow release of temephos formulation having residual effectiveness for more than 2-3 weeks	Village panchayat can take up training and supply of of material and equipment by government to head of panchayat	Multipurpose workers namely the Medical Officer, primary health centre/district malaria officer/chief medical officer
	3. Intermittent irrigation	Active/passive participation	Pilot demonstration project
	4. Monitoring impact of agricultural pesticide application	Through the village panchayat	Multipurpose workers / zonal entomologist/state entomologist/state malariologist
	5. Zooprophylaxis as a supplemental	Village panchayat	Medical Officer of primary health centre/district malaria officer/chief medical officer
	6. Intersectoral coordination for water management for reducing/eliminating mosquito breeding source. This should be done at district level to draw up the plan of action	Nil	Through health education machinery, if needed