



*executive committee of
the directing council*

PAN AMERICAN
HEALTH
ORGANIZATION

*working party of
the regional committee*

WORLD
HEALTH
ORGANIZATION



78th Meeting
Washington, D.C.
June 1977

CE78/INF/4 (Eng.)
3 June 1977
ORIGINAL: ENGLISH

STUDY GROUP ON MALARIA CONTROL
IN THE AMERICAS

REPORT TO THE DIRECTOR

1977



STUDY GROUP ON MALARIA CONTROL
IN THE AMERICAS

12 - 15 April 1977 - Washington, D.C.



REPORT TO THE DIRECTOR
PASB/WHO

PAN AMERICAN HEALTH ORGANIZATION
PAN AMERICAN SANITARY BUREAU, REGIONAL OFFICE OF THE
WORLD HEALTH ORGANIZATION

PAN AMERICAN HEALTH ORGANIZATION
Pan American Sanitary Bureau, Regional Office of the
WORLD HEALTH ORGANIZATION

STUDY GROUP ON MALARIA CONTROL IN THE AMERICAS
12 - 15 April 1977, Washington, D.C.

TABLE OF CONTENTS

	<u>Page</u>
Participants	i
Introduction.....	1
A. Summaries of Working Documents.....	3
1. The Present Status of Malaria in the Americas.....	3
2. The Cost of Malaria and of its Control in relation to socioeconomic realities.....	7
3. Recent Advances in Malaria Research.....	10
4. Vector Control Research and Malaria Control.....	13
5. Organization and Methods for Optimal Use of Resources for Malaria Control.....	15
6. Coverage of Rural Areas by General Health Services and their Relations with Antimalaria Programs.....	19
B. Synthesis of Discussions.....	22
C. General Recommendations.....	29

PARTICIPANTS

Dr. Gustavo Mora
Chairman of the
Executive Committee - PAHO

Dr. Alfredo Arreaza Guzmán, Advisor
Ministry of Health and Social Welfare
Caracas, Venezuela

Dr. L. J. Bruce-Chwatt
Wellcome Museum of Medical Sciences
London, England

Dr. Robert De Caires, Director
Division of Program Analysis
International Health
US Department of Health, Education
and Welfare
Washington, D.C.

Dr. Ernani Guilherme Fernandes da Motta
Superintendent
Superintendence of Health Campaigns
Ministry of Health
Brasilia, DF, Brasilia

Dr. Guzmán García Martín, Director
School of Malariology and
Environmental Health
Maracay, Edo. Aragua, Venezuela

Dr. D. A. Henderson, Dean
School of Public Health
John Hopkins University
Baltimore, Md.

Dr. Lee M. Howard, Director
Office of Health
Agency for International
Development
US State Department
Washington, D.C. (Chairman)

Dr. Carl M. Johnson
Director Emeritus
Gorgas Memorial Laboratory
Panama, Rep. Panama

Dr. Leonard Schuman, Chief
Department of Epidemiology
School of Public Health
University of Minnesota
St. Paul, Minn.

Dr. Reuel Stallones, Dean
School of Public Health
University of Texas
Houston, Texas

Dr. Rogelio Valladares
Chief, International Public Health
Ministry of Health and Social
Welfare
Caracas, Venezuela (Rapporteur)

PARTICIPANTS (cont.)

OBSERVERS

Dr. Robert Kaiser
Medical Director
Bureau of Tropical Medicine
Center for Disease Control (CDC)
Atlanta, Ga.

Mr. Edgar A. Smith
Office of Health
Technical Assistance Bureau
Room 633
Agency for International Development
Washington, D.C.

Dr. Jack W. Millar, President
Gorgas Memorial Institute
of Tropical Medicine
2007 Eye Street, N.W.
Washington, D.C.

Col. Dr. G. Rapmund, Director
Walter Reed Institute of Research
Walter Reed Army Medical Center
Washington, D.C.

Dr. Abram S. Benenson
Director Designate of the Gorgas Memorial Laboratory
Panama, Rep. Panama

WORLD HEALTH ORGANIZATION

Dr. I. D. Ladnyi
Assistant Director-General
World Health Organization
Geneva, Switzerland

Dr. Tibor Lipes
Director, Division of Malaria and
Other Parasitic Diseases
World Health Organization
Geneva, Switzerland

Dr. Jacques Hamon
Director, Division of Vector Biology and Control
World Health Organization
Geneva, Switzerland

PARTICIPANTS (cont.)

PAN AMERICAN HEALTH ORGANIZATION

Dr. Héctor R. Acuña, Director

Dr. Pedro N. Acha, Chief, Division of Disease Control

Dr. Silvio Palacios, Chief, Malaria and Other Parasitic Diseases

Dr. José A. Nájera, Chief, Vector Control

Dr. K. C. Liang, Epidemiologist, Malaria and Other Parasitic Diseases

Dr. Jaime Ayalde, Epidemiologist, Malaria and Other Parasitic Diseases

Dr. Ramón Martínez, Medical Officer, Mexico-0200 Project

STUDY GROUP ON MALARIA CONTROL IN THE AMERICAS
12 - 15 April 1977, Washington, D.C.

REPORT TO THE DIRECTOR, PASB/WHO

INTRODUCTION

In compliance with the Resolutions of the Governing Bodies in relation to the development of the antimalaria program in the Americas, the Director of the Pan American Sanitary Bureau convened a meeting of a study group in Washington, D.C., from 12 to 15 April 1977.

At the opening session, Dr. Héctor R. Acuña, Director of the Pan American Sanitary Bureau, welcomed the participants and expressed that the recommendations of this prestigious Group would guide the future policies and strategies of the Pan American Health Organization and the World Health Organization in the Region of the Americas. He indicated that changes in malaria control were needed and that they were emphasized at the II Hemispheric Meeting of Directors of Malaria Programs, as well as at the Meetings of the Executive Committee and Directing Council of the Organization in 1975. This need was reflected in the Technical Document entitled "Guidelines for the Future Conduct of the Malaria Program in the Americas", in 1976.

Dr. Acuña expressed his concern over the current malaria situation, stagnation in some programs and deterioration in certain areas. Although the problems of vector and parasite resistance, as well as those connected with human ecology have not yet found an adequate solution, it is believed that malaria activities can be improved if epidemiological knowledge is deepened, resources better deployed, and more effective and efficient use made of the health services available.

Dr. Acuña stressed that the top priority program in the Americas is the extension of primary health care services until total coverage is achieved, and that the Governments of the Americas will come to recognize the urgent need to include antimalaria activities in the primary health care services. It must be borne in mind that, in the Region of the Americas, one billion dollars was invested in malaria programs from 1957 to 1976. This effort has entailed the organization of an operational structure, covering extensive rural areas, which should also be used in the new priority programs.

Dr. I. D. Ladnyi, Assistant Director-General of WHO, greeted the participants on behalf of Dr. Halfdan T. Mahler, the Director-General, and wished all success in the deliberations of the study group. He supported the view expressed by Dr. Acuña in relation to the resurgence of malaria as a serious public health problem and the necessity to adopt flexible approaches in the utilization of both conventional and classical methods to reduce the rate of transmission and to alleviate suffering.

Following the addresses of Dr. Acuña and Dr. Ladnyi, the Group unanimously elected Dr. Lee M. Howard as Chairman and Dr. Rogelio Valladares as Rapporteur.

Each topic on the Agenda was introduced by a participant through the presentation of a working document. The subject was then discussed and a summary of the highlights was prepared.

Seven plenary sessions were held, the first being inaugural, followed by four working sessions to discuss the topics on the Agenda and the last two dedicated to discussions, drafting and approval of recommendations.

The Meeting was closed at 11:30 a.m. on 15 April 1977.

The following pages of this report contain the summaries of the working documents, the synthesis of discussions and the general recommendations.

TOPICS DISCUSSED

A. SUMMARIES OF WORKING DOCUMENTS

1. THE PRESENT STATUS OF MALARIA IN THE AMERICAS*

At the end of the 1950's, all the countries in the Region of the Americas in which malaria existed organized programs to eradicate it.

The policy adopted at that time was based on a principal method of attack with residual action insecticides, 100% coverage of localities and houses in the malarious area, a system of epidemiological evaluation aimed at detecting the last case of malaria, and the interruption of transmission throughout the malarious area within a limited period.

In the early 1960's, successes were obtained in vast areas of most of the countries; nevertheless, in that period serious problems emerged and became acute at the beginning of the 1970's. Certain areas were shifted back from the consolidation to the attack phase; in others, operations had to be suspended because financing, even though increased in some countries, was not sufficient to meet the needs of most of the programs.

Since 1969, when the Twenty-second World Health Assembly adopted a more flexible strategy and recommended that the Governments of the countries with programs underway revise them in cooperation with the Organization, with a view to adapting them to the epidemiological and socioeconomic conditions of their countries, most of the programs in the Americas have been revised to that end.

In 1975 the Pan American Sanitary Bureau, in accordance with the instructions of its Governing Bodies, organized the II Meeting of Directors of Malaria Programs in the Americas. The deterioration in the epidemiological situation was recognized at that meeting, which emphasized the need to introduce changes into the policy and strategy of the programs. In 1976 a number of countries began to apply methods that were supplementary to or in replacement of insecticide spraying, with a view to improving malaria control.

According to the present epidemiological situation in the Americas, the countries may be classified into three groups:

Group I - countries or territories in which malaria eradication has been certified throughout their entire extent - includes: Cuba, Chile, Dominica, the continental United States, Grenada and Carriacou, Guadeloupe, Virgin Islands, Jamaica, Martinique, Puerto Rico, St. Lucia, and Trinidad and Tobago. During 1976 they remained free of transmission.

*Based on Working Document RM/1: "The Present Status of Malaria in the Region", by Dr. Silvio Palacios, Chief, Malaria and Other Parasitic Diseases, Division of Disease Control, PAHO/WHO, Washington, D.C., USA

Group II - includes the political units in which the epidemiological situation has shown a favorable response to the measures applied: Argentina, Belize, Costa Rica, Dominican Republic, French Guiana, Panama and Paraguay.

Group III - includes Bolivia, Brazil, Colombia, Ecuador, El Salvador, Guatemala, Guyana, Haiti, Honduras, Mexico, Nicaragua, Peru, Surinam and Venezuela. The majority of these countries have areas in the consolidation and maintenance phases where the problems are limited to imported cases and well-defined residual foci. However, all of them have areas still in the attack phase.

An analysis of the situation, country by country, was presented.

Taking into account the epidemiological situation of each group of countries in the Region and comparing the cases registered in 1974, 1975 and 1976, it may be seen that there has been a substantial deterioration in the epidemiological situation in the areas in the attack phase of Group III, which, in those years, contained 31.8, 30.4 and 29.6% respectively of the total population of the original malarious area.

A hemispheric appraisal of the problems faced by the malaria programs can begin with the physiological and behavioral resistance of vectors to insecticides and P. falciparum resistance to chloroquine.

Studies made in several countries have shown that, when resistance is present in areas in which transmission persists, it is not the only cause of the problem. Persistence exists in areas in which the vectors are susceptible to insecticides, but it is caused by other epidemiological and anthropological factors.

The population of the areas in which the vectors are resistant to insecticides represents 20% of the total population of the malarious areas of the countries affected, principally in Central America.

P. falciparum resistance to chloroquine has been known in the Americas since 1960, and is very widespread in Colombia and Brazil. It is also present in certain areas of Guyana, Panama, Surinam, Venezuela, and recently cases of resistance have been discovered in the northern part of Ecuador and on the coast of French Guiana. In the areas in which the problem exists, most of the resistance cases are R-I. "In vitro" susceptibility tests are being carried out at the hemisphere level.

Anthropological factors, various cultural patterns, land settlement activities, construction and maintenance of dams and irrigation systems, and road building are examples of the kind of problems connected with human behavior that frequently conduce to the persistence of transmission.

With respect to the financing and utilization of resources, mention must be made of a decisive aspect for the future, namely, that geographically malaria has not been and is not uniformly distributed, over the entire

malarious area. What has been said shows that it is necessary to deepen our epidemiological knowledge in order to reallocate funds in accordance with epidemiological conditions and technical, operational, and economic feasibility.

Since 1957, a total of US\$1,018,889,000 has been invested in the malaria programs in the Americas; of this amount, 81.1% was provided by national governments and 18.4% by international assistance.

The rigid criteria of the traditional methodology of malaria programs are in the process of being transformed into operational flexibility, which takes more account of epidemiological, socioeconomic and health conditions in the country, as well as of the resources available.

The Pan American Health Organization and the World Health Organization and their Governing Bodies have fostered those changes. In this regard, mention may be made of the following important events: the II Meeting of Directors of Malaria Programs in the Americas held in Quito, Ecuador, in April 1975 (Governments and PAHO/WHO); the Meeting on Bioenvironmental Methods of Malaria Control (UNEP/WHO) in December 1975, held in Lima, Peru; and the preparation of the PAHO/WHO Technical Document "Guidelines for the Future Conduct of the Malaria Program in the Americas," April 1976, on which favorable comments concerning its acceptance and applicability have been received from the countries.

A number of countries in the Region have adopted new plans of operations based on better epidemiological knowledge and on operational studies for the application of combined methods of control.

The Organization is taking steps to improve personnel training because favorable changes cannot be obtained without an important training component.

The traditional approach to the training of malariologists has been modified. In 1976 the first International Course in Public Health with emphasis on Malaria and Other Parasitic Diseases was held at the School of Public Health of Mexico; the second course began in February 1977. An International Refresher Course on Mosquito Control, which was attended by the engineers in charge of the field operations of malaria programs was held in California and El Salvador, with financial assistance from USAID. In Brazil, a course on entomoepidemiology was held at the School of Public Health of São Paulo for entomologists; this course will be repeated in 1977. In Venezuela, the XXXII International Course on Malariology and Environmental Sanitation was held in Maracay in 1976. The XXXIII Course began in January, 1977.

Recent work in the field of research includes field trials for the evaluation of new insecticides, studies of the susceptibility of parasites to drugs and vectors to insecticides and investigation of potential use of local species of larvivorous fish. Worthy of mention is the initiation in 1977 of two regional projects, one with aid of USAID, connected with the use

of animal models in the production of human plasmodium antigens; other with studies on parasite susceptibility to drugs, clinical trials of new anti-malarial drugs and seroepidemiological studies.

Most of the malaria programs in the Region have been assigned additional responsibilities for other health programs, such as American trypanosomiasis, schistosomiasis, filarial diseases including onchocerciasis, leishmaniasis, yaws and Aedes aegypti. The structure of the malaria services and their operational capacity in rural areas is an excellent resource for the program of the extension of health service coverage.

To sum up, the report contains a review of the difficult situation the malaria programs in the Americas are facing. In the Region, there are four types of area relevant to the present status of malaria: a) certified eradication; b) favorable progress; c) stationary situation; and d) manifest deterioration.

Where transmission has been interrupted, an epidemiological surveillance system exists to prevent the re-establishment of the disease, but there is increasing danger that these areas may be reinfected as a result of the increase in communications and migrations.

In the areas in which progress is still being made, the traditional strategy has proven to be effective; however, it must be meticulously applied in order to interrupt transmission before technical problems are produced.

Where the situation is stationary or has deteriorated, further knowledge must be obtained of the epidemiological situation, and combined methods may be used, with or without insecticides, and always tailored to epidemiological conditions and technical, operational and economic feasibility. These combined methods will entail increased investment and will also require the participation of specialists from other disciplines.

In the areas in which the methods currently available are not effective, it will be necessary to set limited goals such as to prevent malaria mortality, control outbreaks, and further study the causes of persistence. Methods of biological and genetic control of the vector are still far from practical application.

With respect to the resources of the malaria programs, they must be better distributed, they must participate in other health activities and additional financial aid must be obtained.

It is recognized that the knowledge of professional personnel currently working in malaria programs must be broadened to include public health and other parasitic diseases. The shortage of university trained entomologists is another serious problem; it is urgently necessary to train more entomologists and to assign them to malaria programs and programs for the control of other parasitic diseases.

We are facing an especially complex problem whose complete solution has so far not been possible. Malaria continues to cause deaths, and morbidity remains high in many endemic areas.

2. THE COST OF MALARIA AND OF ITS CONTROL IN RELATION TO SOCIOECONOMIC REALITIES*

Malaria has a major place among the endemic tropical diseases. It was estimated 20 years ago that the annual incidence of the disease was of the order of 250 million cases with 2.5 million people dying of malaria every year. Today the estimated annual malaria mortality throughout the world is less than 1 million, but the expected conquest of this disease is still an unfulfilled dream.

The worldwide program of malaria eradication was formally adopted in 1955 by the Eighth World Health Assembly and by 1977 all malarious countries in the Americas and Europe, and in the majority of countries in Asia and Oceania had malaria eradication programs. Today, when we come to the end of the second decade of our great international endeavour in fighting malaria, the results are not satisfactory. Even if the original concept of malaria eradication may be justified, the present conclusion is that highly advanced technology of public health can produce expected results only when socioeconomic conditions are appropriate for its introduction.

The resurgence of malaria in some countries is very disturbing. There is increasing concern with imported malaria as one of the tropical diseases now frequently seen in Europe, the USA and other parts of the temperate world.

The general consensus of opinion is that malaria eradication should remain the final goal as long-term investment because of its overall impact on health and its socioeconomic benefits. Wherever malaria eradication programs have good prospects they must be pursued with vigor towards their defined goal. In countries where eradication does not appear to be feasible because of the inadequacy of financial resources, manpower requirements, or shortcomings, if not worse, of basic health services, malaria control operations may form a prolonged transitional stage toward the future achievement of malaria eradication.

The objectives of an antimalaria program within a national health plan may aim at one or several of the following targets: 1) elimination or a substantial decrease of the number of deaths caused directly or indirectly by malaria; 2) elimination, or at least a substantial decrease, of malaria

*Based on Working Document RM/2: "The cost of malaria and of its control in relation to socioeconomic realities", by Dr. Leonard J. Bruce-Chwatt, Wellcome Museum of Medical Sciences, London, England.

morbidity and lessening of the impact of diseases or conditions /e.g. malnutrition, anemia/ indirectly related to malaria; 3) improvement of labor output and earning power of populations (especially rural) living in malarious regions; 4) saving of losses of agricultural crops and of industrial production, due to the shortages of labor or to its decreased efficiency; 5) improvement of health of pregnant mothers exposed to malaria; 6) decrease of the proportion of low birth-weight babies and of neonatal deaths; 7) decrease of expenses for treatment of malaria and for general medical care; 8) improved school attendance; 9) use of land that could not be cultivated in areas of intense malaria, because of the absence of settled population; 10) opening up of new parts of the country for industrial development.

Of all human diseases malaria is the one that gave rise to the greatest number of attempts to quantify its direct and indirect adverse effects on socioeconomic development.

Some of recent attempts at estimating the economic impact of malaria on a tropical country were made in Sri Lanka and in Paraguay. Both studies, showed that tracing the influence of a single factor through all the intricacies of real economic world is a complicated task. Illness does not affect people in the same way in all aspects of their daily lives.

At present, the general consensus of opinion is that any widespread endemic disease and malaria in particular has a profound socioeconomic effect on the country. However, the difficulties of assessing these effects in monetary terms are enormous.

An attempt to estimate the cost of eradication of malaria from the world was made by the WHO in 1959 and based on the approximate cost in malarious areas of each WHO Region of insecticide spraying operations followed by surveillance, assuming that the cost of the latter amount to 75% of the former. On this basis a highly conjectural estimate of the total cost of malaria eradication from the world was of US\$1,691 million. It is obvious today that this figure given in 1961 was a gross underestimate since another tentative calculation made two years later was already \$200 million higher.

Gabaldon (1972), in discussing the problems of resurgence of malaria in Latin-American countries, pointed out that in nine of these countries less than US\$5.00 per capita per year is spent on health and of this less than 5% or US\$0.25 are spent on antimalaria activities.

The constantly rising costs of antimalaria campaigns are causing much concern. This was stressed by Palacios (1975) in his recent study of principal problems in the Region of the Americas and by García Martín and Nájera. In 1973 the oil crisis caused a spectacular rise of the cost of all raw materials. Soon the price of DDT increased by 2-1/2 times and that of malathion by 5 times in comparison with pre-1973 prices.

Consequently, many antimalaria programs in developing countries experience difficulties in obtaining adequate supplies of insecticides and had to cut down on their planned consumption. Partly because of this, there have been several waves of resurgence of malaria in many tropical developing areas.

No additional evidence is needed to prove that eradication or even a substantial degree of control of malaria is followed by a significant reduction of the direct or indirect death rate related to this infection.

In Guyana, Newman (1965) concluded that malaria eradication in the densely inhabited coastal areas was responsible for about 1/3 of the fall in the average crude death rate. This was amply confirmed by Giglioli (1974).

In Guatemala, malaria control in the 1960's was responsible for a 20% decline of the crude death rate and similar effect was seen elsewhere.

The standard of health and education both influences and is influenced by the economic status. Standards of health and education in developing countries cannot rise unless more wealth can be produced to provide for them; on the other hand, higher standards of health and education are equally necessary to increase economic production, since ill-health and ignorance are powerful factors in keeping people poor.

3. RECENT ADVANCES IN MALARIA RESEARCH*

During the past 20 years the World Health Organization has encouraged and assisted many research workers to undertake research on malaria and some 800 contractual services agreements were concluded in respect of specific research subjects. There was, in fact, rather an explosion of information in this field and in the last 25 years over 15,000 articles have been published in various periodicals throughout the world dealing with different technical aspects of the disease.

Since the initiation of the malaria eradication program, two main subjects concerning the vector occupied the place of interest in public health and specialized journals: susceptibility of different anopheline species to available pesticides applied by various means and development of biological agents for the control of vectors.

As regards the resistance of a particular species of anopheline, many facets of this problem have been investigated such as the genetic aspect, cross-resistance, speed of selection within a particular species under pressure, etc. and there is an inventory of the susceptibility/resistance status of all known vectors of malaria in different parts of the world.

However, the practical malariologist in the field should be given guidance on how long an insecticide can still be used from the moment resistance first occurs.

Advances have also been made in the field of mosquito genetics. The techniques developed have helped in identifying not only sibling species but also genetic variants, which has particular importance and relevance in relation to the vectorial capacity of several vector species complexes.

A considerable amount of research has been devoted in the last 20 years to investigations on the possibility of biological and genetic control of diptera-nematocera in general and, in part, of some anopheline species. The results of all these studies indicate that the principles applied were valid but that additional studies are required and that these techniques could not shortly become available for practical use in malaria control programs.

Bionomical studies carried out in the field have practically been abandoned by entomologists. This is particularly true as far as the "secondary vectorship" is concerned.

*Based on Working Document RM/3: "Recent advances in malaria research and prospects for near future", by Dr. Tibor Lipes, Director, Division of Malaria and Other Parasitic Diseases, WHO, Geneva, Switzerland.

It is considered that additional bionomic studies are needed on the role that any anopheles species occurring in an area may play in the transmission of malaria.

Classical malariologists have given considerable attention to the behavior of the human population. Today, however, one should go one step further. It is not only the question of exposure to infection but rather the study of ways and means to secure community participation that is required.

Considerable progress has been made in our knowledge of the life of the plasmodia. Research on the ultrastructure of the parasite and the probable function of different organelles in relation to the metabolism thus became possible.

Another aspect receiving attention is the in vitro cultivation of plasmodia.

Trager and his collaborators succeeded in establishing the right ratio of CO₂ and O₂ to support "in vitro" culture. It was a considerable breakthrough and since last year a number of laboratories are maintaining in vitro cultivation of P. falciparum and P. knowlesi. Studies on the possibilities of infecting different species of monkeys and apes with human species of plasmodia lead to the successful infections of apes by P. falciparum, but no doubt the most important development was the susceptibility of Aotus trivirgatus to all four human species of plasmodia which remains the best model, both for chemotherapy and immunization.

Admittedly, the question of susceptibility of the human host is a complex matter, indicated clearly by the discovery of the Duffy blood group determinant and that persons having a Duffy negative blood group determinant are resistant to P. vivax infections.

For many decades the existence of different strains of certain species of plasmodia was considered but most of the observations made in this respect were clinical and epidemiological. We ought to encourage research workers in malarious countries to study numerous isolates which, in turn, should show to what extent we are dealing with different strains.

Progress has been considerable in the field of chemotherapy. The activity of long-acting sulfonamides (among which are a number of analogues of sulfadoxine, sulfones and sulfalenes) in combination with pyrimethamine, as well as their use in chemoprophylaxis of malaria, has been well established.

As far as the development of new antimalaria drugs are concerned, the United States Army program has studied more than 300,000 compounds which resulted in the development of four groups of compounds that are highly promising. Of these compounds one, mefloquine, has reached the advanced stages

of clinical and field testing and experience already shows that it will be a good replacement for chloroquine in areas where P. falciparum is resistant to this drug.

There are some aspects that require further basic research: Mechanisms involved in chloroquine resistance of P. falciparum strains. It needs to be further explored the preparation of formulations with a slow release of primaquine which would make this drug a much more valuable tool in the chemoprophylaxis of malaria, and in areas where 4-aminoquinolines are largely used in vitro testing of chloroquine resistance should be undertaken from time to time.

In the past 15 years considerable progress has been made in our understanding of the immune response as developed following natural transmission of infection, on measuring the immune response (or rather on measuring the experience of the human host with malaria infection), on the detection of immunopathological consequences, in other words, formation of immune complexes that may occur in a certain number of infections with P. malariae and, finally, on possibilities for developing immunizing agents.

Considerable advances have been made in the serology of malaria and several techniques for the serodiagnosis of malaria have been developed like: Indirect immunofluorescent antibody test (IFA), indirect haemagglutination test (IHA), Gel-precipitating test and Enzyme linked immuno sorbent assay (ELISA). None of those tests specifically measures the protective immunity of an individual, yet they are very useful tools in seroepidemiology of malaria, particularly on malaria control programs at their advanced stages or for screening of these techniques may be very useful in confirming clinically suspected cases for a certain period of time to infection and have been under incomplete chemoprophylaxis.

The research so far carried out shows that immunization against malaria appears to be a feasible proposition. The results show the principal lines of further research needed and many technical problems that should be solved; in terms of quantitative improvement of in vitro cultivation, the separation of free merozoites in non-synchronous species such as P. falciparum, development of a suitable adjuvant, problem of preservation of free merozoites, etc.

It is believed, however, that with the renewed interest in malaria and the creation of the WHO Special Programme for Research and Training in Tropical Diseases, most of the basic research required will be encouraged and intensified. However, to control malaria successfully with the tools and means available at present, much more applied research is required. As well as much more epidemiological research aimed at developing methods for applying the already available tools to the maximum advantage. This type of research should be basically a national responsibility but WHO should technically cooperate with interest governments of malarious countries in providing expertise, training for nationals, development of study protocols and in evaluating the results obtained.

4. VECTOR CONTROL RESEARCH AND MALARIA CONTROL*

Traditionally WHO has always given a great emphasis on the screening and evaluation of chemical pesticides and the development of safe and effective methods of chemical control of the vectors. This work is carried out in close cooperation with the industry and a large network of collaborating laboratories, PAHO/WHO field research units and national projects and involves seven consecutive stages of evaluation, the last one corresponding, in the case of pesticides for malaria control, to large scale operations and their epidemiological evaluation. Unfortunately since a few years the progress made in the screening and evaluation of new pesticides for residual house spraying has been very modest, for two main reasons. First, the industry is facing rapidly increasing research and development costs and is not keen to invest large sums of money for producing new pesticides which may not find a large market, and malaria control does not constitute a large market. Second, WHO has no longer the resources needed to carry out large scale evaluations.

As far as chemicals for residual applications within houses are concerned, we have a few candidates up to stage IV (which is that of evaluation in specially built houses with exit traps) and only one outstandingly promising, one relatively new pyrethroid which is extremely effective and might be used in very low dosages, its safety margin for mammals is being investigated.

In the field of chemical larvicides the situation is much better. There are already many conventional insecticides available for that purpose and their number is steadily increasing while considerable improvements are possible in the field of formulations, to reduce the risk for non-target organisms, extend the period of effectiveness, decrease hazards for operators, etc. Furthermore, two insect growth regulators are being marketed and new chemicals of this category will certainly follow, with a very large safety margin for vertebrates and most non-target organisms.

In the field of biological control through the massive application of microorganisms the investigations have been at a standstill for a long time. Attention has been focussed on half a dozen microorganisms, although their limitations are recognized. They will mostly act as larvicides, will kill Anopheles larvae much more slowly than chemical larvicides, and will probably not be more persistent than chemical larvicides. Priority is given at present to safety investigations, but a great attention will be given also to strain preservation, mass production, storage and formulation problems, etc., and this is a matter of a few years.

Since a few years a greater attention has been given to fish, resuming thus studies almost entirely abandoned a quarter of century ago. Among the many species quoted in the literature Gambusia affinis is the only one of proven effectiveness under most operational conditions although the epidemiological evaluation of its impact on malaria transmission has been made only in a few instances.

*Based on Working Document RM/4: "Vector control research and malaria control", by Dr. Jacques Hamon, Director, Division of Vector Biology and Control, WHO, Geneva, Switzerland.

Limited attempts have been made to use nature larvivorous fish for malaria control, with very limited success. One of the main difficulties usually encountered is the fact that most fish species have their population dynamics regulated by strong density-dependent mechanisms. It is thus difficult to mass produce them and maintain in nature densities high enough to ensure a good control of the larvae of malaria vectors. Such studies should nevertheless be encouraged wherever possible as nature fish are less environmentally objectionable than Gambusia affinis in countries where the latter has not yet been introduced.

Genetic control of malaria vectors has received a very limited attention from WHO, due to the limitation of the Organization's resources. Despite a generous assistance of the U.S. Government during several years the studies carried out or assisted by WHO have rarely reached the stage of very modest field trials and the results were not very encouraging.

Studies on vector species complexes and vector malaria parasite relationships have rather well progressed since a few years. They are extremely useful to better interpret field observations but they rarely led by themselves to the development of better control methods.

Biological studies on vectors under insecticide attack, or under more normal conditions, have continued to be carried out in a number of countries whenever expertise and financial resources were available and some could contribute to rather large improvements of the control methods. The necessity of increasing such studies is now obvious.

Broadly speaking, it is doubtful that vector biology and control research will produce new tools which could change the trend of malaria control operations. A few new residual insecticides may appear on the market; many new larvicides could be developed; biological control agents will probably be substituted for chemical ones, or associated to them; in the future-- and in special instances genetic control, ULV application of insecticides from the ground or from the air, etc. could constitute useful complementary tools. Environmental control of vectors will certainly regain the importance that it had in the past. There is thus no doubt that the new strategy must be based on a better use of the existing tools, with redefined objectives.

Broadminded public health specialists are required and training must be expanded for the medical officers and other professionals needed. The situation is much more difficult for entomologists and, in a number of countries, for sanitary engineers as non medical university graduates have rarely the same career opportunities than MD's in the Ministry of Health and thus few bright people are attracted by such activities while much better opportunities are offered by universities, Ministry of Agriculture, Ministry of Public Works, etc. The team work required by the new strategy implies the training of good professional entomologists and sanitary engineers, fully aware of the general problems of vector biology and control, environment contamination, environment management, cost/effectiveness analysis, economics, etc. This implies also the existence of suitable career prospects for these specialists.

5. ORGANIZATION AND METHODS FOR OPTIMAL USE OF RESOURCES FOR MALARIA CONTROL*

The topic under discussion is of considerable importance since it focalizes the operational and administrative problems, and demands a high degree of pragmatism and rationality in the search for logistic and operational formulas to achieve the ideal cost-benefit mix.

Less ambitious programs for the combat and control of malaria, which nevertheless imply long operational time spans, also involve considerable expenditures since eradication is, in any case, their ultimate goal. These programs should work to ensure a steady reduction in the indices of transmission, without which they would otherwise reach a standstill and be rendered inoperative.

In the case of malaria, either there is investment, or there is stagnation and regression. This is not a quiescent disease, but rather a dynamic one involving high risks for unprotected populations, including those which are no longer immune, having lost contact with the parasites in the course of a once successful program which has regressed.

In areas which have already entered the phases of maintenance and consolidation, where activity is limited to epidemiological surveillance, the impact of malaria is no longer felt. Under these conditions, authorities will often exclude from their set of priorities, the financial resources which should be invested in this surveillance program. The aftermath of such a policy has been a disaster for more than one country.

In areas where the work is difficult and the success rate is low because of ecological, technical, or administrative problems, it becomes necessary to insist, sometimes impatiently, that the flow of resources be maintained. The impossibility of a prescheduled termination date for such programs does not justify abandoning the populations involved to the mercy of malaria-caused morbidity and mortality when the former can achieve a rate of 75-80%, destroying health and vitality, particularly of the younger age groups.

A program for the eradication or control of malaria, with good steady administrative and financial support, should, in the most difficult areas, accomplish the established objectives since it does not merely lower the incidence, but also restricts it to certain foci. On this point, there is consensus among all the malariologists.

* Based on Working Document RM/5: "Organization and methods for optimal use of resources for malaria control, by Dr. Ernani G. Fernandes da Motta, Superintendent, Superintendence of Health Campaigns, Ministry of Health, Brasilia, D.F., Brazil.

In those countries less endowed with financial resources, antimalaria programs which are individualized, autonomous, and costly, should perhaps be redesigned in view of the new administrative and financial realities, reworked to fit formulas capable of preserving the goals and the operational nature of the health sector.

Such a procedure accords with the highest decisions of the latest WHO and PAHO health conferences and congresses which moved to suggest that each program be adapted to existing national realities, with the selection of new priorities and the redistribution of resources so that the status of areas where operations are most difficult will not worsen and see their populations ravaged by hyperendemic malaria.

The Brazilian experience presents a wealth of lessons, acquired during long years of constant work in which different models were tested in the process of perfecting a methodology, reducing costs, and obtaining better results. Many mistakes were made before reaching a stage of maturity. We now feel that we have achieved a high quality model, part of which is already solidly rooted and part of which is still being implanted.

It contains an account of the history of malaria control in Brazil, which goes back more than 50 years. During the period various forms of organizational structures were adopted until the advent of DDT (1947) and the establishment of DNERU (National Department for the Control of Rural Endemic Diseases). As early as 1958 a National Malaria Campaign was set up within DNERU and in 1965 it was separated from DNERU and its status as an autonomous institution was recognized by law. Subsequently, SUCAM (Superintendency of Public Health Campaigns) was established by consolidating the various agencies responsible for endemic disease control.

The program for the eradication of malaria in Brazil altered its strategy after it was demonstrated that due to the difference in geographic, epidemiological, and socioeconomic characteristics, not all malarious areas responded in the same manner, nor with the same speed, to uniform measures of attack.

The area designated for short-term eradication, with 1.8 million square km., represents 26% of the country's malarious land area, and holds 34 million inhabitants corresponding to 79% of that region's total population. The area designated for long-term eradication has 5.1 million square km. and 9.1 million inhabitants, corresponding respectively to 74% and 21% of the totals for malarious regions in Brazil.

The new strategy was based on operational flexibility and diversification for the rationalization of actions taken in accordance with the epidemiological characteristics of each area with a view to the intensification, refinement and complementation of measures of attack and of the activities involved in epidemiological surveillance, so as to facilitate and to consolidate the achievement of the final objective.

As a result of the aforementioned rationalization of operations, based on epidemiological criteria, resources have been freed for use in other SUCAM activities with no harm to antimalaria programs.

In the areas under surveillance, there is a population of 32 million inhabitants representing 72% of the total in the nation's malarious areas. Population in the areas within the attack phase is 12.7 million inhabitants, or 28% of the total.

The principal malaria foci are found in Amazonia which contributed 89% of the cases recorded in 1976 for the entire country.

The participation of malaria personnel in other health programs and activities of interest to the Government began in the Amazon River Region.

In the second half of 1970, the smallpox eradication program used the malaria structure to vaccinate all of the inhabitants of the Amazon Region.

In 1970, the same personnel participated in the "General Census of Brazil" by means of the epidemiological surveillance units. Thus, in a short period, a poll was taken of the population in most of the interior of the Amazon Region, precisely in the areas which were most difficult to reach.

In the campaign against meningococcal meningitis (1975) mass immunization of the population of Brazil was begun because of the existence of an expanding epidemic situation in the country.

The program was completely successful and before the anticipated period (10 months) more than 80 million people had been vaccinated (bivalent A + C vaccine).

The technical and operational basis of the current program against Chagas disease were revised in 1975. The experiences of the malaria program were used as a basis for the revision.

In the areas where the two diseases existed simultaneously, alternate cycles of DDT and BHC were applied by the field workers. After the second year of activities (1976) these programs covered 60% of the disease area, an extent which had not been reached previously.

The appearance of foci of cutaneous and muco-cutaneous leishmaniasis along the coast of Northeastern Brazil (1975 - 1976) resulted in the mobilization of SUCAM personnel in this area with previous experience in the malaria campaign. These people will be used to combat the vectors through the spraying of houses.

Onchocerciasis is a recent discovery in Brazil. SUCAM has been coordinating research activities (1975 - 1976) which are being developed with the participation of scientists from other institutions.

The malaria entomology personnel are preparing to carry out field work related to other diseases (Chagas disease, schistosomiasis, leishmaniasis).

The National Division of Sanitary Dermatology promoted intensive training of field personnel between spraying cycles for the recording of leprosy cases. At first, personnel from the Amazon River Region units, who have been doing the recording for several years, were trained.

In view of the small number of units in the general health services network and the widely scattered population in the interior of the Amazon Region, the survey of birth and death rates is still quite insufficient. In an attempt to collect this information, SUCAM has now surveyed most of the cities in the States of Amazonas and Pará.

During a work cycle, SUCAM, in cooperation with the Ministry of Agriculture, carried out a census of rural areas in the Amazon River Region. This was also done in conjunction with the schedules of the spraying teams: A similar project was developed to aid the Ministry of Education and Culture in determining the condition of schools in the interior of the Amazon Region.

More recently, SUCAM has participated in PIASS (Program for Development of Primary Health Services in the Hinterland) coordinated by the Ministry of Health. The purpose of this program is to provide localities with up to 20,000 inhabitants with a network of simplified health units.

In conclusion, integrating programs for combating serious endemic diseases into a single structure is both viable and feasible, and constitutes an excellent and encouraging method for more effective utilization and rationalization of resources in the struggle against malaria.

6. COVERAGE OF RURAL AREAS BY GENERAL HEALTH SERVICES AND THEIR RELATIONS WITH ANTI-MALARIA PROGRAMS*

The extension of the coverage of medical care services is neither new nor recent.

What is recent, new and of major importance in this process of expanding medical care coverage is the explicit recognition that it will not be possible to satisfy health care needs through university-trained physicians, as well as the recognition, also explicit, that, in these circumstances, auxiliary personnel can perform the basic medical tasks of diagnosing and treating a limited number of diseases that are prevalent among, and cause the most harm to, non-urban communities. This express recognition has been worldwide, since it is present, not only in most, if not all, of the developing countries, but also, to some extent, in the developed countries; and not only by Ministries of Health and Governments, but also by private professional institutions and associations.

The organizational patterns the countries have developed vary, and range from the use of "paramedics" who have two or three years of study after high school to "barefoot doctors" appointed by the communities from among their members who divided their time between their productive work and their medical work, who have no formal training and are allowed great leeway in their therapy. Each pattern of organization and each type of personnel is probably valid for their own way of life, their own culture, and their political system.

Besides the operational objective of providing the underserved communities with access to medical care, there has been a change over time in the very purpose of this program and the functions of its agents.

In view of the primary need for relief and treatment of disease in order to prevent suffering, disability and death, in places where there are no doctors, the solution found has been "simplified medicine" (as it is called in Venezuela) which is nevertheless comprehensive medicine in that preventive and curative activities are carried on in parallel and the development of the community is an essential part of the preservation of health.

The result is that the agent of the primary medical care program is becoming a multidisciplinary agent of change and development and ceasing to be merely the helper of someone who is suffering.

He ceases to be what the poor expect of him and seek to obtain from him and becomes a person with many functions, some of which are so distant from the felt needs of the community that they only reflect a grandiose (because of the many things it covers) theory which claims that the old law of the division of labor is no longer functional.

*Based on Working Document RM/6. "Coverage of rural areas by general health services and their relations with anti-malaria programs," by Dr. Rogelio Valladares, Chief, International Health, Ministry of Health and Social Welfare, Caracas, Venezuela.

In accordance with these various organizational patterns, objectives and functions, many (if not all) countries in the Region of the Americas are endeavoring to provide the so far unserved population with minimum health services. But what are the real facts? What is, after all, the theoretical coverage that has been achieved with all this network on levels of health services in our countries?

We must also recognize that there are areas and communities whose ecological, social and cultural conditions are obstacles to the development of any kind of health structure and for which different organizational patterns will have to be used.

On more than one occasion, the delegation of responsibility for certain malaria activities to the general health services available in a particular area has been studied and put into practice. This arrangement worked and is working regularly and efficiently and also has the advantage of bringing malariologists, isolated in their specificity and the officials of the general health services, diluted in their "generality," into direct contact with one another.

The Ninth Report of the WHO Expert Committee contains a very good definition of what is meant by "health infrastructure" or network of peripheral centers manned by auxiliary personnel whose functions are described extremely well in paragraph 2.2.6 of that report. In Section 2.2, "Health infrastructure," we find all the essential elements for establishing effective coordination of malaria activities with those of the general health services in rural areas.

With the exception of vector control proper, especially spraying operations that call for meticulous work in planning and execution within the framework of pre-established timetables and geographical itineraries, it is admitted that the general services must participate in other activities, and especially in the consolidation and attack phases.

In the Americas, the participants in the seminars on the Role of the General Health Services in Malaria Eradication (1964 and 1965), despite the effort to appear to accept that these services have an important role to play (and sometimes a definite role as in the maintenance phase), show themselves to be very "verticalist" and "eradicationist;" the report reflects a lack of trust in what the general health services could efficiently do in malaria eradication programs.

The author brought to the attention of the Group a number of questions which reflected the subject under consideration, such as:

- The important role that general health services can and must play in malaria control or eradication programs.
- The present constraints on coverage of primary health care services.

- The fact that coordination and cooperation between malaria services and primary health care services have not received from either of the two parties the necessary stimulus.
- The cost of keeping specialized personnel exclusively devoted to malaria as a way of maintaining the control or eradication of this disease, which is difficult to justify.
- The need to study the local problem in each malarious area in order to define strategies and to determine the functions of personnel.
- The fact that cooperation, coordination, responsibility and "esprit de corps" will not operate effectively at the local level unless it is an expression of similar activities at the higher levels of the Ministries of Health.
- The priority needed in the planning and operation of primary health care services to ensure total coverage of the rural population.
- Where no infrastructure exists and its early establishment is unlikely, the installation of special systems for the penetration of remote geographical areas, or areas in which access is difficult for cultural reasons, may serve as a basis for the future expansion of the health infrastructure. In these cases, however, the system of penetration must not be directed towards the solution of a single health problem but cover those problems which, in addition to being priorities because of the harm they cause to the population, are responsive to the measures available for dealing with them.

B. SYNTHESIS OF DISCUSSIONS

The highlights of the discussions on each topic are presented herewith, in the understanding that they represent opinions expressed by members of the Group, and that they do not necessarily imply a consensus of the Group as a whole.

The presentations made by the speakers who introduced the topics and the discussions that followed, were the basis for the general recommendations, which were unanimously adopted.

1. Analysis of Present Malaria Situation in the Region

The quality of the available epidemiological data, concerning morbidity and mortality was analyzed. In malaria eradication programs, epidemiological information is obtained by both active and passive case detection, supplemented by epidemiological surveys.

The data collected are sufficient for determining the distribution of malaria cases, and the origin of the infections. It was recognized that the present evaluation system is not designed to reveal the severity of malaria. High morbidity is not necessarily accompanied by a high mortality, although in some areas high mortality was recorded during the epidemics caused by a chloroquine-resistant strain of P. falciparum. The problem of early interruption of anti-malaria activities and the problems associated with under-financing of the program were discussed.

A recent example was given of a country where a political decision was taken to suspend malaria activities and, as a result, a serious epidemic occurred.

The relative importance of the problems faced by the malaria programs were analyzed. Technical problems are obstacles in some programs but they may be regarded as of secondary importance. Vector resistance to insecticides and parasite resistance to antimalaria drugs are indeed problems but they are not widespread and are not extending rapidly. Although malaria budgets have been increased, the increases have been more than off-set by escalating insecticide and drug prices and operating costs. Financial support is essential but by itself it can not solve the mosaic of problems.

Attention was called to the decrease in DDT consumption by the malaria programs during the last five years. In 1972, a total of 7,754 metric tons of DDT (100% equivalent) were used by the programs, while in 1976 only 4,249 were applied. Several reasons for this decrease were mentioned, mainly higher prices, the need to use local currencies to buy imported materials after UNICEF and other granting agencies discontinued their support to the programs; change of insecticides due to resistance of the vectors to DDT; reduction of areas of spraying based on epidemiological reasons.

There was general agreement that the crucial problem was that of the political decision, which must be considered the key factor in the success of a program. As regards financial support, while there are countries that need more funds, if they are to carry out an effective malaria program, there is also a recognized need for a better utilization of funds on the basis of epidemiological criteria.

The group stressed that in order to apply the new strategy, which requires flexibility in using all available control methods in accordance with local epidemiological conditions and resources, more technical staff are needed. In some cases the problems can not be solved with the available methods. Further research, especially operational research is required.

It was recognized that in order to meet the requirements of the new anti-malaria programs, both in terms of operational staff and research workers, it is essential to place greater emphasis in the training of new personnel as well as in the reorientation of the present staff.

It was mentioned that the ecological approach to malaria control, as a part of a more comprehensive program or programs aiming at diseases sharing similar epidemiological characteristics would give the anti-malarial effort more acceptability.

The need involve the community more effectively, a matter that appears to have been neglected, was also stressed.

The malaria situation appears to have been stable in the recent years, if the Region is taken as a whole. Malaria incidence rises in some countries and decreases in others, and the total number of cases varies very little from one year to another. It is foreseen that in many areas malaria control will have to be pursued for many years to come, in order to reduce malaria incidence to a low level and thus permit social and economic development must be continued.

2. The cost of malaria and of its control in relation to socioeconomic realities

During the second working session, the fact that any health program needs a yardstick to measure the degree of success in relation to well-defined targets was emphasized. A number of attempts have been made to quantify the direct and indirect adverse effects of malaria on socioeconomic development, through decrease of morbidity and mortality, but the true scope of health economics is much broader than that. The difficulties of assessing these effects in terms of monetary units are enormous.

Several parameters were mentioned to measure the cost of malaria and of its control, recognizing that all of them have a relative value, as Dr. Bruce Chwatt had mentioned in his report. It was stressed, however, that despite their shortcomings the findings of these studies were very important to economists and health planners alike.

Taking the matter of agricultural losses such as those suffered recently in Sri Lanka, as an example, the difficulties to measure the impact of malaria versus meteorological phenomena (dry weather) as the causes for those losses were mentioned. To what extent each cause played a role?

None of the participants would attempt to place a dollar value to human lives; for instance, how much would 80,000 deaths, recorded in Sri Lanka in 1934-35 as due to malaria, be worth to that country? We do not know.

The group then turned its attention to the analysis of the problem in terms of the community and the health services to be provided. If all malaria control activities were interrupted in areas where transmission of the disease still exists, there would be an expansion of the endemicity and morbidity due to malaria, and the cost of treating the disease would rise substantially.

During the discussion, reference was made to the need of a health infrastructure to carry out preventive and curative measures. However, in many cases the malaria program planners set up a program which was far more advanced than the general public health program, to the extent that there is a gap, and whenever there is a need for support of the malaria program, the general health services were not prepared to do so, a fact that explained some of the problems we are now facing, particularly in rural areas.

In relation to the above, it was mentioned that the malaria program has indeed had a long-range plan, but this was a "single purpose" program, while the general health planners had to address themselves to the health picture as a whole. Besides, in the past the malaria program lacked the flexibility of adapting its strategy to changing epidemiological situations, a matter which is now being attempted to be solved. Another problem for the health services is the adoption of priorities, with targets which are often difficult to measure except by negative indicators. The health planner has

to apply the available resources in those areas where better results are expected, in terms of cost/benefits, which might explain the existence of the so called "gap" between the development of the health services and the penetration of a "single purpose" program.

Several examples were mentioned in relation to the cost of malaria and of its control: India, Indonesia, Mexico, Sri Lanka, Paraguay, about which Dr. Bruce Chwatt provided specific figures.

3. Recent advances in malaria research and prospects for the near future

In the discussion an attempt was made to try to predict the time lapse needed for the development of a malaria vaccine for field application. Although it remains a subject of mere speculation whether a lapse of 5-10 years or 10-15 years could be expected, predictions have progressively become more optimistic as new discoveries have been made on the immunogenic capacity of different parasite forms and "in vitro" cultivation of parasites.

The question whether insecticides should remain the principal tool enabling the interruption of malaria transmission was explored in comparison with classical source reduction methods. It was indicated that due to the dynamics of malaria transmission, the reduction of longevity obtainable by insecticides shows a greater capability of interrupting transmission than the mere reduction in densities. It was also expressed that control of malaria should be based on insecticides + source reduction (with community participation) + chemotherapy.

The question was posed whether it could be possible to prevail upon the great drug manufacturing companies to devote more effort to the development of new antimalarials. The group was informed that the drug companies may be receptive for a joint approach by pharmaceutical manufacturing associations for the development of new antimalarials which may not show the economical incentives needed to interest individual manufacturers.

A concern was expressed about the gap that exists in the field of malaria control, as in other public health activities between the impressive effort devoted to basic research and the operational application of the acquired knowledge. The need for each individual country to study the possibilities of an early application of the results of current research, was recognized. It was also mentioned that most countries are in a position to carry out operational research, and that they should be encouraged and supported to do so, particularly for the purposes of developing new methods as alternatives or complements to insecticides.

4. Organization and methods for optimal use of resources for malaria control

It was agreed that the Brazilian experience presents a wealth of lessons, acquired during long years of constant work in which different models were tested in the process of perfecting a methodology, reducing costs and obtaining better results.

The new "multipurpose" institution was referred to as a useful compromise between the previous monolithic structure and a horizontal organization covering the health needs of a community. Doubts were expressed, however, as to the possible ill effects on the specific programs due to the loss of specialization and as to the problems involved in adopting priorities for action.

Dr. Motta explained that in the case of Brazil there are five major regions each with their own problems, and that priorities are selected based on local needs, which included the addition of new activities or in some instances even the suspension of old ones when the specific targets have been reached; these changes demanded retraining of personnel, but on the other hand avoided the social problem that would arise if the professional staff and field personnel, once completed a task, had to be dismissed from the job. This, of course, implied certain conditions in terms of management. For instance, a health field worker is appointed as an "auxiliary health agent" whether he is assigned to malaria, *A. aegypti* or onchocerciasis control programs. The same can be said about the doctors, who are appointed as "Public Health Physicians" and then assigned to the areas where their services are most needed.

It was noted that SUCAM in Brazil was very effective in carrying out attack measures connected with malaria control and a wide range of other endemic diseases, but many rural areas lacked the necessary horizontal structure to continue consolidation and maintenance activities, to the extent that very often SUCAM itself had to provide these services in a semipermanent basis.

Mention was also made to another country in South America, where the population covered by health services exceeds 70% of the total population of the country, but the malaria program carries out its activities as a vertical program without the support of the general health services. Differences in resources were also stressed. It was recognized that the model presented by Dr. Motta, is giving excellent dividends in Brazil.

One could not lose sight of the fact that the Government of Brazil has assigned a good portion of the health budget of the control of endemic diseases and that this is a substantial amount, even for a country the size of Brazil. No doubt this decision was linked to overall development plans, which can be different from one country to another.

5. Coverage of rural areas by general health services and their relations with antimalaria programs

The Group recognized that in the planning of the health sector, high priority must be attached to malaria eradication or control programs and that Health Plans, in turn, must be part of National Development Plans.

Since most of the population of the malarious areas of the Americas live in rural areas, where health services are underdeveloped or consist solely of a basic health infrastructure ("primary health care") such specialized and general personnel as are available should be used. In relation to this matter, it was mentioned that in order to make use of the basic health infrastructure in malaria control activities, the guidelines set forth in the IX Report of WHO Expert Committee on Malaria (1962), should be followed.

In the Americas the malaria program has achieved a very good penetration of rural areas, where the health infrastructure is in the process of being developed. The Group highlighted the need to establish better coordination and cooperation between malaria and primary health care services and also expressed that the malaria program in the hinterland may serve as the basis for the expansion of the health infrastructure.

The principal function of the general health service is to provide accessible primary health care to the community. On the other hand, a vertical antimalaria service is to apply control measures and it requires coverage and an active penetration to the rural community. The organization of a mass campaign is justified during the attack phase, but the general health service should take over the epidemiological surveillance during the consolidation and maintenance phases.

The role of preventive and curative medicine was also discussed. It was mentioned, that while curative medicine is passive, reactive and based on medical science, prevention has to be active, anticipatory and based on economics, political, social and environmental sciences. There is no way in which prevention can compete for the use of funds with curative medicine if they are in the same service because of irresistible demand for treatment that illness exerts, often beyond the rational. It was also suggested during the discussions that the malaria control program be integrated with the services responsible for the economic development.

It is pointed out that each country should determine the best approach for the planning of its health services and antimalaria program with PAHO's participation within the spirit of technical cooperation.

C. GENERAL RECOMMENDATIONS

At the plenary session on April 14, the Group reviewed the draft recommendation presented by five sub-groups appointed by the Chairman, and adopted the following general recommendations, which were submitted to the Director, PASB/WHO on 15 April 1977, during the Closing Plenary Session.

1. Malaria, a disease affecting the performance of human beings, is still an important health problem in the Americas as well as in other tropical and subtropical areas of the world. Therefore, in the planning of the health sector, high priority must be attached to malaria control programs. Health plans, in turn, must be part of the National Development Plan, since the purpose of those plans is to protect man, who is the means and the end of economic and social development.
2. The malaria situation in the Americas remains serious. The comparative analysis of the progress of Malaria Programs indicates stagnation in several countries and therefore there is a grave risk of resurgence of the disease wherever control measures are relaxed.
3. The adverse impact of malaria morbidity on food production and on industrial expansion are well recognized and fully documented. Thus, the control of malaria must be expanded and made more effective especially in those areas which are included in the development plans, such as hydroelectric or irrigation projects and new human settlements.
4. The objective of a national malaria control program should be stated in terms of identifiable and measurable targets which should not be limited to the decrease of morbidity and mortality stated in general terms. The influence of better health on the improvement of labor output, decrease of expenses on curative medicine, school attendance, use of land that previously could not be cultivated, etc., may not be easily assessed, but these beneficial effects almost invariably follow in the wake of successful malaria control.
5. The Group recommends that the Governments should re-evaluate their respective malaria control programs on the basis of epidemiological data in well defined areas of their respective countries and with the understanding that these programs are often long-term enterprises. Moreover, some technical and financial conditions may impose the review of methods that have been used, in order to develop other possible alternatives.
6. The Group believes that the realistic planning of malaria control must be given high priority by governments, according to the technical, administrative and financial feasibility. There is need for an improvement of the institutional planning capability in each country to determine the degree, extension, speed, organizational pattern and financial implication of antimalaria programs.

7. If the country requires external financial assistance, PAHO should help the Government in obtaining it from whatever sources are available including bilateral and multilateral agencies. An important source may be financial institutions, such as the international banks. PAHO should assist the governments in preparing applications for such funds.
8. In view of the need to maintain interest on the part of Governments and international funding sources for support to malaria control programs and to be able to appraise, continuously, the contribution which such malaria control programs make socioeconomic development of populations and the productivity of man, encouragement should be given to methodologic research of the benefit component of a benefit/cost analysis of the program.
9. The price of malaria control programs has greatly increased during the past few years following the oil crisis and general inflationary trends. While this cost is relatively low, when compared with many environmental health expenditures of developed countries it is high when measured against the budgeted per capita health expenditures of most of developing countries of this Region.

There is need for higher per capita expenditures on malaria within the national health budget; this can be done by increasing the proportion of the health budget of most of the tropical developing countries of the Americas where this proportion is extremely low varying between 0.1% to 1.7% of the gross national product.

10. The Group feels that higher priority should be given to developing improved combinations of methods for malaria control in areas with most difficult problems. Research on combined methods should be focused on field studies in the areas concerned.
11. Special attention should be directed toward determining appropriate use of various control methods, as alternatives or complements to residual insecticides, in different environmental and epidemiological conditions. These methods include: source reduction of the vector through use of water management, including draining and filling; antilarval measures including chemicals and larvivorous fish; mass chemopreventive-prophylactic therapy in selected populations; host protection, specifically including screening, repellants and use of nets.
12. In some countries with complex epidemiological factors requiring a radical change of the strategy and tactics of malaria control, the assignment of a multidisciplinary task-force for the study of appropriate control methods may be considered. The composition of such a task-force will be determined by a joint agreement between the countries concerned and PAHO/WHO Office.

13. Appropriate epidemiological and ecological studies should be developed to define more explicitly the key factors most susceptible to resolution or alleviation, especially in problem and development areas. Such factors include: drug resistance, emergence of secondary vectors and the bionomics of vectors.

Among other problems requiring proper studies one should include cost-effective methods of imogocides through space spraying, and new ways for community involvement and collaboration.

14. The Group recognizes that many fundamental research needs for the discovery of new scientific tools applicable to malaria control are included by the WHO Special Program for Research and Training in Tropical Diseases. However, the evaluation of new drugs and vaccine on humans requires special attention.
15. Training facilities should be extended and supported to develop necessary human resources including, particularly, epidemiologist, entomologists, environmental engineers, and auxiliary field personnel. This personnel should be provided with a broad enough training that would permit their utilization in other public health fields, thus ensuring stability and career prospects.
16. The integration of different specialized programs into a single administrative structure is a viable approach to solving health problems, and, therefore, the expansion of the malaria programs to incorporate the control of other vector-borne diseases and other well-defined diseases prevention programs should be considered, provided that sufficient resources are available and the necessary specific anti-malaria activities are not adversely affected.
17. The malaria control program activities themselves constitute a valuable source of information for many important health problems that cannot be revealed in the laboratory. The Group recommends that careful attention should be given to planning programs so that this resource may be more fully exploited. This calls for the application of rigorous techniques in evaluating research, based on epidemiological principles.
18. The Group recognizes the possibilities for improving malaria control activities provided that available resources are redistributed on the basis of epidemiological situation and that a more effective utilization of the general health services is obtained.
19. Since most of the population of the malarious areas of the Americas live in rural areas, where health services are absent or rudimentary, any specialized or general personnel that may be available should be used for malaria activities wherever possible.

20. The necessary infrastructure for ensuring coverage of the rural population and leading to the success of the health program must be available; thus top priority should be given to the planning of the operation and progressive expansion of these services in all the countries of the Region. This depends on the political will to accelerate the development of such services.

In order to make use of the basic health infrastructure in malaria control activities, the guidelines set forth in the IX Report of WHO Expert Committee on Malaria (1962), paragraph 2.2 "Health infrastructure" should be followed.

21. Because insufficient encouragement and support has been given to coordination and cooperation between malaria and primary health care services, the primary health services do not feel the same degree of responsibility towards malaria control as do the malaria control services. If both of these services are to feel equally responsible, joint programming of activities is essential. This will make the staff aware of responsibility to fulfill. To that end, cooperation, coordination and responsibility must be the reflection of a similar attitude at the higher levels of the Ministries of Health.
22. Where no health infrastructure exists and its early establishment is unlikely, the setting-up of special systems such as the malaria program for the penetration of areas to which access is difficult, may serve as a basis for the future expansion of the health infrastructure. In these cases, however, the system of penetration must not be directed towards the solution of a single health problem but cover those needs which, in addition to being priorities are responsive to the measures available for dealing with them.