



SEMINAR ON THE ROLE OF HEALTH SERVICES  
AND TRAINING INSTITUTES IN THE CONTROL  
OF VECTORS AND RESERVOIRS OF DISEASES

EM/SEM ROL INS CTR VCT RSV.DSS/ 8 SCHIS

Baltchik(Varna), Bulgaria, 4-11 October 1982

Agenda item 8 and 6

THE PLACE OF SCHISTOSOMIASIS CONTROL  
IN THE NATIONAL HEALTH SERVICE IN DEVELOPING COUNTRIES

by

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## I INTRODUCTION

Schistosomiasis is a trematode infection of 200 million inhabitants of many countries in Africa, Asia, South America and the Caribbean. More than 600 million people in the same areas are at risk.

The importance of the disease in public health is increasing because of its spread to new areas as a result of water development, the extension of agricultural land, population movements, the discovery of new foci of infection and greater knowledge regarding the high morbidity of the disease.

The further development of water resources, urbanization and additional population movements in the future will change the pattern and geographical distribution of schistosomiasis and will increase the magnitude of the problem.

While efforts to control infection were started 50 to 60 years ago in a few countries and in many infested areas during the past decade, control operations have been successful in only a few countries.

Among several factors contributing to that failure in the past have been the absence of very effective control measures, lack of trained manpower, the high cost of control, organizational deficiencies and the use of the vertical approach to control of the disease. While the use of the vertical approach, in the form of special campaigns for the control of various endemic diseases, has given successful results in the control of some diseases in many instances the success achieved could not be maintained because the control activities did not have enough community participation and operations were relaxed soon after the external vertical control force was removed.

There is an urgent need for complete revision of the strategy for the control of schistosomiasis and other endemic diseases in view of the change which is occurring in the general policy of delivery of health in developing countries towards greater emphasis on comprehensive and integrated approaches and with the establishment of the primary health care system in many infested areas.

This paper will briefly review past experience in bilharziasis control before discussing the future organization suitable to carry out the new control approach.

## II SCHISTOSOMIASIS PARASITES AND THEIR TRANSMISSION

Four species of schistosomiasis are normally parasitic to man, namely, Schistosoma haematobium, S. mansoni, S. japonicum and S. intercalatum.

The first species causes urinary, and the other three intestinal bilharziasis among the population of various countries in Africa, Asia and South America.

Spontaneous infection with more than one species, mostly for S. haematobium and S. mansoni is found among the population of some countries in Africa and the Arabian Peninsula. Various strains exist for each species

Eggs of these parasites are excreted in feces (S. mansoni, S. japonicum and occasionally S. haematobium) or urine (S. haematobium and rarely S. mansoni) and, if they enter fresh water, they hatch into ciliated miracidia which, if they come in contact with suitable fresh-water snails, will penetrate into the snail and multiply into thousands of cercariae, the infective stage of the parasite

Cercariae, on coming into contact with human skin, penetrate into the body

Once in the body, parasites migrate to the lungs and then to the hepatoportal system where they mature and, after moving to the mesenteric or vesical venules of the host, they start egg-laying in the tissues, some of the eggs are excreted outside Of fresh water snails, various species of the genus Bulinus are intermediate hosts of S. haematobium and S. intercalatum, different species of Biomphalaria are hosts of S. mansoni and species of Oncomelania are hosts of S. japonicum. The Lithoglyphopsis aperta snail has recently been found to be the intermediate host of S. japonicum in the foci in the Mekong river area in the Far East

The percentage of infected people with clinical manifestations (disease to infection ratio) in schistosomiasis is comparatively higher than it is for most other helminthic infections

A comparatively higher percentage of infected people also suffer from complications of the disease such as involvement of the urinary tract in S. haematobium and hepatosplenomegaly in other species.

### III. PREVENTION AND CONTROL

Different methods have been applied for the control of the disease in the last 4 to 5 decades with more promising results in the last decade when access to better control tools has been possible. Success achieved in the prevention of the disease has been negligible.

The following are comments on the past and present condition and future outlook of organizations and approaches for schistosomiasis control.

#### 1. Past experiences and present conditions

##### 1.1 Organization

In many countries schistosomiasis control programmes formed part of the responsibilities of the Departments of Preventive Medicine or Infectious or Endemic Diseases in Ministries of Health. In some countries an independent agency, or an agency related to a research or academic institution handled control operations. In most cases, separate organizations for the control of various local infections and diseases and with different types of functions were located in these departments.

Cooperation between the separate organizations was minimal and it was not surprising to see two or more teams from the Ministry of Health in one rural area, each group working on the control of one particular disease while, on occasion, the control action of one group was offset as the result of actions taken by the other group. For example, fish introduced for the control of Anopheles larvae for the

control of malaria were sometimes destroyed by molluscicide used for snail control by a bilharziasis control team.

In many instances, the lack of coordination and inadequate interdisciplinary consultations between health and irrigation personnel at the planning stages of the development of water resources have resulted in an increase in the transmission of schistosomiasis and other communicable diseases

Because of the lack of an adequate health care network at the peripheral level in most of the infested areas, vertical efforts represented the main approach to control

## 1.2 Control Methods

The main principles for the control of schistosomiasis were and still are:

- a) Destruction of snails through application of chemicals (molluscicides), engineering, such as the elimination or improvement of snail habitats to make them less suitable for snails, and biological methods, in which predators and parasites of snails are used,
- b) Limitation of host-parasite contacts with bodies of water through the provision of safe water supplies and sanitary facilities,
- c) Elimination of the parasite inside the host body by administration of drugs

The combination of the above mentioned methods has however been used in only a few countries.

## 1.3 Training

Personnel for schistosomiasis control came mainly from other programmes, particularly malaria control, and had little formal training on schistosomiasis, they were mostly trained during service. This condition has created a great

shortage of experienced manpower, especially at the higher levels

## 2. Future Organization, Activities, Training and Research in National Schistosomiasis Programmes

### 2.1 Organization

With the new concept in the delivery of health care in developing countries, in which an integrated, community-based primary health care system is accepted as the main approach, the complete revision of the organization and strategy of bilharziasis control is required

Since eradication of bilharziasis is very difficult in most infested areas, the main objective of the programme should be to control infection at a level where the disease cannot be considered to be a public health problem. This goal can be achieved by reducing the disease/infection ratio or the proportion of infected people with clinical signs to the total number of people infected, and by reducing the intensity of infection

National bilharziasis control programmes should be organized in such a way that the main objective of the programme as mentioned above can be reached within the existing possibilities and limitations of each programme.

In the programme, every effort should be made at the higher levels of administration to integrate all resources and manpower available for the control of endemic diseases and to include control activities in the tasks of the frontline health workers in the primary health care system.

The establishment and strengthening of a vector biology and control unit for integrating efforts for the control of vector-borne and snail-transmitted diseases is another way in which benefit could be obtained as a result of the cooperation of various agencies with similar objectives

Close cooperation should also be established with other organizations outside the Ministry of Health, such as agencies responsible for irrigation development.

Such cooperation, if established from the early planning stages and continued by the implementation of feasible precautionary measures during the construction of water development projects, will prevent the expansion of the disease into new areas.

Because of the importance of schistosomiasis control operations in reducing the prevalence, incidence and intensity of animal trematodes which are highly prevalent in many schistosomiasis infested areas, cooperation should also be established with veterinarians working on controlling these and other vector-borne animal diseases in the areas.

## 2 2 Activities

In recent years the strategy of schistosomiasis control has changed from the use of single control techniques such as mollusciciding towards the use of combined methods of control. In the new strategy all available methods, including mollusciciding, chemotherapy, provision of safe water supply, health education and socio-economic improvement are used.

The projected use in the future of combined methods of control together with the availability of comprehensive health delivery, especially the use of primary health care systems in rural areas, will enhance prospects for success in the control of schistosomiasis. For example, recent advances in finding effective, single-dose schistosomicidal drugs of low toxicity have heightened hopes for the successful control of schistosomiasis.

More extensive use of this method will result not only in disease control in the human population but also in transmission control by affecting the biological cycle

Water management as a method of controlling filariasis may also be effective in the control of some other diseases such as malaria, hookworm, guinea worm and filariasis.

In future, therefore, more extensive use should be made of the following for purposes of integrated control: simple water management practices such as land filling and leveling, drainage, minor engineering to prevent stagnant pools and burrow pits; improvement of channels and seepage drains by cement lining, and elimination of waste irrigation water used previously as a method of vector control

The presence of a village sanitary aid as a frontline health worker in the primary health care systems in some developing countries together with community participation and the cooperation of the irrigation authorities, can facilitate the use of these methods.

Community participation may also help to reduce operational costs and assure better maintenance of progress achieved in the control of disease.

Control operations can be conducted in the following three phases. In the first phase, baseline data is collected, the goal of the control programmes is defined, priorities are established, the strategy of control is designed and appropriate resources are allocated to the programme. During the second phase, control will be applied in accordance with the strategy adopted. In the third phase, the results of the operation will be evaluated, efforts will be made to maintain activities and manpower and the amount of funds allocated will be adjusted accordingly.

Activities for the control of schistosomiasis should be applied at three levels, namely: (a) the national level at the Ministry of Health, (b) at the intermediary or provincial level and (c) at the peripheral level, integrated into the primary health care network.

#### 2.2.1 Activities at the National Level (Ministry of Health)

The tasks involved in the schistosomiasis control programme at the Ministry of Health include the following: establishment of the strategy of control, planning of the programme of operations, projection of funds and manpower needed and preparation of the budget accordingly; securing the availability of funds and manpower, and



establishing full cooperation and coordination between the various activities of the programme and the activities for the control of other diseases on a comprehensive basis.

Another responsibility of the organization at this level is the evaluation of the cost-effectiveness of the operation with the object of finding methods which will produce maximum gains and benefits at minimum cost.

The adjustment of financial and manpower allocations to the programme will be made periodically according to the progress of the control operations.

In the future, through the development and strengthening of the Vector Control and Biology Unit, activities for the control of vectors and intermediate hosts of various diseases can be better integrated into the general health service at the various levels of health delivery.

This type of organization will be more useful in countries where several types of vector and rodent-borne diseases are causes of morbidity among the population. This situation is found in countries of the WHO Eastern Mediterranean Region, where many of these diseases, such as malaria, leishmaniasis, filariasis, trypanosomiasis, and several arbovirus diseases, tick-borne relapsing fever, sylvatic plague and murine typhus are endemic

The future organization for vector biology and control will be responsible for the provision of all epidemiological, biological and ecological information on vector-borne diseases and on snails as the intermediate hosts of schistosomiasis.

This unit will also be responsible for intersectoral and international collaboration for vector control, for reporting and disseminating information on vector biology and control measures and for evaluating the results obtained from control of the diseases.

Integration of the activities designed to control vector-transmitted diseases can be realized by establishing vector-borne control organizational units at different levels of the health services.

With the formation of this unit at the provincial level, many activities on snail-intermediate hosts will clearly be incorporated into the common services provided by this unit, such as vector identification, selection of control methods; susceptibility testing for insecticides and molluscicides and overseeing and monitoring the safe use of pesticides, the possible use of biological control and use of plant molluscicides, and training of polyvalent manpower for various tasks. Some of the above tasks will be undertaken by members of the primary health care system at the provincial level.

#### 2.2.2 Activities at the Intermediary or Provincial Level

The role played by the intermediary organization of the schistosomiasis control programme is more diversified and important than the activities at other levels. At this level, while the vertical approach cannot be avoided at the beginning, the ultimate objective is to use horizontal approaches. The establishment of a well-organized, well-staffed and well-funded vector control unit greatly facilitates the attainment of such an objective.

Such a unit should possess a strong mechanism for coordination and supervision at all levels and should be able to use the services of various personnel with different specialities such as a medical entomologist, a malacologist and sanitary and irrigation engineers; it should integrate prevention and control activities for the control of vector-borne diseases.

It should be realized that the formation of an efficient organization with the ability to carry out such diversified functions requires many years of endeavour and the use of feedback from failures such as will contribute to the improvement of the system.

The main tasks of the organization responsible for the control of bilharziasis at the provincial level will include the collection of baseline data to establish

the magnitude of the problem, the application of control measures and the evaluation of the effects of control operations

Data should be collected on the prevalence, incidence, intensity, morbidity and complications of disease in various subgroups of the population. Data which will help to determine the geographical distribution of the infection should also be gathered.

Information on snail-intermediate hosts includes the distribution, density, ecology and biology of snails, the rate of their infection with larvae of the parasite and the density of cercariae in water.

The collection of demographic data such as the habits of the inhabitants and their socio-economic status, will be the task of staff at the intermediary level. The results of control activities will be assessed through the periodical measurement of the epidemiological parameters mentioned above and through comparisons of the results obtained with previous results.

Another responsibility of the programme at this level is to conduct operational research, such as the assessment of various control measures under local conditions, including the molluscicidal effect of local plant, resistance to molluscicide and biological control

### 2.2.3 Peripheral Level

The main machinery for the attainment of the objective of Health for All by the Year 2000 is the use of the primary health care system for the delivery of health, especially among the rural population of developing countries. Increasing efforts are under way in most under-privileged areas of the world for the establishment and use of such a system.

While evaluation of the impact of the primary health care system has shown significant progress in the provision of medical care and the promotion of general health in some countries, direct efforts to evaluate the effect of these type of

services on reducing the prevalence and incidence of vector-borne and parasitic diseases, which are the main public health problems in the rural areas of developing countries, have rarely been attempted.

This lack of interest, if continued, will jeopardize the attainment of one of the main goals of the primary health care system, namely the provision of health for the community by using horizontal approaches.

Although the terms used for the frontline health workers in primary health care systems are different in various countries, their main tasks are similar. Adequate recognition and consideration should be given to the future contributions which these workers can make to the long-term effort for the control of schistosomiasis and other endemic diseases, which in many areas are the main health problems. By incorporating the following tasks into the activities of primary health care workers, these workers can play an important role in the control of schistosomiasis.

At the village level, in an ideal system, a female worker is responsible for curative aspects for the promotion of general health vaccination, maternal and child health and referral; a male worker is responsible for the general sanitation of the village

The proposed tasks/functions of community health workers pertinent to the control of bilharziasis and malaria are as follows.

- a) Mapping of all water resources around the village;
- b) Search for snail-intermediate hosts of schistosomiasis and insect vectors of malaria and other diseases and reporting their findings to the control team,
- c) As a member of the control team to assist in mollusciciding, larviciding and house-spray,
- d) Water management for the control of schistosomiasis and malaria including the use of community help for the elimination of vector habitats by draining small collections of water and filling ditches,

- e) Maintenance of water supply systems,
- f) Collection of blood, stool and urine samples from school children and inhabitants of villages and their transportation to dispensaries to be examined by microscopists,
- g) Assisting in the information and recording system,
- h) Assisting in the distribution of antischistosomal and other drugs;
- i) Participation in all community activities regarding the general development of the village, including health aspects,
- j) Health education of the inhabitants to use simple measures for protection against schistosomiasis and other endemic diseases.

In villages with a high prevalence of schistosomiasis (more than 30 to 50%) where administration of schistosomicidal drugs to the entire population, without identification of cases, is recommended, community health workers can make an effective contribution to the distribution of drugs among the inhabitants of villages or school children.

In most primary health care programmes, the establishment of a small laboratory at the district level of the health care (secondary level) system is planned

Experience in some countries of the Eastern Mediterranean Region has shown that the presence of a microscopist who can diagnose only schistosomiasis and malaria will be helpful in the detection of cases of these diseases. Later on laboratory diagnosis of some other diseases such as leishmaniasis can be added to the tasks of these microscopists.

The role of sanitarians in health centres would be to coordinate the activities of village sanitarians in various aspects of the control of vector-borne diseases and in general sanitation.

#### IV. TRAINING AND RESEARCH

##### 1. Training

The future multidisciplinary approach to the control of various endemic diseases will create a need for personnel with a broader knowledge of various local diseases.

The use of integrated methods of control requires more diversified information about human behaviour, the biology of snail-intermediate hosts and the geological and environmental characteristics of infested areas.

Training should also be provided for non-medical professional personnel such as irrigation engineers, econometricians and behavioural scientists.

At the national level, in the Ministry of Health, training can be provided jointly by the Ministry and an academic or scientific training institution

Training of the personnel needed at the provincial level can be provided by the Vector Biology and Control Unit of the Department of Health with help from local research and training institutions. This unit will identify the type of training for each category of staff, according to the vector-borne health problems in the area. The preparation of educational materials and a comprehensive manual on different aspects of vector control are immediate needs.

Training for frontline health workers at the village and district levels will be provided by special institutions designed for the training of primary health care workers.

Information about local vector-borne diseases and schistosomiasis should be included in the curricula of courses for these type of auxiliaries. The training course should minimally cover the following subjects on schistosomiasis:

- a) The parasite and its life cycle,
- b) Epidemiology of the disease and its morbidity,
- c) Malacology, biology and ecology of the snail-intermediate hosts,
- d) Control methods, including chemical and biological control of snails, water management, mass treatment, provision of sanitation facilities and health education,
- e) Evaluation of the cost-effectiveness of each method,
- f) Evaluation of the results of the control operations.

More training courses for the senior administrative personnel of bilharziasis control programmes are urgently needed. WHO can greatly assist in this respect by establishing regional training courses once every 3 to 4 years.

## 2. Research

The new approach accepted by many countries for the development and use of the primary health care system for delivery of health to the rural communities creates needs for more diversified operational research to find answers to several new questions. The Vector Biology and Control Unit will initiate and supervise research at various levels of administration. Among types of operational research required are the following.

### 2.1 Methods for integrating Activities for Control of Endemic Diseases into the Primary Health Care System

Despite extensive efforts already under way in many countries for the establishment of a primary health care network, available knowledge about the methods and processes of integrating the control of endemic diseases into this system is very limited.

Research to ascertain the best strategy for the integration of schistosomiasis and the control of other local diseases into the health delivery system will help to smoothe the transition from vertical to horizontal approaches.

## 2.2 Resistance of Snail-Intermediate Hosts to various Molluscicides

Although the resistance of snails to molluscicides already in use has only been reported once, from Iran<sup>(1)</sup>, and the report was not confirmed by any other worker, the possibility of this happening should be considered in the development of snail control strategies and organizational planning.

## 2.3 Continuous and Long-term Evaluation of the Effects of Molluscicides on the Biota

The purpose of such research would be to assess the possibility of any long-term and cumulative effects, with the object of finding methods with minimum adverse effects on the environment

## 2.4 Evaluation of the Effects of Biological Methods of Control and Environmental Alterations and Modifications

## 2.5 The Effect of Controlled-release Molluscicides and Devices for the more Cost-effective Application of Molluscicides

## 2.6 Evaluation of the Optimal Dosage and Efficacy of New Drugs under Local Conditions

## 2.7 Human Behavioural Research

More emphasis should be devoted to human behavioural research in relation to the epidemiology and control of vector and snail-transmitted diseases.<sup>(2)</sup>

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(1) WHO (1980 Epidemiology and Control of Schistosomiasis. Report of a WHO Expert Committee, Tech.Rep.Ser. 643, Geneva, Switzerland

(2) Dunn, F.L. (1979) Behavioural Aspects of the Control of Parasitic Diseases. Bull.Wld Hlth Org., 57: 499 - 512



Most of the operational research should be conducted at the intermediary and peripheral levels, with guidance from the higher level.

V. CONCLUSIONS

The establishment and strengthening of Vector Biology and Control Units in the Ministry of Health, with the objective of integrating all activities for the prevention and control of vector-borne diseases may increase the efficiency of the system and lead to greater success in the control of these diseases, while decreasing the manpower, funds and facilities needed

Because of the diversity of epidemiological, ecological, environmental and behavioural factors in different countries, the organization and administration of the establishment will be different in various areas. Research should be initiated to find the most suitable organization in each country.