DEVELOPMENT OF A CONTINENTAL PROGRAMME OF
APPLIED FIELD RESEARCH IN MALARIA
1. **Background**

The Continental Malaria Eradication Programme was officially launched in 1954 by the XIV Pan American Sanitary Conference, although since the 1940's various countries had already started and some had completed their eradication campaigns.

The early success of the programme was very impressive, but soon problems started to be recognized and efforts were made for their correction. Progress slowed down by the late sixties and during the seventies resurgence of malaria transmission occurred in several areas and new malarious areas appeared by opening virgin forest for agricultural colonization, has masked the progress made in other areas to give a consolidated picture of increasing malaria.

As the first problems were identified in the late fifties a classification was adopted in two categories, the first included operational, financial or administrative problems for which a solution was sought through technical collaboration and the promotion of external or internal support to the programme; the second category, or technical problems, included all those related to the epidemiological links in transmission, man, parasite or vector, which required a change in the design of the control strategy or in the attack measures applied; the solution of technical problems had to be sought through epidemiological studies or testing and evaluation of alternative attack measures.

Since 1960 AMRO has recognized applied field research as an important component of the regional malaria eradication programme, by sponsoring specific regional projects for research on problems of particular regional importance as the testing and evaluation of new insecticides, the study of insecticide resistance, and later the epidemiology and control of malaria in problem areas.
Since the beginning AMRO established a post of regional malaria research officer. During the first years it was considered that research was basically a regional activity, but as problems became more frequent and the need for developing diversified strategies became accepted, the PAHO ACMR and regional meetings such as the I Interamerican Symposium on Malaria Research in 1971, and the II Meeting of Directors of Malaria Eradication Services in 1975 encouraged governments to support research, oriented to the solution of field problems, as part of the normal activities of their antimalaria programmes.

2. Evolution of the Malaria Problem

The continental programme as a whole can claim as of 31 December 1978 to have eliminated the risk of malaria from areas inhabited by 106 million population and to have interrupted general malaria transmission in areas inhabited by 60 million, of a total population of 220 million of the originally malarious areas.

Continental data on malaria morbidity show steady increase in reported malaria cases as full coverage with case detection was being established up to 1967. This increase in case detection masked the impact of the antimalaria programme on malaria morbidity, which is later reflected in the decrease of morbidity indices from 1970 to 1974. Nevertheless since 1974 the general picture of the continent shows continuously deteriorating malaria morbidity figures, with case detection activities being maintained at a stable level. (Table 1)

This picture is even more disturbing when compared with the total costs of the continental antimalaria programme shown in Figure 1. The escalation during the last few years in the costs of insecticides, personnel, equipment, supplies and transport have seriously affected the capacity of the programmes to cope with the development of technical problems and the concentrations of resources needed for their solution. As shown in Figure 1, governments continue to give
3. Formulation of a new Hemispheric Plan for the Promotion and Support of Malaria Programmes

The XX Pan American Sanitary Conference examined this situation with great concern and recommended the development of a hemispheric-wide plan of action against malaria, stressing the need for intensification of training and research in order to reach such goal.

The III Meeting of Directors of National Malaria Eradication Services in Oaxtepec, Mexico in March 1979 made an in-depth evaluation of the continental programme and established the bases for the requested hemispheric plan which may be summarized as follows:

a) Stratification of the malaria problem based on physical, ecological, epidemiological, sociocultural and economic characteristics of the different areas as well as on the administrative and operational capabilities for conducting control measures.

b) Selection and application of antimalaria measures in accordance with the stratification of the problem, the revised priorities, and the resources of the programme which should be enhanced by a maximum collaboration with primary health care and engagement of community participation.

c) Mobilization of all possible additional financial resources, including:
   - intersectorial cooperation
   - technical cooperation among developing countries
   - external collaboration

d) Promotion, support and coordination of Applied Field Research

e) Development of human resources and training

This plan is conceived as a conjugation of different national plans designed in accordance with the local characteristics of each country, which should
formulate its own antimalaria strategy. PAHO should concentrate efforts in the promotion and support of these national plans and in the formulation of coordinated regional programmes for training and research.

4. Regional Programme for Malaria Research

As mentioned before the technical problems hampering the malaria eradication programme have been studied for the last twenty years. Expert Committees, Coordination and Technical Meetings and the PAHO Directing bodies have repeatedly encouraged governments, public institutions and international agencies to promote and support malaria research particularly that devoted to the development of better control measures or to the solution of field problems in malaria control.

Periodic analyses of problems show that in the last twenty years there has been some extension of the problem areas, an increase in recognition and a considerable intensification of the most important problems. Nevertheless the types of problem and their general distribution have changed little since they were first recognized.

The research recommendations referred to above were generally followed by proposals for coordination of research on a continental basis and PAHO has constantly promoted that active antimalaria programmes undertake the study of their field problems and their possible solutions including the testing and evaluation of new control measures. The Directors of Malaria Eradication Services made a recommendation in these terms in 1975 in Quito.

In spite of these recommendations the budget specifically devoted to malaria field research has not changed significantly in the last fifteen years, which is in sharp contrast with the nearly three-fold increase in the total cost of the continental malaria programme in the same period.

Even the UNDP/World Bank/WHO Special Programme for Research and Training which has its own funds is finding the Applied Field Research, the most difficult
area to implement, having noticed that submission of grants is developing very slowly and that the quality of the proposals is often below expected standards.

This is in sharp contrast with the awakening of interest in more basic fields of malaria research such as immunology and chemotherapy where the TDR Programme has had an enthusiastic response from the scientific world.

5. Possible Cause of Slow Development of Field Research

Without pretending to be comprehensive we are enumerating some of the factors which may have influenced this slow development, in order to avoid or correct them in future proposals for the promotion of field research.

5.1 Classification into technical and operational problems

This classification, and particularly its projection to classifying areas as "areas with technical problems" and the implication that technical problems should expect technical solutions and operational problems, administrative solutions is one of the main causes of the limited applicability of field research results in the past.

As a matter of fact problems are never purely technical or administrative and very often the cause of technical problems is operational and viceversa. In some areas the incapacity of the services to achieve total coverage with DDT in an opportune time was responsible for the maintenance of transmission up to the time when insecticide resistance was developed while the persistence of technical problems led to the demoralization of the service, confusion in goal identification, routinization and decrease of prestige and support.

The insistence in considering insecticide resistance simply as a technical problem has led this kind of programs to a chain of insecticide replacements with subsequent development of resistance to all of them, while in fact their real problem might not have been the loss of effectiveness of DDT, but the incapacity for establishing and maintaining adequate control operations for the required time.
As a contrast, other programs were able to eradicate malaria while resistance was being developed when the service was able to maintain spraying coverage and complement it with an effective vigilance and opportune focal treatment with chemotherapy or other measures.

Very often the operational problems are not related to an administrative incapacity of the service but to particularly difficult characteristics of the population, its habits or the terrain. These constitute the whole area of problems related to human ecology or other sociocultural factors, which have been considered borderline between technical and operational. They are also in the border area between research, epidemiological evaluation and planning, and so have often been forgotten by all.

5.2 Complete dependence from Malaria Eradication Services

Applied field research has been traditionally considered the responsibility of the antimalaria services, based on the idea that their concern with control was the best motivation to study the problems hampering it and to explore possible solutions. In spite of the truth of this assumption, it has been one of the main obstacles to properly planned and conducted field research.

Malaria eradication was originally planned as an operational programme and the demand for action has been so strong as to discourage careful studies forcing, instead, short term testing of whether or not a certain alternative could solve a particular problem, as soon as it was identified. Solutions were tested before a proper study of the problem and the need to choose prevented a proper evaluation of the causes of apparent successes, as well as of those of partial or total failure, without which it became impossible to define with detail the actual indications of potential attack measures. The concept of malaria eradication being achievable by the global application of a single measure created the illusion, which still persists in many malariologists, of the need to find an
alternative panacea, instead of looking for a better understanding of the problem and the potential use, and indications, of a whole range of possible control measures.

Moreover, due to a decline in their prestige during the last decade, antimalaria campaigns have failed to attract the young scientists necessary to replenish their cadres and are suffering of a chronic shortage of technical staff.

The general acceptance of the feasibility of success discouraged outside research institutions from embarking in malaria research, and the theoretical need for administrative independence of the programme led to a lack of cooperation with the general health service, and therefore with the epidemiological surveillance.

Since 1962 the directing bodies of the Organization have tried to promote closer collaboration between the malaria and the general health services. Many countries have developed good organizational models, but in some others the lack of collaboration has become more accentuated. This separation has further reduced the technical resources available for epidemiological studies and field research.

5.3 High Costs of Field Research

Detailed epidemiological studies and properly conducted evaluations of control interventions require a volume of activities, personnel and equipment, that is beyond the resources of most countries' research institutions. External resources for this purpose have also been limited.

Well organized field research programmes have been sponsored by WHO and recently by the TDR for some specific purposes like the testing and evaluation of insecticides, the study of malaria epidemiology in holoendemic areas, distribution and spread of *P. falciparum* resistance to antimalarial drugs. It might be possible to organize similar well coordinated programmes for other
high priority problems of global importance, but limitations of resources will not permit as many such programmes as may be considered necessary.

It is necessary to movilize and support the national capabilities for epidemiological studies and field research and to develop cooperative studies on a wide scale as the nature of the problem would require.

5.4 Lack of confidence in the Applicability of Research Results

The inability of providing the simple operational solution, which traditional malaria programmes were seeking, and the limitations in applicability of new attack measures, led to the development of a certain mistrust about the ability of research workers to provide solutions for field problems. Moreover there has been a natural tendency for malaria research to concentrate in those areas where control was least successful and transmission was persisting at high levels; this concentration included epidemiological research, testing and evaluation of new control measures or diagnostic procedures and also field collection of material for other kinds of laboratory research. A correlation could easily be established between the intensities of research attention and of the malaria problem, to such an extent that a causal relation was even suggested in some areas.

5.5 Lack of Adequate Epidemiological Knowledge

The assumed general applicability of the malaria eradication techniques set the global programme on a qualitative classification into malarious and non-malarious areas. The operational approach and the progressive attrition of technical staff, referred to above, did not permit the detailed epidemiological studies which would be needed to design a new strategy.

It is necessary to study more deeply the epidemiology of malaria in areas of colonization, with an adequate consideration of the ecological and sociocultural
factors, These factors also play a fundamental role in the malaria of temporary labour forces and the areas affected by them. Particularly important is also the study of the epidemiological repercussions of insecticide resistance of vectors and parasite resistance to drugs affecting different populations in different ecological conditions.

6. Development of a Research Programme Responsive to Control Problems and Needs

The malaria research programme should provide the knowledge needed to guide the formulation, evaluation and modification of the new plans of action. It is suggested that it should incorporate the following aspects:

6.1 Development of New Tools

The normal purpose of a research programme has been the development of new tools. There is no doubt that new tools are needed, this is, nevertheless, a slow process which is dependent of more basic laboratory research. The programme of applied field research should make operational as soon as possible the new tools developed for control or evaluation.

In the meantime, it is urgent to stop or revert the present tendency to deterioration in the malaria situation in the Americas. This has to be done with new locally developed strategies, making better use of available tools, as was postulated by the WHA in Boston in 1969. The last ten years have shown that there are important gaps in our knowledge which have not permitted this development. These gaps require investigation.

6.2 Methodology of Stratification

There is no doubt that if a detailed knowledge was available of the local factors responsible for maintaining malaria transmission, it would be possible to design an effective control strategy. The non availability of that precise knowledge, the conviction that any effective control will require actions in several fronts, with collaboration of the primary health care and participation of the community, and therefore the complexity of the causal factors which may have to be considered for intervention, indicate the need to develop methodologies for
stratification which could progressively incorporate new knowledge derived from epidemiological studies and evaluation of control activities.

6.3 Evaluation of the Possibility of Maintaining Control

Several antimalaria programmes in the Region have been able in the past to concentrate efforts, when malaria transmission acquired dramatic or epidemic proportions, to organize successful control operations, either with an effective insecticide or with a combination of control measures, but this effort could not be sustained long enough or widely enough to achieve eradication, either because of development of resistance or the inability to maintain the effort once the immediate effect was obtained. Control measures were withdrawn, malaria returning in a few years to precontrol levels or worse.

When evaluating potential antimalarial measures in the past, emphasis has always been placed on effectiveness. Emphasis today should be placed in the possibility of designing a control programme where gains could be sustained and progress steadily maintained even if only advancing at a slow pace. Very effective but short lived control measures will have much more limited applications.

6.4 Development of planning and control methodologies

These should be based on the stratification mentioned in 6.2 above and following an adaptive strategy, i.e. incorporating planning, control activities, complementary research and evaluation with a highly efficient system of feedback so that the programme may be corrected as new knowledge is developed. This type of methodologies, originally developed for environmental impact studies and management, may be the only solution to the planning of a programme based on the use of different partially effective measures with different feasible coverages, in different parts of an area, at different times, including various organizations and incorporating the participation of the community.

In order for the programme to be feasible it has to balance the resources devoted to increase our knowledge with those devoted to control, so that the
demand for short term control does not jeopardize the long term progress of the campaign.

7. Proposed Plan for the Promotion and Support of Applied Field Research on Malaria

As mentioned before this should be a fundamental component of the Continental Plan of Action against Malaria. To achieve this purpose a series of activities are contemplated for which the support of the ACMR is essential.

7.1 Promotion activities

These are needed at the level of Malaria Eradication Programmes, the Ministries of Health and Research Institutions inside and outside the malarious countries.

AMRO has been and continues promoting field research through its whole collaborative mechanisms with the National Malaria Eradication Programmes, including the PAHO country teams, regional research and advisory projects, particularly those specifically devoted to malaria research or vector biology and control, and through short term consultants, meetings, seminars or working groups.

Nevertheless, in order to overcome traditional constrains it would be necessary to promote the recognition of malaria research as a high priority within the general plan for biomedical research of all countries where malaria continues to be a serious public health problem.

The magnitude of the problem at the continental level deserves the high priority given by the ACMR. The ACMR may consider to guide and support the actual development of the continental plan.

The development of the TDR/FIELDMAL Programme on a global basis is providing a solid support for the regional programme, which should be more closely integrated with it to obtain an effective coordination with research in other regions or other related scientific disciplines. The forthcoming appointment of a regional
TDR officer will facilitate this coordination, as well as that of the developing malaria field research programme with the TDR training and institutional strengthening programmes.

It is necessary to conduct seminars on research methodology as well as the dissemination of knowledge on the resources available for support of research through the TDR and other agencies, as well as the proper design, execution and evaluation of field research, including the preparation of research grant requests. Such seminars may be shared with other WHO programmes such as General Epidemiology and Parasitology or Vector Biology and Control.

AMRO is reestablishing in the Central Office the post of malaria research officer. This full time staff member will help promoting contacts between the malaria eradication programme and research institutions, the establishment of firm collaborating ties between developing research institutions in endemic areas and those that may provide them with technological support, and the designation of a network of reference laboratories for backing up the field research efforts.

As mentioned before one of the principal constraints for the development of a field research programme is the scarcity of human resources. It is absolutely necessary to ensure the closest collaboration between the research and training programmes, so that resources are best utilized.

7.2 Selection of Priorities

The strategic plan for applied field malaria research, developed by the TDR/FIELDMAL, constitutes a very good guide for identifying interrelations among different areas of research, it may assist in the selection of research priorities; the latter should be based in an analysis of the main problems and the possible research lines for their solution, the strategic plan will guide in the identification of other areas which should be looked into, when planning field research projects in a certain line.
Priorities should be selected at the national level for national projects, with several countries sharing common problems collaborating or at least interchanging information on their research projects. Regional projects and/or regional coordination should be established for the investigation of problems of a widespread distribution or problems which, because of their extension or intensity, have acquired continental importance.

Research on these problems, at least on a regional basis, should not concentrate on finding direct simple solutions, but going deeper into the nature of the problem, find a solution which can be usefully applied for a long term benefit.

Research should concentrate on:

a) Study of the nature of the problems, their causative complexes, their ways of spreading and possible barriers to that spread, points of possible intervention and conditions for successful intervention.

b) Mode of action of available or new attack measures, defense mechanisms of the target (vector or parasite), dosage effect relationships, undesirable effects and ways of preventing or minimizing them, acceptability and cost factors.

c) Appropriate use and interpretation of new diagnostic techniques, and the influence of different evaluation methods on epidemiological and operational indicators and indices. Development, verification and improvement of interpretative models.

d) Sociocultural factors favoring transmission or its control, modifiable aspects of behaviour, possible modifications of control strategies to adapt to sociocultural patterns.

e) Operational research on the methodologies for developing adaptive strategies for control.
f) Prevention and Control of malaria in areas of sudden economic development, colonization, building of large hydroelectric projects, roads, etc.

7.3 Setting up of a Coordinating Mechanism.

The programme should be periodically reviewed by a board including scientists and administrators linked to the ACMR and the TDR. This board should help the PAHO and TDR officers responsible for the programme, to establish and maintain the necessary relations with the scientific community as well as to channel ideas from scientists to field testing or utilization.

The programme should establish a system of consolidation, evaluation and distribution of information, and promote and assist in the selection and distribution of important observations made by routine operational programmes.

It is essential to reestablish the fruitful relations and mutual fertilization between scientists and public health administrators which guided the development of malaria control methodologies during the first two thirds of the already centenarian discipline of malariology.
Table 1
MALARIA MORBIDITY IN THE AMERICAS
1958-1977

<table>
<thead>
<tr>
<th>Year</th>
<th>Population</th>
<th>Total malarious area</th>
<th>Blood Slides</th>
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<td></td>
<td>Total Country</td>
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<td>387 276</td>
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