

## THE VENEZUELAN EXPERIENCE IN THE CONTROL OF SCHISTOSOMIASIS MANSONI

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*Schistosomiasis mansoni* endemic zone of Venezuela is located in the valleys of the north central mountain region, with an extension of 15,000 km<sup>2</sup> and inhabited by 5.1 million persons. The disease was discovered in 1906, but an organized Control Program was not established until 1943. Its basic activity has been the control of the snail vector, but prevention of man-water contact, prevention of snail infection, treatment of infected people and sanitary instruction, have also been carried out. Prevalence has diminished from 14.7% (1943-60) to 0.9% (1981-84). At present few active foci still persist, but a low transmission rate and low morbidity makes it difficult to know the exact number of infected people, which has been estimated to be about 50,000.

### HISTORICAL

Schistosomiasis was first observed in Venezuela by Soto (revised by Iturbe, 1955, *Gen.*, 10: 33-59). The first control measures had already been established by 1922, once the snail vector could be demonstrated in 1917 (Iturbe, 1955), but at a time when its national geographical distribution was still unknown. Control activities were concentrated in the Caracas valley, and were basically: a) publicity of the disease, b) the prohibition of agriculture on the banks of the main river, drainage of swamps, cleaning and periodical drying of irrigation canals and c) chemotherapy with emetic (Iturbe, 1955). Consequently, by 1922 Riskey reported a drop in the prevalence of the disease from 28% to 5% in Caracas, while Iturbe reported a prevalence of 0.8% (Iturbe, 1955). It must be stated that both data were produced from limited numbers of faecal examinations, carried out at Caracas' main hospital. Population surveys were not available at that time. The most complete knowledge of the national distribution of the disease came from the work of Scott, initiated in 1938 (revised by Luttermoser, 1947, XII Conferencia Sanitaria Panamericana, Venezuela. Cuadernos Amarillos, no. 12). He found the intermediate host and human infection by *Schistosoma mansoni* in the states of the north central region: Carabobo, Aragua, Miranda and the Federal District. Human infection ranked from 10 to 100%, with a high percentage of

children infected. Attempts to control the intermediate host with molluscicides were initiated by Luttermoser in 1941 (Luttermoser, 1947).

### THE SCHISTOSOMIASIS CONTROL PROGRAM (SCP)

The SCP started as an organized structure in 1943. It organized intense investigations of the whole known endemic area, carried out by human teams composed of a topographer, a laboratory technician and a sanitary inspector. Data to be collected included (Jove & Marszewski, 1955, *Gen.*, 10: 119-194): 1. Reconnaissance of all watercourses, waterbodies and irrigation systems, where snail vectors were found; 2. Investigation of the source of water for human use and man-water contact in villages and farms; 3. Information on safe sources of water that could be used for the population; 4. Survey of villages, disperse housing and their means of faecal disposal; 5. House by house collection of faecal samples from selected populations. Samples were examined by the Stoll method; 6. Knowledge of all places of sewage drainage to watercourses, population served by this sewage system and sewage treatment.

Results showed a global prevalence of 29.1% for the Caracas valley, and for the states of Aragua, 24.8%, Miranda, 10.3% and Carabobo, 9.9%. In some villages the prevalence was as high as 100%. Unfortunately, parasite load was not quantified, to know the intensity of the infection. In the state of Guarico a survey

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using the intradermal reaction in people from the state capital (San Juan de los Morros), showed 30% positive (Jove & Marszewski, 1955). The frequency of clinical forms of schistosomiasis recorded were: a) asymptomatic: 11%, b) intestinal: 33%, c) hepatointestinal: 43% and d) hepatosplenic: 13%. Higher frequencies have been reported for the hepatosplenic form, 34.7% (revised by Luttermoser, 1947) and 24.6% (Benaïm Pinto, 1955, *Gen.*, 10: 257-346). Snails were found in most places where human infection was detected, basically in association with watercourses used for agricultural irrigation, watercress culture, lagoons and some rivers. Outside the endemic area, snails had been found in the Caripe region (Monagas state) (Jove & Marszewski, 1955) and later in the states of Portuguesa, Lara and Falcon (Otero et al., 1986, VII Congreso Venezolano de Salud Publica). With this information in hand a control campaign was organized taking the following measures: Control of snail populations; Prevention of human infection; Prevention of snail infection; Sanitary education; Chemotherapy.

*Control of snail population* – Controlling snail population has been the basic effort of the SCP. Molluscicide substances and sanitary engineering works have been employed.

a – *Molluscicides* – Luttermoser began using freshly slaked lime in 1941. Other substances that have been used are: copper sulphate (1947), sodium pentachlorophenate (1951), copper pentachlorophenate (1953), N-trytylmorpholine or Frescon (1964) and niclosamide or Baylucid (1974). At present, molluscicides in use are Baylucid for most places and Cupentachlorophenate, when the former is not available. Lime is still used in swamps and Na-pentachlorophenate is used as a herbicide in these places.

b – *Sanitary engineering works* – Drainage of swamps, canalization and rectification of watercourses to increase waterflow and soil filling of natural or artificial land depressions, have been used in combination with molluscicide application. Accordingly, *Biomphalaria glabrata* has been eliminated from 2,202 watercourses, which represents 72.3% of the 3,046 original watercourses having snails in the endemic area (Otero et al., 1986).

*Prevention of human infection* – Measures were taken to provide water through public

water pipe systems in the main establishments of towns. Public baths and laundries were constructed as well. These measures began in 1947 and were carried out on a small scale, before running water was made available inside houses. Additionally, pedestrian bridges and small road bridges were built and warning notices were placed in sites of transmission. Warning notices, although ethical, did not seem to have much influence on non educated populations (Jove & Marszewski, 1955).

At the beginning of the 1960's a program for the construction of hygienic rural houses with appropriate water supply and faecal disposal systems, was started. This project, not handled by the SCP, is aimed at controlling several endemic parasitic diseases, as well as to improve the quality of life of rural inhabitants.

*Prevention of snail infection* – From the beginning of the campaign, appropriate faecal disposal was recognized as one of the main tasks to be achieved. It was a hard task indeed, because it touched the core of the problem: man is not educated to appreciate the value of adequate faecal disposal. Faeces were disposed on the soil. Consequently, an intensive program for latrines construction was started in 1946 and was aimed at controlling both, hookworm disease and schistosomiasis. Nevertheless, results of maintenance of latrines were disappointing (Jove & Marszewski, 1955). Even today, many people in self established rural communities, do not build latrines nor sanitary system for faecal disposal on their own initiative.

A new problem is posed by the construction of sewage systems in towns located in the endemic area. Direct sewage to watercourses without previous treatment is a frequent situation. This problem has not been satisfactorily resolved.

*Sanitary education* – Personnel for the control campaign were trained in the basic knowledge of the disease in order to teach people in schools and communities. Mass communication media were also used. A program for sanitary education in schools was produced by Vicente & Riley (1947, XII Conferencia Sanitaria Panamericana, Venezuela. Cuadernos Amarillos, No. 15). Direct education was carried out during latrine or public bath construction. At present, sanitary instruction

is given by the same sanitary inspectors responsible for all control activities. There are no education specialists working for the SCP.

*Chemotherapy* — Although *antimonials* (1919-55) were used to cure sick people, chemotherapy, as part of the SCP, began only in 1954, when the safer drug *lucanthone*, was introduced. About 15,000 infected persons were treated during a period of 16 years. The use of *hycanthone* from 1970, was an important development, because it was very effective and could be administered in a single dose, although inconveniently applied intramuscularly. Up to 1975, 3,073 patients had been treated (Otero et al., 1986), but its toxicity, showed by workers in other countries, forced the SCP to stop its administration. In 1975 *oxamniquine* introduced a new development: an effective drug administered in a single oral dose. At present, about 1,500 patients have been treated. Since 1980, *praziquantel* has been used on trials to compare its efficiency against oxamniquine. Praziquantel, administered also in a single oral dose, has the additional advantage of being effective against other helminths. At present, about 600 patients have been treated.

#### THE ACTUAL SITUATION

At present, the endemic area is, basically the same as that described in 1942 by Scott (*Am. J. Hyg.* 35: 337-366). This may be due to the absence of the intermediate host in most parts of the country (in spite of the construction of dams and irrigation systems), and also to the work of surveillance of the Control Program. The endemic zone comprises about 15,000 km<sup>2</sup> of the states of Carabobo, Aragua, Miranda and Guarico as well as the Federal District (1.6% of the national territory) (Fig.). The estimated population is 5.1 million inhabitants (about 30% of the national population) (Otero et al., 1986) and the population which may be directly exposed to the risk of infection has not been estimated. Any calculated number becomes underestimated if we recognize the high mobility of suburban communities and that transmission sites may be used for recreation by people from the cities, at certain periods of the year. The transmission of schistosomiasis outside the traditional endemic area was discovered for the first time in 1976. This was in the town Paraiso de Chabasquen, located in the lower Andes mountains of the state of

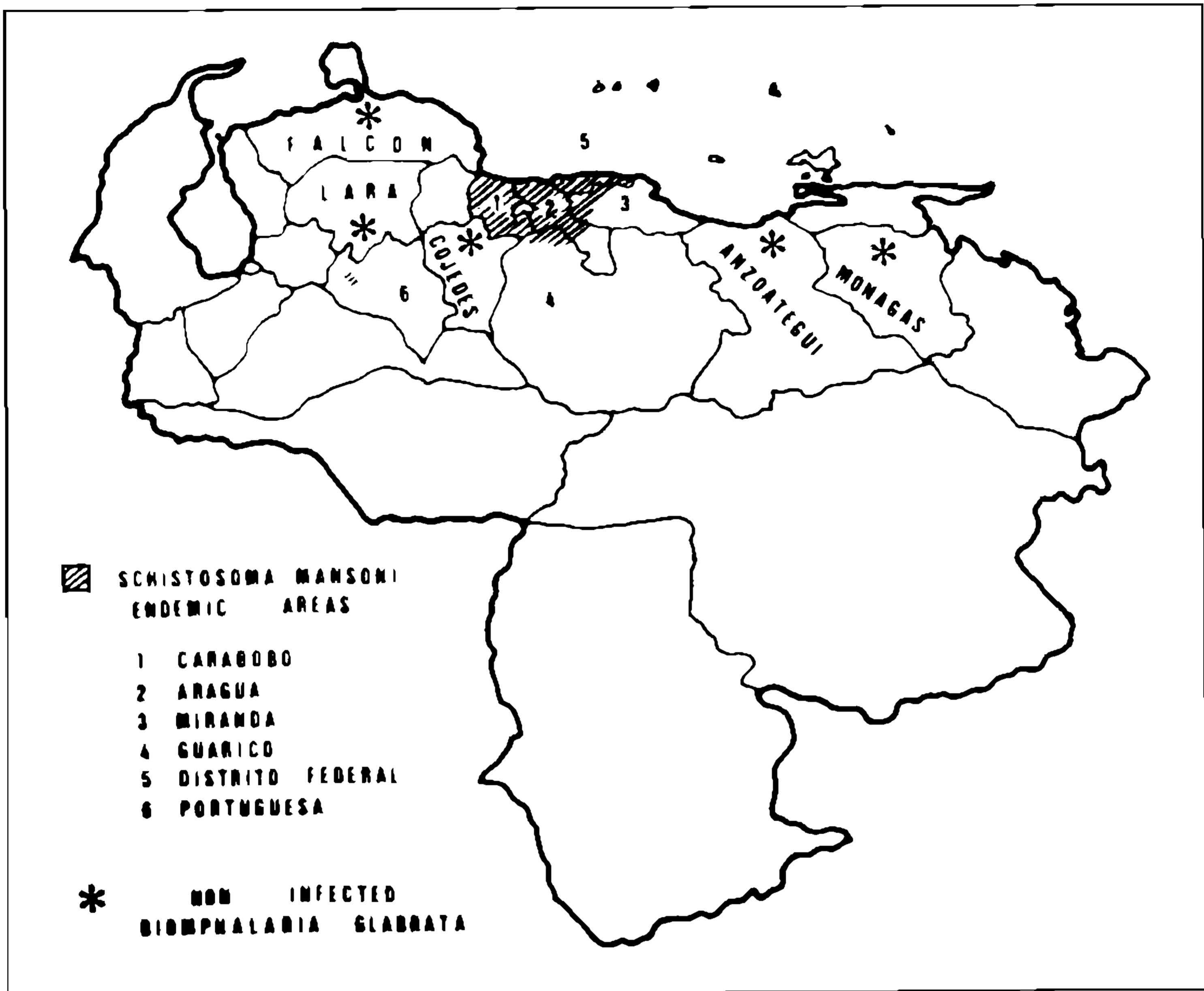
Portuguesa (about 200 km west of the traditional endemic area) (Fig.). Prevalence there was 0.8% (44 human cases, out of 5,563 persons examined) and it seems to be presently under control, with no new cases registered since 1978. Although active transmission was detected, it appears that the disease was brought there by migrating peasants who worked in the traditional endemic zone. (Otero et al., 1979, XXIV Asamblea General Ordinaria de la Sociedad Venezolana de Salud Publica).

The evolution of the prevalence of schistosomiasis, according to data of the SCP, can be summarized as follows: 14.7% for the period 1943-60, 8.2% for 1961-65, 4% for 1966-70, 2% for 1971-75, 1.9% for 1976-80 and 0.9% for 1981-84. These data are calculated on samples taken from the population under direct risk of infection.

#### CRITICAL EVALUATION

It is evident that an important success has been achieved in controlling the disease. Nevertheless, when careful studies are concentrated in certain transmission sites, prevalence numbers become elevated. For example, the area of Caraballeda, a touristic beach town in the Federal District studied by Alarcon de Noya et al. (personal communication), showed a prevalence of 32% in 1982. The number of inhabitants directly exposed to the risk of infection is about 5,000, but this number can be substantially increased if we take into consideration the fact that thousands of inhabitants from Caracas spend their weekends at these beaches, after which they take sea sand off their bodies in the main river. This river had infected snails until 1983. In the village "El 25", in the south of Carabobo, which we ourselves investigated (Incani et al., 1987, International Symposium on Schistosomiasis, Rio de Janeiro), a prevalence of 25% was found. In the town Pao de Zarate (Aragua state) the prevalence found by the SCP was 8.5% (Camejo & Balzan, 1987, personal communication). These findings deserve some comments related to the methodology used for diagnosis, number of people examined, administrative problems and control policy.

*Methodology used for diagnosis* — In Venezuela, the Kato smear technique substituted other methods like the Stoll or the spontaneous sedimentation, since 1969 (Bastidas, Internal



Geographical distribution of *Schistosoma mansoni* and non-infected *Biomphalaria glabrata* in Venezuela. Source: Ministerio de Sanidad y Asistencia Social, Departamento de Parasitosis Intestinales y Esquistosomiasis, Maracay, Venezuela.

Report of the SCP). The Kato is an easy and economic technique, with a good sensitivity in conditions of medium or intense infections (> 100 eggs/gr of faeces). For conditions of low parasitic load, it becomes less sensitive and has to be repeated several times. Low parasitic load (and also low morbidity) appears to be, at present, the most common epidemiological condition in our endemic zone. Up to 1986, prevalence numbers reported by the SCP were obtained from 1 Kato smear carried out on 1 stool sample of each person examined. The figures showed previously for Caraballeda, "El 25" and Pao de Zarate, were obtained from 3 Kato smears carried out on each of 2 stool samples per person, collected on separate days, as recommended by our Schistosomiasis Research Group. It appears then, that prevalence must be higher, and the estimated number of infected people must be close to 50,000 (Otero et al., 1986).

*Number of people examined* – The prevalence figure for 1981-84 was obtained from a limited number of 82,877 faecal samples. This was about half the number of samples examined (158,519) for the period 1976-80, and this in turn was about 67% of the samples (235,656) for the period 1971-75. More wide spread and intensive surveys have not been carried out. National economic problems on one side and a reduction in SCP's budget due to cost increases on the other, are to blame. But, ironically, it is also common that in health affairs, the consequence of a successful program is a drastic reduction in its budget.

*Administrative problems* – Another consequence of success is the difficulty to keep the same moral of work when the disease seems to be coming under control. The habit of permanent surveillance of potential or low frequency problems, is a factor that does not seem to be

totally present in underdeveloped countries. It appears that more sanitary education for health workers is needed in this sense. On the other hand, budget problems and low salary scales pose additional difficulties in obtaining trained professionals, technicians and workers for the SCP. Finally, the intromission of politics at all levels of state administration, creates difficulties for efficient workers and makes jobs in public health unattractive to young, well trained professionals.

*Control policy* – Up to the present, control activities have been basically directed to stop transmission. Since the snail vector appears as the weakest link in the transmission chain, most efforts have been directed to controlling it. Snail control is carried out on large scale throughout the entire endemic zone, which includes large areas without transmission. This kind of work is, at present costly, even for so called rich underdeveloped countries like Venezuela, although it is acknowledged that snail control has been of great importance in reducing the prevalence of the disease. Poorer endemic countries where snail control has been attempted, have met with disappointing results. It appears that an important change in control policy should be recommended.

#### RECOMMENDATIONS

*Change in control policy* – Control efforts should be directed towards the infected people and those running a risk of infection. Early detection and treatment of infected people should be encouraged. Mass treatment has become a feasible task since the advent of safe and effective drugs like oxamniquine and praziquantel. Mass treatment should be defined according to local conditions. Prevalence, size of the community and cost, must be taken into account. Snail control measures should not be stopped, but should be directed to the active transmission sites or to those places having high risk (Gabaldon, 1985, *Bol. Dir. Malar. San. Amb.*, 25: 1-18).

*Integration of local health personnel (physicians, nurses) to control activities* – Local health personnel may be useful particularly in chemotherapy and sanitary education. Integration of the control activities to primary health care, should be taken with caution in countries like Venezuela, where vertical control activities have been successful.

*Sanitary education* – Education must be seen as a way to achieve changes of attitude and not just a means of informing people about the disease. It must also stimulate the participation of local inhabitants in surveillance and control work.

*Integration of local authorities to control activities* – Local councils, or regional authorities must collaborate in control activities, particularly in sanitation.

*Personnel* – An adequate career structure should be envisaged, to attract trained personnel.

*Budget* – Health authorities should be aware that surveillance activities are as important as those of control. Control Program budgets should not be critically limited because of success in reducing prevalence.

*Diagnosis techniques* – Research must be encouraged for finding suitable parasitological and immunological diagnosis techniques, that can overcome the problems posed by actual methods. A quantitative parasitological method like the Kato-Katz should be used routinely, instead of the standard Kato smear.

*Integration of research institutions with the control program* – Difficulties faced by control programs in carrying out research, are well recognized throughout the world. It is also known how complex it is to bring together research institutions and control programs. In Venezuela, we have had a successful experience in this matter. Members of two universities (Universidad de Carabobo and Universidad Central de Venezuela) and a research institute (Instituto Venezolano de Investigaciones Cientificas), work in collaboration with the Control Program as a Schistosomiasis Research Group, producing work relevant to control activities.

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