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Evaluates the possiblity of a single environmental assessment (EA) to anticipate the potential environmental impact of many Malaria control programs. If a universal EA can be prepared for all Malaria programs, much time can be saved and funds currently set to assess environmental impacts could be expended directly on control activities. In the course of this evaluation, much of the basic Malaria literature was reviewed and specialists were consulted in Washington, the Center for Disease Control in Atlanta, and other places. Several documents related to Malaria projects and the EA of the Sri Lanka Malaria control project were studied. Three conceptual principles are basic to the development of A.I.D. environmental policy with respect to Malaria programs: environmental uniqueness; transferability of information about selected environmental impacts; and monitoring as a means to achieve project continuity and feedback. The main body of the report describes the Malaria control project in Pakistan, the applicability of the Sri Landa EA for the Pakistan project and also presents a series of recommendations for future environmental policy.

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Recommendations on Procedures for Environmental Assessment of Malaria Control Programs

with special reference to

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Clark University
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Recommendations on Procedures for Environmental Assessment of Malaria Control Programs with special reference to Pakistan

April, 1978

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ABSTRACT

This report addresses one basic question: "Is it possible for a single environmental assessment (EA) to anticipate the potential environmental impact of many Malaria control programs?" The concept is intriguing. If a universal EA can be prepared for all Malaria programs, much time can be saved. Moreover, funds currently set to assess environmental impacts could be expended directly on Malaria control activities. To come to our recommendations on this question, we have read much of the basic Malaria literature; talked with specialists in Washington, Atlanta (Center for Disease Control), and other places (see Appendix D for a longer listing); examined several documents related to Malaria projects, especially in Pakistan (see Appendix F); and read the environmental assessment prepared for a Sri Lanka Malaria control project.

These analyses have led us to identify three conceptual principles which we see as basic to the development of AID environmental policy with respect to Malaria programs in Pakistan and other parts of the world. These three working concepts are: (1) environmental uniqueness; (2) transferability of information about selected environmental impacts; and (3) monitoring as a means to achieve project continuity and feedback.

1. Environmental Uniqueness. Every Malaria control program interacts within the context of a unique social and physical setting. Assessments of the impact of each project must be made in terms of these unique characteristics. We do not recommend a universal Malaria program environmental assessment.

2. Transferability. In spite of local environmental uniqueness, there are a number of elements in environmental assessment which are common to many Malaria projects. These common elements can be incorporated into operating manuals which can be used to guide project managers and to assist EA teams.

3. Monitoring. Even with excellent environmental assessments and well prepared operating manuals, AID's current procedures do not assure that potential problems will be followed throughout the full life of the project. Thus, our third operating principle is that assurance of environmental quality must involve the continuing monitoring mechanism as an integral part of every Malaria control project.

The main body of our report describes the Malaria control project in Pakistan, the applicability of the Sri Lanka environmental assessment for the Pakistan project and also presents a series of recommendations for future environmental policy. A series of appendices, as noted in the Appendix Table of Contents, follow the report.

ENVIRONMENTAL ASSESSMENT OF A MALARIA CONTROL PROJECT IN PAKISTAN AND IMPLICATIONS FOR OTHER PROGRAMS

I. Introduction

The purpose of this report is first to assess the current situation with regard to environmental assessment of the Malaria Control Program in Pakistan. An initial outcome of such an assessment would naturally be recommendations on how to proceed with meeting and monitoring environmentally sound project parameters with regard to malaria control in Pakistan. In making such recommendations, the authors were asked to consider carefully the implications for Pakistan of a comprehensive environmental assessment of a malaria control program in Sri Lanka (Gerberg, 1977).

The second purpose of the study was to examine the broader issues related to malaria control programs and to make recommendations about ways in which good environmental assessment could be made without unnecessary overlap and duplication of studies and reports.

In attempting to meet these and other subsidiary objectives, the report first reviews the Pakistan situation, goes on to analyze the Sri Lanka environmental assessment, and finally makes recommendations for both Pakistan and other malaria control projects. A summary of these recommendations follows:

1. Transferability of Environmental Assessments to Other Projects

We recommend against a policy which would enable one environmental assessment to cover all malaria control projects. Instead, we recommend a process which will identify those variables which are transferable from one project to another as well as procedures which will identify environmental variables which are not transferable.

2. User Guide for Malaria Control Projects

We recommend that a manual be developed for project managers which will identify factors common to most malaria control projects and how to deal with them. For consideration of these variables, we do not anticipate need for detailed environmental assessment.

3. Non-transferable Factors

We recommend that environmental assessment be conducted on those factors which are unique to a specific social or physical environment.

4. Monitoring

We recommend that structures be set in place which will permit a continuing assessment of interaction between project activities and their environmental impact.

5. Selectivity and Restraint

We recommend a policy of minimal use of insecticides in order to reduce likelihood of insecticide resistant species emerging.

6. Institution and Network Building

We recommend mechanisms whereby local institutions will be strengthened in participating countries as well as links developed between several host countries which have malaria control programs underway.

7. Broader Based Environmental Assessments

We recommend that environmental assessments look beyond specific malaria control projects in an effort to integrate and coordinate a much broader base of environmental interaction directly into environmental assessments.

8. Composition of Environmental Assessment Teams

We recommend that malaria control environmental assessment teams consist of combinations of expertise in epidemiology, health, ecology, entomology, pesticide impact, and physical and social information about the region in question.

9. Training

We recommend that existing training activities be broadened to include several of the above recommendations as well as specific new training efforts organized.

II. Malaria Control Project in Pakistan

A. The Malaria Control Program

In the 1950's and 1960's, policy makers thought it possible to eradicate malaria from most tropical countries within a comparatively short time. The W.H.O. and other authorities proceded on that assumption and set up malaria eradication programs in a number of countries. Residual insecticide spraying and other technology was available. If properly mobilized, it was thought, the disease could be eliminated.

In Pakistan, the program began in 1961 with a goal of total eradication by 1975. By 1967 it seemed that the battle was almost won: recorded cases of malaria

had dropped from 7 million to 9,500 and eradication did seem around the corner.

Since then, however, malaria has again reached epidemic levels and in 1974 Pakistan recorded about 10 million cases. The disease had not even been controlled much less eradicated and a new start was needed. A fundamental cause of this failure appeared to be that the malarial programs had not been incorporated into the national health systems and were not maintained once external support ceased. Another problem was that programs did not include urban areas which became centers for reinfection of the countryside. The GOP now places high priority on malaria control. AID had contributed over $28 million to the first program and became involved in a newly designed malaria-control program in 1974-1975. The new program objective was to reach a level of no more than 40,000 cases of malaria in a population of 80 million people by the year 1980.

B. Control Techniques and Program Components

There are eight aspects of the Pakistan control program:

1. Interior spraying by periodic spraying of inside walls of rural homes with one of DDT, malathion, and benzene hexachloride (BHC);

2. Exterior vector control, especially in urban areas, by application of oil, larvicides draining,and infilling low areas, and introduction of larvivorous fish;

3. Case detection through both visits to dwellers and by checks on fever cases at health centers and hospitals;

4. Case treatment by radcal treatment to eliminate the parasite completely from individuals with malaria;

5. Evaluation of program effectiveness on a continuous basis;

6. Research, both basic and applied, including studies on susceptibility to the insecticide and vector source reduction through improved water management among others;

7. Training of malaria workers, both in-service and new personnel;

8. Health Education to improve general knowledge of malaria causes and prevention.

C. The Environmental Assessment of the Pakistan Program

As part of the initial project document (AID/DLC/P-2073), there was a five page annex entitled "Environmental Assessment." Although this EA was prepared before current AID procedures came into effect, it contains much helpful information. This document (Annex G) is reproduced as Appendix G of this report.

The Pakistan E.A. focused on the spraying program emphasizing:

> "The potential environmental hazards from a malaria control program are limited to the storage, handling, and application of chemical insecticides and to effects of the slow biodegradability of some of these insecticides and their consequent ecological magnification in food chain organisms."

Of the three insecticides to be used, DDT was recognized as open to criticism, BHC was not as persistent as DDT, while Malathion "is considered a safe insecticide for mass spraying campaigns if normal precautions are observed."

The assessment also quotes the WHO director's 1971 statement supporting the use of DDT for malaria programs, and states that although there was little perceived risk from the use of DDT, vector resistance has made other insecticides more important. As these insecticides are more easily degradable, this makes the risk of their use even lower.

It recognized risks to sprayers but calculated they would be low.

> "Thus we may conclude that the risks involved from the use of chemical insecticides in the proposed Malaria Control Program will be low and will decrease even further with the shift from DDT to Malathion."

The assessment commented on urban area operations focusing on larvivorous fish introduction and suggesting experimental work before introduction.

The assessment rejected possible alternative control methods because they were not available at present and the consequences of any substantial delay were thought to be disasterous. It concluded:

> "The net effect of the proposed Pakistan Malaria Control Program on human health and the environment and in the broad sense, is positive. Any possible risks are greatly outweighed by the benefits arising from properly controlled use of insecticides in the program."

D. Program Developments 1975-1977

The program did not get fully underway until 1976. Because of shortages of both insecticides and sprayers, spraying did not start until June, 1976. Within the first two weeks of spray operations, five workers and related people died and many others became ill. Because it was thought that Malathion was less toxic than DDT, no special precautions or hygenic measures were instituted for the sprayers. Investigations by WHO and CDC concluded that Malathion supplied by two Italian companies (Snia Viscosa and Rumianca) was considerably more toxic than that supplied by Cyanamid (a U.S. company). The report linked the Italian material with all the deaths and most of the other illnesses. New safety recommendations were made.

Despite these considerable problems, 75% of the rural areas were sprayed in 1976 and recorded malaria cases

dropped 40%. In 1977, delays in shipment of materials and training in new safety procedures again led to late spraying but once more approximately 75% of the rural areas were expected to be covered. In 1978, plans are for a full spraying program with safety procedures in place. Provincial malarial organizations are in place except in Punjab.

With the need for additional funding, the project falls under the current AID procedures which prescribe for an IEE and possibly an EA. Hence, the question at this time is the need for additional environmental examination in the light of past studies and the Sri Lanka report.

E. Investigations and Reports on the Current Program

As a result of fatalities and illness, a number of investigations were made and reports presented. The documents (or excerpts from them) are included as Appendix A. They are:

Malathion Intoxication in Spray Workers in the Pakistan Malaria Control Program (CDC, 1977)

Safe and Effective Malathion Spraying Against Malaria in Pakistan, Robert Davis, 12 Aug. '77

Malaria Control Project: Final Report on Evaluation and Redesign of the Project, Walter S. Shurkin, 16 Oct. '77

Report of Malaria External Review Team, 1-20 Dec. '75

Malaria Control Project, A memo of 31 May, '77 by Dr. Edward Baker, CDC.

These reports all deal with the problem of toxicity of malathion, risk to sprayers, and safety and training precautions needed to reduce the risks involved.

It is clear from the documents that a great deal of time and effort has gone into a solution of this problem. Given the continuation of the strict safety measures and the improvement of detailed operations in some areas, it is clear that major steps have been taken to reduce this specific but vital problem. It is also clear from the documents that a very tight system of control is needed from shipment, to dock, and to transhipment, to village stores to spraying. There are clearly many points of concern in maintaining this complex system.

Appendix B lists the variety of specific recommendations made by the various reports.

F. Comments on Pakistan Material

There has been considerable documentation on the Pakistan malaria control project. Apart from the first Environmental Assessment, nearly all of this study has focused on the toxicity problem for sprayers, with a

second level of comment on handling problems in the chain of delivery of malathion and other pesticides. Areas of potential concern not apparently addressed include:

(i) urban area program

(ii) effects of malathion on people in sprayed area

(iii) effect of malathion on livestock and household generally

(iv) the research program

III. The Sri Lanka Environmental Assessment and its Significance for the Pakistan Program

At this stage in the study, a review was made of the Sri Lanka E.A. and its use for the malarial program in Pakistan. Appendix H is a review of the assessment. The review finds that as a first E.A. this is a useful document. It provides an extensive background to the social, cultural, and environmental conditions in Sri Lanka and then goes on to provide a detailed, though not completely comprehensive review of the impact of insecticides on the environment in general. The study is a good illustration of the mix of perspectives needed for an E.A. on malaria programs. What is needed is both an understanding of the general impacts of insecticides and other technology and the characteristics of the local situation which will emphasize or deemphasize certain aspects of those general impacts. The study also shows, as our conclusions suggest, that there are

transferable elements in malaria program E.A.'s but that there are other elements that are not easily transferred.

IV. Topics of Potential Environmental Concern in the Pakistan Program

In this section, we review the elements of the Pakistan program and point out some possible areas of environmental concern. The purpose is to establish a checklist as the beginning of a scope of work for a possible environmental assessment. The following eleven topics are reviewed:

1. Interior spraying
2. Exterior spraying
3. Transport and handling of insecticides
4. Vector control
5. Impact of program on population movement and land use patterns
6. Case treatment
7. Training
8. Case detection
9. Research
10. Evaluation
11. Health education

Specific comments on each of these eleven categories follow:

1. Interior Spraying

One of the greatest areas for potential contamination from malaria pesticides comes from spraying inside individual houses. Safeguards have been developed; training programs are in place; monitoring and field checks, to some degree, are operational. Yet it is still important to call attention to the several areas where potential problems are particularly severe:

a. on food which may be exposed to spray;

b. on furniture, household implements, baby toys, or tools which may come in close contact with people;

c. on clothing, bedding, or wall hangings which are absorbent and may hold insecticide whereas smooth surfaces will not absorb it;

d. on people, both spraymen and householders;

e. on exposed water in pots. Particular attention should be paid to clay water containers which are porous and which may absorb insecticide;

f. on animals inside house, either pets which absorb through fur or livestock (i.e. chickens) which eventually are eaten;

g. on house itself. For example, some Asian houses have mud plaster walls which are recoated 2 or 3 times a year. If interior spraying takes place a few days before replastering, there may be extensive exposure to householders who put a new thin coat of mud plaster on, primarily using palms of hands to do the smoothing.

2. Exterior Spraying

External spraying, though less direct than the internal spraying, presents a number of concerns including:

a. impact on domestic animals;

b. exposure of food, either human or animal food;

c. on water supply, either because it is directly used by humans or because of indirect exposure through fish or foods grown in the water;

d. on local crops growing in nearby fields;

e. on natural vegetation and animals which eat that vegetation;

f. through airplane spraying, on all of the above.

3. Transport and Handling of Insecticides

Handling of insecticide requires special attention in storage, transportation, mixing, spraying, and disposal, as follows:

a. Storage/Transport

1. leaking or broken containers
2. exposur· to moisture
3. rat/beetle infestation
4. safeguards in event of truck/train accident
5. fire

b. Mixing

1. equipment to protect personnel who do the mixing
2. caution in terms of where the pesticide is mixed (i.e. proximity to food, etc.)
3. safeguard that proper proportions of powder are used and water and mixing buckets kept separate;
4. check that sprayer are in proper working order

c. Actual Spraying

1. enforcement of clothing change every day
2. enforcement that gloves and masks are worn
3. concern for eating area and situation for spraymen
4. regular health monitoring of spraymen
5. sick pay arrangements for spraymen

d. Disposal

1. suitable place and setting for disposing of unused spray
2. disposal of outdated spray powder
3. disposal of empty insecticide containers (i.e. burning of malathion containers, if not properly cleaned before burning, produces a poisonous gas).

4. Vector Control

There are a variety of approaches to vector control including:

(i) oil coating of standing water

(ii) infilling or drawing of local pools and swamps

(iii) biological controls

Each of these has environmental consequences.

Oil coating affects other insect life and can affect local water supplies if not carefully applied. There are

potential impacts to children and animals.

Infilling or draining of local pools and swamps has generally a positive impact on the local environment but if undertaken on anything but a very local scale, must impact water systems and related ecology. The impact will need to be considered in each project context. (Also consider impact of new irrigation).

Biological controls are both potentially the most effective and have potentially the most impact of all measures. Larvivorous fish, if introduced in an ecosystem, may have impacts on other parts of the biota other than larva. While such impacts can generally be identified from a few case studies, review might be needed before introduction into totally new habitats.

5. Impacts of Program on Population Movements

Malaria control programs are sometimes aimed at health improvement in already well settled areas, sometimes they can improve health conditions in sparsely settled areas.

The change-over, if achieved, of an area from a high risk to a low risk for malaria can have important consequences. In some cases, the reduction of malaria encourages a new level of movement of people into the area to take advantage of land resources which now have become more

attractive. The malaria control program has indirectly resulted in changed person/land relationships, changed communication systems, changed local fuel requirements and changed community patterns.

Such changes obviously have a major effect on the human, social and natural environment and must be considered in program assessment. Again, it is appropriate to consider two levels of assessment; an awareness of such impacts in malaria programs in general and a local assessment of the likely impact.

6. Case Treatment:

With each malaria case, there is a therapeutic dose of 4-aminoquinalones given to remove red cell forms of the parasites. Also given is primaquine which acts on the liver stages of the parasite to prevent relapses. In larger scale outbreaks, mass drug therapy has been given in the past to large groups of people.

Potential Environmental Impacts or Issues:

a) side effects due to incorrect dosages or accidential poisoning,

b) may have hemolytic anemia which develops in G-6PD populations if they take primaquine,

c) development of drug-resistant forms of the parasite - Chloroquine resistance in Southeast Asia,

d) outdated and improperly stored and handled drugs can give toxic reactions,

e) disposal of old or outdated drugs - protect water supply from contamination,

f) potential for drug reactions secondary to taking more than one drug simultaneously,

g) impact of introduction of modern drug therapy into village culture,

h) all of the above may be intensified by mass drug treatment program.

7. Training:

Potential environmental impacts or Issues:

a) appropriateness of the training for the socio-cultural setting - appropriate technology,

b) is the training done in place which is not far removed from the job situation,

c) are there potentials for "brain drain" within the training process,

d) training should include orientation to the potential environmental impacts or hazards introduced by the program - appropriate to the particular job of the worker involved,

e) increases educational level and awareness of people

involved in the program cadre of people with health training and skills.

8. Case Detection:

The technique is that house visitors take blood slides and give presumptive treatment. Slides go to laboratory to be stained and read. If positive, there will be further investigation (blood survey) and respraying of houses in affected village. Potential environmental impacts and issues include:

a) infections secondary to taking blood samples,

b) drug reactions due to presumptive treatment,

c) improper storage, utilization and disposal of staining materials at lab sites,

d) respraying of village houses reintroduces the same problems as original spraying - may be more intensive due to the fact that it could come within weeks of original spraying,

e) changes in village social system due to weekly/monthly visits of government health workers.

9. Research

A wide variety of research topics can be pursued in relation to a malaria program such as that in Pakistan. Included in the topics are new forms of vector control, water management parameters of malaria control, and resistance of mosquitos to particular insecticides.

Not included explicitly in the Pakistan program but desirable is research on environmental impacts of insecticides on air, water, people and land, effects of social customs on hazards from spraying, attitudes of people and sprayers to malaria and control programs etc.

At present, research suggests the possibility of negative environmental impact. It is important that program linked research contributes to the minimization of negative environmental impacts.

The back up research field in malaria programs is an area where a careful delimitation of responsibilities and a good communication network is needed. There are many research centers around the world dealing with malaria and insecticide problems. The output from these centers needs careful and updated review and should be a first approach in dealing with a specific problem.

A second approach would be the designation of particularly important topics as world wide and/or region wide priorities for research. A third approach would be a detailed study within a country project which either uses the country project as a case study, which has implications outside that national area or applies, tests, or evaluates the applicability of general research findings to a local situation.

10. Evaluation

Evaluation of the Pakistan Malaria project has little or no direct impact on the environment.

11. Health Education

Potential environmental impacts or issues:

a) public awareness of hazards introduced by programs and how to recognize and avoid them,

b) education can create a positive attitude towards other programs (family planning) or educational opportunities,

c) impact of health education on cultural values of villagers and urban dwellers.

V. MAJOR RECOMMENDATIONS CONCERNING ENVIRONMENTAL ASSESSMENT IN MALARIA CONTROL PROGRAMS

1. Transferability of Environmental Assessments
2. A User Guide for Malaria Control Projects
3. Non-Transferable Factors
4. Monitoring
5. Selectivity and Restraint
6. Institution and Network Building
7. Broader Based Environmental Assessments
8. Composition of Environmental Assessment Teams
9. Training
10. Considerations Other Than Those Already Raised

RECOMMENDATIONS

1. Transferability of Environmental Assessments to Other Projects

One of the basic questions for this consultancy was to consider whether a basic environmental assessment could be prepared which would cover all (or at least most) malaria control projects, thereby saving the considerable time and money necessary to prepare EA's for individual projects. Our analysis suggests that a general environmental assessment will not do the job.

We therefore recommend (1) a principle of "transferability" of some factors which are common to many malaria control projects. We further recommend (2) that individual environmental assessments be conducted for those factors which are unique to individual projects and for which transferability would be unwise. For these two procedures we recommend:

a. Where transferability is possible - We recommend preparation of a "User Guide" (see recommendation #2) which project officers and others can use. The Guide will identify problems, indicators to look for, procedures to follow, and further literature to consult for factors which are generally similar in any malaria control project.

b. Where transferability is not possible - For assessment of unique factors (see recommendation #3) we recommend that individual environmental assessments be undertaken. However, substantial savings in time and energy can be realized because the User Guide will have set the stage and provided basic information which could reduce by as much as 50% the working time which an environmental assessment team would require in the field.

2. User Guide: A Manual for Managing a Malaria Project (for situations which are transferable from one project to another).

We recommend that a booklet be prepared to provide information on the do's and don'ts of individual activities in malaria control programs. It must be a practical guide, based on field experiences of project managers and environmental specialists. We urge that it include data on the environmental impact of those activities which will have essentially similar impacts, regardless of the local political, social, economic, or physical setting.

The Guide will draw upon literature concerned with the impact of pesticides on man, wildlife, water quality, and aquatic life. In addition, the Guide will include data drawn from medical literature which describes the complications and potential environmental problems associated with the use of anti-malarial drugs. Discussions with a number of individuals suggest that preparation of User Guides would be extremely helpful for project managers and environmental assessment team members. Topics would include:

I. Pesticides

a. Information on potential impact of pesticides
   - names of chemicals and their structure

b. Toxicology

   acute toxicity --
   chronic toxicity -- (studies on animals and humans)
   teratogenicity, mutagenicity, tumorgenicity

b. Environmental impacts on

1. water
2. soil and soil organisms
3. vegetation
4. human (malaria workers and householders)
5. household articles (food, stored water)
6. air quality
7. wildlife and aquatic life
8. domestic animals

d. Effects on local environment brought about by transportation and storage of pesticides

e. Problems related to the disposal of pesticides

II. Potential Environmental Concerns Created by Use of Anti-Malaria Drugs

a. Description of drugs

b. Information for Use and Dosage Schedules

c. Contraindications

1. specific . cial or ethnic groups
2. children and infants
3. pregnant women

d. Short-term reactions or side effects

e. Long-term side effects or toxicity

f. Effects of using out-dated or inadequately stored medications

g. conditions for proper handling, storage, and disposal of drugs

The Guide should also contain a section on pertinent literature for those who wish to pursue individual questions in greater detail.

It is our judgment that individual environmental assessments for each malaria project will not be necessary for the topics and impacts covered in the User Guide. By placing these guides in each project manager's hands, one can be assured that the potential environmental impacts will have been anticipated. In addition, availability of the Guide will help to orient an EA team as it prepares to go into the field to assess the impact of those variables whose impact is not common to many projects (see recommendation #3).

Preparation and availability of the User Guide is not a substitute for an individual environmental assessment. In our judgment, in preparing an EA, there is no replacement for information and "feel" acquired in a ground assessment and on-site visit. The User Guide's contribution will be to shorten the time of an EA team in the field and to make better information available to project managers concerning potential environmental problems.

We also add that coupled with the User Guide is the concept of closely coordinated monitoring or surveillance. Thus, recommendation 4 which concerns monitoring is extremely important.

3. Activities which Require Separate Environmental Assessment for Each Individual Project

Some parts of Environmental Assessments are not transferable and we therefore recommend that an environmental assessment be made of every malaria control project during the normal stages of project design. Although the scale and type of unique variables to be considered will vary from project to project, we list below the range of possibilities as examples of local differences. The list is not intended to be definitive.

We recommend that individual assessments consider at least the following variables which are not common from project to project:

a. Use of larvivorous fish. In those cases when larvivorous fish are being considered as a means to control mosquito larvae, although this approach is potentially ecologically sound, it must be carefully assessed. Individual specie variety, social practices (such as diet) in the area, and physical environmental characteristics make a major difference in ways in which the introduction of the new fish specie will interact. Thus, it is essential that small and carefully controlled experiments be conducted and closely monitored for trial period prior to the introduction of larvivorous fish on a large scale. Thus, an environmental assessment for such an approach is of great importance.

b. Epidemiological patterns. Local epidemiological patterns vary from region to region, in part because of differences in the physical environment and also because of social and cultural differences. An environmental assessment should include these local patterns.

c. Anopheline specie differences can also influence the nature of the project. An environmental assessment should include

attention to the unique specie patterns in the project area.

d. Local socio-cultural patterns will also make a difference in the implementation of a project. Techniques of animal shelter, food preparation, water storage, diet, personal hygiene, house maintenance, and sleeping patterns (to name but a few) will vary greatly from culture to culture and region to region. Thus, careful examination of the social practices which relate to malaria control activity should be carefully examined for each district.

e. In those projects where the malaria control program is multi-faceted or integrated with other development activities (such as resettlement or small-scale farming projects) the very complexity of the interaction among the several variables leads to the necessity for an environmental assessment. For example, some projects may combine larvivorous fish with pesticide use; others may involve two pesticides, one for agricultural purposes, and the second for malaria control. Whenever several factors are being introduced, an environmental assessment is essential.

f. A final concern, although overlapping with some of the items on the "transferable" list must be considered. Although the User Guide may provide data on the impact of a particular activity, it does not provide an opportunity to weigh one transferable aspect against another. Thus, an on-site visit by an environmental assessment team is essential in order to provide a sense of priorities, balance, and interrelationships between the several different factors under consideration. As a result of the site visit, variables can be weighted against one another and firm priorities established.

4. Monitoring

One shortcoming in present procedures is that even if an environmental assessment team visits a project site and prepares a competent environmental assessment, there is no mechanism currently in place to assure that the cautions raised in an environmental assessment will be followed up. The project manager does not have time to do this monitoring on a systematic or close basis, both because he or she may not have the particular environmental expertise and also not have sufficient time available.

Therefore, we recommend that mechanisms be set in place to monitor environmental aspects of malaria control projects. We see four points relevant to the recommendation for monitoring:

a. Agreement must be developed on the critical indicators which should be monitored. The broad categories include monitoring of the health of people involved in the project, including both residents and spraymen; local water quality; local flora and fauna; spray practices; storage/transportation techniques of insecticide handling; etc. This list of critical indicators should be devised in close cooperation between project officers, specialists in malaria control projects, and those with extensive field experience.

b. Base-line data should be acquired during the environmental assessment in order to serve as a reference point for the monitoring.

c. The composition of annual review teams (currently practiced by most malaria control projects) should be broadened to include a specialist with skills in environmental assessment.

d. A manual should be prepared which describes how monitoring should be undertaken. The manual would be designed to assist project officers in setting up monitoring and should include sections devoted to:

    i. how to use local institutions and local personnel in the monitoring;

ii. what to look for in terms of critical indicators;

iii. how to fund monitoring efforts;

iv. how to monitor the monitoring -- i.e., are people actually following through with the monitoring that they are supposed to do?

v. how to use feedback from the monitoring system to determine whether new variables or new pesticide-resistant species have developed and whether the original project design should be altered.

5. Selectivity

We recommend, in light of environmental concerns, a formal policy of selectivity and restraint in insecticide use in order to reduce the incidence or development of pesticide-resistant species. Experience of the last decade or two indicates that use of an insecticide may lead to its reduced effectiveness, in part because of the development of resistant species. Thus, malaria control spraying and agricultural use of pesticides should be undertaken only when necessary.

In conjunction with the selective use of sprays, it is also extremely important that information be gathered on types of spraying which may be underway in areas adjacent to the malaria control region. For example, parathion is a commonly used agricultural insecticide which has many qualities similar to malathion. If parathion and malathion are used in close proximity by independent projects and independent agencies or organizations, it is conceivable that cumulative suppression of cholinesterase in the blood may occur. Thus, it is important that careful coordination of all spraying become a part of the environmental assessment of malaria projects.

6. Institution and Network Building

In dealing with environmental assessment of malaria projects, particular attention should be paid to organizing activities which will further the exchange in the sharing of information between participating countries. Three sub-points should be considered:

a. Insofar as possible, efforts should be made to have duplication or commonality of US nationals on environmental assessment teams which visit different countries within the same geographic region. By having overlap of personnel, experience will be shared from one country to another. In addition, it is recommended that the format which the environmental assessment team uses will be similar from country to country, thus assuring that the exchange of information will be in compatible forms.

b. Efforts should be made to employ local hire consultants from one country to participate on environmental assessment teams which visit other countries -- with appropriate political sensitivity used in selecting such cross-nation consultants. The sharing of national specialists will further facilitate cross-fertilization of environmental procedures related to malaria control.

c. Efforts and funds should be organized in ways which will enable malaria control projects to strengthen capabilities of local institutions. In the long-run, environmental assessment work should be conducted largely from the resources and ranks of local personnel, not visiting consultants. Thus, for work in training, monitoring, project planning, environmental assessment, and evaluation, particular attention should be given to use of local institutions. Building a network has particular value in terms of helping local institutions develop closer contact with international research and policy organizations such as WHO, both in terms of WHO research stations and administrative offices.

7. Environmental Assessments Should be Extended Beyond the Scope of a Single Project

The terms of reference for many scopes of work for environmental assessments limit the investigation to primary and secondary impacts of the project in question. Yet the eventual impact of malaria control activities frequently extends to many related variables, some of which may result from projects and activities in fields quite unrelated to malaria. Moreover, several projects may be operating within the same physical region. We urge consideration, as appropriate, of a policy which looks beyond the single project and integrates the environmental impact of several projects into one EA. For example, in a situation where a malaria project and an irrigation project are proposed for the same area, a single EA for both would cost less and be a more useful and comprehensive product.

8. Composition of an Environmental Assessment Team

Because of the complexity and inter-relatedness of so many of the variables, an environmental assessment team should be made up of perhaps three persons whose experience and understanding, between the combination of skills on the team, include the following:

a. A person with expertise in malaria epidemiology;

b. A specialist in the physical and social setting of the country in question;

c. A person with experience in environmental systems, particularly as environmental systems relate to water and health;

d. Someone with a thorough working knowledge of the impact of pesticides on the social and physical environment;

e. A specialist in entomology.

9. Training

Explicit attention should be given to training efforts to improve both information and skills related to environmental assessment for malaria control projects. A number of local training activities have been increased dramatically in the last year or two in Pakistan following recommendations of a number of reports (see Appendix A). In addition, we have learned of a series of regional pesticide seminars currently being coordinated by Professor Raymond Smith of the University of California, Berkeley. To the extent that specific malaria questions can be included in these existing training programs, that effort should be undertaken.

Where it is not possible to modify existing training programs, new procedures should be devised. Both modifications and new procedures in training should be developed with reference to:

a. Acquainting project managers with the details of the proposed User Guide;

b. Introduction to techniques of monitoring, as suggested in the proposed guide to monitoring;

c. Preparation of training materials and workshops dealing with:

    1. Techniques of monitoring;

    2. Techniques of environmental assessment as they relate to malaria;

    3. Preparation of scopes of work for malaria control environmental assessment.

10. Recommendations on Spraying Techniques Not Found in Other Documents (See Appendix A)

Two sets of recommendations do not fit conveniently into any of the previous regular categories. They are:

a. Particular precautions to be highlighted in spraying techniques. Of the several reports examined, we have not found explicit mention of special precautions for spraying in houses where young babies are present. Because infants spend much of their time on the floor and are inclined to put dirt and household implements in their mouth, special precaution should be taken in spraying homes where young children are present. In like manner, special precautions are in order for spraying in homes where elderly residents are present. Because age frequently brings declining health, elderly people are more vulnerable to toxic exposure. Moreover, elderly people probably spend more hours inside a house than do younger adults, thereby increasing the exposure to insecticide beyond that of a physically active adult.

b. In the process of research, we have come across several references to studies of the long-term impact on householders of malaria control programs. Evidently WHO conducted such assessments in Gujarat (India) and in Brazil. However, results of these studies seem not to have been published. We have been unable, in the short time available, to track down where these results may be available. Nonetheless, for longer range environmental assessment as well as for preparation of the Monitoring Guide and User Guide, as recommended, location of these data on householder impact could be crucial.

LIST OF APPENDICES

APPENDIX A

Summary Reports of Malathion Investigations in Pakistan

The following reports are included in this appendix:

A. Malathion Intoxication in Spray Workers in the Pakistan Malaria Control Program. A report to USAID by Edward L. Baker; McWilson Warren; Matthew Zack; Ronald D. Dobbin; James W. Miles and Stephen Miller. January, 1977.

B. Safe and Effective Malathion Spraying Against Malaria in Pakistan. Final Report by Robert Davis, USAID Malaria Consultant. August, 1977.

C. Malaria Control Project. Final Report on Evaluation and Redesign of the Project by Walter S. Shurkin (Malariologist). April, 1977.

D. Report on Malaria External Review Team by Ch. A.A. Mujahid; Dr. L.A. Simeonov; Dr. Antiaz Hussain Shah; Rashed Bahar; Carlos C. Campbell and Roger Grenier. December, 1975.

E. U.S. Government Memorandum. Final Report of Consultative Visit to Pakistan Malaria Control Program Regarding Pesticide Toxicity Problem by Dr. Edward Baker. May, 1977.

MALATHION INTOXICATION IN SPRAY WORKERS IN THE PAKISTAN MALARIA CONTROL PROGRAM

A Report to the United States Agency for International Development Department of State

Edward L. Baker, M.D.[1]
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Matthew Zack, M.D.[1]
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BACKGROUND

The Pakistan Malaria program first used malathion on a wide scale in 1976. Several small scale field trials had been conducted in 1975 to evaluate the efficacy of the pesticide and these were associated with no reports of illness. In 1976, DDT and BHC were also used for mosquito control, in areas of low malaria endemicity and where pesticide resistance had not developed in the vector population. Over 70% of the pesticide used in Pakistan in 1976 was malathion and this usage was largely in 2 provinces. Punjab and Northwest Frontier. Malathion from three formulators was used: American Cyanamid, Snia Viscosa (Italy), and Rumianca (Italy). In these 2 provinces, spraying began in June or July, depending on pesticide availability and was scheduled to continue for approximately 4-5 months. The malathion was used in the form of a 50% water dispersable powder which was mixed with water at the site of application. Hand compression sprayers were used to apply malathion to room surfaces at a dose level of 2 gm/M^2. Each spray team consists of 5 spraymen, 1 mixer, and 1 field supervisor. Approximately 7,490 workers were involved in the field spraying operations in these 2 provinces: 1,070 field supervisors, 1,070 mixers, and 5,350 spraymen (Table 1).

These spray teams were composed of uneducated village men, ages 14-60, many of whom had previously used DDT and BHC in earlier spray programs. The men received 7-10 rupees (70¢-$1.00) for a day's work and were not reimbursed for time lost from work or for medical expenses related to pesticide intoxication episodes. Training of spraymen and mixers was the responsibility of the local field malaria supervisor and focused primarily on operational methods (i.e., spraying technique, mixing technique, etc.) with little attention given to safety methods.

THE EPIDEMIC

Cases of pesticide intoxication were observed within a few days of the start of spraying. The course of the epidemic in Lyallpur district was typical of that occurring throughout the country: spraying began in different times in different parts of the district due to pesticide availability and was followed within a few days by cases of intoxication (Figure 2). The symptoms and clinical histories of these patients were consistent with organophosphate insecticide intoxication; subsequent data on cholinesterase levels confirms this diagnosis. Treatment of the cases was handled inadequately in the early stages. Later, atropine was made available through the Malaria Program and use of this drug undoubtedly prevented many severe illnesses and probably some deaths.

There were at least 5 deaths in spraymen which were probably related to insecticide poisoning. Three deaths occurred in Kohat district, Northwest Frontier Province (NWFP), where Snia Viscosa malathion was used. These were classical cases of organophosphate insecticide poisoning and were exposed to the pesticide only during their normal work activities. One death in Gujuranwala district, Punjab, occurred in a sprayman shortly after he consumed food which had been sprayed with the Cyanamid product. A fifth death in Sheikupura district, Punjab, in a sprayman using Cyanamid malathion was felt by local authorities to have been related to insecticide poisoning but no definitive information existed on this case.

EPIDEMIOLOGIC INVESTIGATIONS

Three studies were conducted to evaluate the extent and causes of this epidemic of insecticide intoxication.

1. Retrospective Questionnaire Survey:

To obtain an estimate of the number of illnesses which had occurred, a retrospective survey was designed. This survey involved interviewing

10% of the spraymen, mixers, and supervisors to determine whether they experienced symptoms of pesticide intoxication during July 1976. This period was used because it represented the peak of the epidemic and because accurate information existed regarding the number of persons working during the month. The interviews were conducted by staff of the provincial malaria programs under our supervision.

2. Field Study:

This study was designed to assess the relative toxicities of the malathion from three formulators being used in Pakistan and to determine if poor work practices could be related to signs of pesticide toxicity. The study consisted of observation of spraymen, mixers, and supervisors during a typical work day by personnel from the provincial and district malaria offices. A detailed work practices and symptom checklist (Appendix 1) was completed by the observer on each worker. Blood samples were drawn from the same workers for the determination of cholinesterase levels before and after the work day. The cholinesterase analyses were performed using 2 methods: the Michel method, a standard laboratory technique which requires relatively sensitive instrumentation and good laboratory facilities, and the tintometric method, a field kit designed for situations where less ideal conditions prevail. The workers were also interviewed at days end to determine if they developed any symptoms of pesticide toxicity during the day. Samples of the malathion used by each spray team were collected and returned to CDC for gas chromatographic analyses. Malathion content was determined by gas chromatography (GLC) run isothermally by an internal standard method. The minor components were determined by GLC in temperature programmed mode with internal standard.

3. Environmental Study:

Air sampling and skin patch testing of individual spraymen were performed to evaluate respiratory and dermal exposures to malathion. Area air sampling was performed in rooms sprayed with malathion. These studies as well as detailed work practice evaluations were performed by an industrial hygienist from the National Institute for Occupational Safety and Health (NIOSH). Analyses of samples collected were performed at CDC and at NIOSH laboratories.

RESULTS

General Observations:

Our direct observations of work practices and the reports we received from district and local malaria program officials provided essential information which supplemented our scientific studies. These observations influenced our conclusions and recommendations, at least as heavily as our scientific studies, and accordingly deserve discussion.

1. Community exposure:

Exposure of villagers occurred during the spraying of houses, since some residents remained inside their houses while spraying was taking place. Some women came in contact with pesticide while trying to wash their walls clean after spraying. Pesticide stored in homes and spilled during mixing operations were other sources of community exposure. Although we heard numerous anecdotes of illness occurring in persons whose houses were sprayed, we were unable to confirm any of these reports. Rumors of illness in householders along with knowledge of the bad odor of the malathion had resulted in growing public resistance to the spray program.

2. Work Practices:

Despite numerous communications from the Central and Provincial malaria offices regarding safety precautions for malathion use, poor work practices persisted in many parts of the country. Workers and supervisors did not regard the pesticide as a dangerous material requiring specific handling

3. Storage and Shipment Difficulties:

Pesticide shipment was accompanied by numerous anecdotes of human and animal exposure to malathion with attendant illness. Broken malathion containers with pesticide spillage were noted in virtually every storeroom. Frequently, inadequate storage facilities in villages resulted in the pesticide being stored in homes.

RETROSPECTIVE SURVEY

Interviews were completed on 204 spraymen, 41 mixers, and 49 supervisors, representing 76.3% of those selected to be sampled in the Northwest Frontier province. In the Punjab, interview information is available on 127 spraymen, 25 mixers, and 26 supervisors in 4 of 8 districts. (Interviews have been completed in the other districts of the Punjab and the data are in transit.)

For the purposes of this survey, a case of malathion intoxication was defined as an individual with at least 1 episode of illness characterized by 4 of the following symptoms: blurred vision, giddiness, nausea, vomiting, or abdominal cramps during July 1976.

Based on this definition, 16% of supervisors, 35% of mixers, and 45% of spraymen experienced at least 1 episode of malathion intoxication during July 1976. Applying these rates to the total work force in the 2 provinces results in an estimate of 2,900 workers with pesticide intoxication in Pakistan during July. Since some of the workers who were ill during July quit work and could not be interviewed, these illness rates probably represent low estimates. Comparison of rates between brands was not possible due to the small number of interviewed workers exposed to Rumianca or Snia Viscosa brands. Thirty-six workers who used DDT during July were interviewed for comparison; none of these men reported any of the 5 pesticide toxicity symptoms mentioned above.

FIELD STUDY

Workers tested in this study were selected based on the proximity of their work site to our central laboratory facilities and the pesticide they were using. One hundred four workers using Cyanamid, 27 using Rumianca, and 36 using Snia Viscosa were tested. Cholinesterase determination using the Michel method were performed on plasma and red blood cell samples from all workers. The tintometric method of cholinesterase determination was performed on whole blood samples from approximately 65% of the workers.

Plasma and red cell cholinesterase levels were lowest in spraymen who used Snia Viscosa brand malathion (Tables 2 and 3). Relative changes in red cell cholinesterase levels from morning to evening showed a similar pattern of increased toxicity among workers exposed to Snia Viscosa and to Rumianca (Table 4).

Cholinesterase depression was associated with symptoms consistent with pesticide intoxication in these workers. Workers complaining of headache, blurred vision, and vomiting had significantly lower red cell cholinesterase levels than those not so affected. These symptoms are

among the earliest manifestations of organophosphate insecticide poisoning.

There was relatively poor comparability in cholinesterase determinations performed by the tintometric method and the Michel method. Afternoon red cell cholinesterase levels correlated with tintometric reading with a correlation coefficient of 0.45, which indicates a significant degree of correlation but not a correlation of the magnitude expected between 2 tests measuring the same substance or the same blood sample.

We were unable to relate observed poor work practicies to cholinesterase depression in workers or to symptoms of pesticide intoxication. Mean cholinesterase levels of those observed to perform certain poor practices were not significantly different from those who practiced good work habits on our day of observation.

Analysis of 25 malathion samples by gas chromatography showed consistent differences between the 3 brands of malathion and very little difference between samples manufactured by the same company (Table 5-7). Highest levels of isomalathion were found in Snia Viscosa samples with intermediate levels in Rumianca samples. Malathion content for Cyanamid samples averaged 45%, for Rumianca 46%, and for Snia Viscosa 35%.

Comparison of chemical analyses with toxicity analyses shows a correlation between levels of isomalathion contamination and depression of cholinesterase levels or symptoms of pesticide intoxication.

Results of environmental testing and LD_{50} determinations of pesticide samples are not available at the present time.

DISCUSSION

This epidemic of pesticide intoxication was caused by the combination of poor work practices and the usage of 2 brands of malathion containing contaminants which rendered them excessively toxic. Poor work habits had been formed while using DDT and were not changed by appropriate training programs when the new pesticide was introduced.

Chemical contaminants in the malathion manufactured by Snia Viscosa and Rumianca were thought to be responsible for the increased toxicity of these products. The most important substance contributing to the increased toxicity of these products appeared to be isomalathion, a chemical relative of malathion with an LD_{50} of 89 mg/kg. In the case of Cyanamid production, there was no evidence of an increase of the isomalathion content with increasing time in storage, therefore we concluded that isomalathion was not formed in storage. This may or may not be true in the case of the other two products.

Toxicity testing of malathion samples from Pakistan by the World Health Organization revealed Cyanamid to have an LD_{50} of 4000 mg/kg, Rumianca an LD_{50} of 1064 mg/kg, and Snia Viscosa an LD_{50} of 300 mg/kg. These determinations are consistent with the degrees of cholinesterase depression seen in workers using the three products and with the isomalathion levels in these products. Toxicity tests on the samples returned from Pakistan by the CDC team are now in progress.

This epidemic represents the first report of significant illness among workers exposed to malathion. Numerous studies of pesticide plant employees, agricultural workers, and spraymen in malaria programs have not observed significant toxicity following malathion exposure. Although some of the cases reported here were attributable to the use of contaminated malathion, symptoms were also reported by workers exposed to malathion manufactured by Cyanamid. The major contributing factors in these cases appear to have

been poor work practices, including mixing of the pesticide by hand, not washing pesticide contaminated clothing, eating pesticide contaminated food, and failure of adequate skin cover during spraying.

The poor correlation between tintometric readings and Michel determinations of cholinesterase concentrations contrasts with previous reports of success with this field method. Difficulty in obtaining suitable distilled water for use in the kit may have contributed to the variability of these readings.

Although poor work practices were evident among these workers, we were unable to relate specific practices to cholinesterase depression of illness. A typical behavior of spraymen who were aware of being observed made valid work practice observations impossible. Workers were observed for only 10 to 15 minutes, too brief a period to obtain a meaningful assessment of work practices.

RECOMMENDATIONS:

Our recommendations fall into 2 categories: those that apply exclusively to the Pakistan malaria program and those that apply to all malaria programs in which toxic insecticides such as malathion are used.

A. Pakistan recommendations:

1. Special attention should be paid to two previously identified groups of workers who are at high risk for developing insecticide intoxication. Workers found in our study to have low cholinesterase levels and workers recently experiencing an episode of malathion intoxication. Workers having dangerously low cholinesterase levels should be removed from the job until the levels rise into the safe range. A red cell cholinesterase level of less than 50% normal activity (less than 0.4 Δ pH units/hour by the Michel method) should be considered in the danger range. This recommendation has been made to the malaria program and a list provided of workers identified with dangerously low cholinesterase levels.

Workers who have been seriously intoxicated and have required atropine therapy should not return to work immediately after their illness. They should return no sooner than 2 weeks after their symptoms subside and only if their cholinesterase level is out of the danger range. (Ideally workers should remain away from work for a considerably longer period; the 2 week period represents a compromise between the ideal situation and practical considerations of the program.

2. Surveillance of intoxication should identify areas where symptoms of organophosphate toxicity are occurring. In those areas where there are symptomatic workers, cholinesterase testing should be performed to confirm the diagnosis of intoxication and to identify symptomatic workers with low cholinesterase levels who are at high risk for developing overt intoxication. Individuals with recent illness and low cholinesterase levels should be removed from exposure until their cholinesterase levels return to a safe range. To facilitate early recognition of pesticide toxicity, malaria supervisors should be familiarized with the early signs and symptoms which are associated with cases of organophosphate intoxication.

3. The malaria program should establish reference laboratories for performing cholinesterase determinations. Training of personnel in these techniques was accomplished during our study. Supplies should be made available to them so that they can perform the determinations. The reference laboratories should be able to perform the Michel method as well as the tintometric method. The performance of the laboratories should be periodically evaluated.

4. More intensive education, training, and supervision is needed to insure that good work practices are carried out by spray personnel. This education program should stress the fact that malathion is a poison and should be treated as such. The specific practices that require most

emphasis are

a) Mixers should not mix with hands.

b) Spraymen should wash clothes and themselves at end of spray day.

c) Skin contact during the day with the pesticide should be minimized by use of clothing which covers exposed skin surfaces, including the mouth and nose.

Provincial and district personnel should be designated as safety officers and given special responsibility for carrying out this program.

5. Safety equipment should be supplied to spray teams to provide additional protection from contact with the pesticide. Specific items would include soap, 2 spray uniforms, elbow-length impervious gloves (for mixers) and cleaning tools. Specific equipment will be detailed in the industrial hygiene report.

6. Because of the high toxicity associated with Snia Viscosa and Rumianca products in the country, we would recommend that the use of these products be discontinued immediately. An investory should be performed of the remaining stores of Snia Viscosa and Rumianca products. The pesticides should be kept in storage pending recommendations on safe disposal of the material.

7. Improved methods of shipment and storage are necessary to prevent inadvertent exposure of the population to the pesticide. Storage of the pesticide in shelters occuppied by humans should be curtailed.

B. General Recommendations:

1. Improved specifications for malathion to be used in the malaria programs should be developed which would insure delivery of a product containing the desired amount of active ingredient and an acceptable level of toxic contaminants. Specifications have been prepared which include new and improved testing for components. Specifications for the packaging

materials used to purchase malathion powder should be strengthened to minimize spillage of the product in the field.

2. A feasibility study should be undertaken to evaluate toxicological testing of pesticides to be used in the malaria program.

3. Further information is needed on the toxicity of various minor contaminants present in commercial malathion. The relationship of prolonged storage to the appearance of these compounds and to increased toxicity of the product should be investigated. Research should be conducted on methods of analysis for toxic components in malathion formulations.

4. WHO should encourage surveillance in programs using malathion to identify toxic effects of the pesticide on spray workers and the general population.

5. Further work is needed to improve the accuracy and reproducibility of field methods used in the determination of cholinesterase levels.

(55)

SAFE AND EFFECTIVE MALATHION SPRAYING AGAINST MALARIA IN PAKISTAN: FINAL REPORT OF ROBERT DAVIS, USAID MALARIA CONSULTANT

ISLAMABAD

12 AUGUST 1977

The work underlying this report was wholly supported by USAID Contract Number AID/ASIA-C-1248/Pakistan, Project 391-U-163, Project Development and Support (Malaria Control).

Contents

1. Terms of Reference

This writer was retained by USAID on a personal services contract "to review and monitor new field spraying operations procedures for the Pakistan Malaria Control Program." In the words of the contract, "of primary concern to the consultant will be the effective and safe execution of the residual insecticide spraying program." Additional oral instructions from Washington and Islamabad made it clear that the writer was to concentrate on the area of safety measures involved in field operations with malathion.

Achievement of these objectives required field trips to the Punjab, the Northwest Frontier Province, and Sind. Those field trips, whose details are appended, focused on conformity of field operations to safety guidelines laid down in the CDC team report of October 1976, the training instructions laid down by Dr. Jesse Ibbbs, CDC, in March 1977 training at Lahore, in the report on cholinesterase reference laboratories written by Dr. Steven Miller, CDC, and in directives to the field from Drs. S. M. Mujtaba and G. H. Mallick, Directorate of Malaria Control (DOMC).

Conversations were also held with all three provincial chiefs, with USAID, WHO and DOMC staff in Islamabad and the field. In Sind, conversations were held with health and medical college officials as well. No field visit was paid to Baluchistan, where malathion spraying begins in September.

This writer's effort has been but a small part of a much larger collaborative effort by DOMC, WHO and USAID to insure that malathion safety precautions are rigidly adhered to. This effort has entailed visits by CDC specialists in toxicology, epidemiology, and cholinesterase determinations, visits to malaria offices and field sites by more than a dozen local USAID and WHO staff, and no fewer than 293 spray squad visits to date by USAID alone.

2. Findings by Province

Since site findings by province have been extensively discussed in earlier reports, they will be briefly summarized here.

2.1 Punjab

Conformity with safety precautions was found to be generally good in nineteen squads visited by this writer in Lyallpur and Sahiwal Zones. Eighteen squads were judged to be doing good work, and one was judged to be doing mediocre work. Occasional deficiencies were noted, such as failure of some spraymen to pull turbans up over the bridge of the nose, failure to cover foodstuffs in one case, with resultant sprinkling due to bounceback, and two cases of supervisors' wearing their own shalwars and kamizes. Six cases of spraymen illness were noted in visits by this writer, none conforming to the CDC definition of malathion intoxication. All recovered.

No deficiencies in equipment or supplies were noted. No Italian malathion was in use.

2.2 Northwest Frontier Province

Conformity with safety precautions for spray was generally good in the 25 subsectors visited by this writer and in the 26 subsectors visited by his co-worker, Mr. Chaudhry Umar Hayat, USAID/Islamabad, with the notable exception of subsector b-5, Swat. This squad was spraying leftover malathion from 1976 in an area not scheduled for malathion. Zone staff promised to have the matter rectified immediately.

There were ten cases of clinical illness among the spray personnel, three among the supervisors and one in a mixer. One fit the CDC clinical definition of malathion intoxication.

No deficiencies in equipment or supplies were noted. No Italian malathion was in use.

Some sources of reducible contamination were noted. These included:

a) dermal intoxication through the area around the eyes
b) dermal intoxication through the feet
c) intoxication through the nose when the sprayman fails to pull the turban up over the bridge of the nose
d) dripping of suspension down side of bucket during pouring into pump.

Dr. A. K. Afridi, Provincial Malaria Chief, reports poor agreement between clinical picture and the results of tintometric tests in some cases. (See below, 3.8.)

A good reporting system exists for results of tintometric tests, but there were no written reports for clinical cases.

2.3 Sind

Conformity with safety precautions was generally found to be good in the districts of Nawabshah and Tharparkar, where this writer and Mr. Khwaja S. Ahmad, his co-worker from USAID/Karachi, observed 34 of 53 and 29 of 48 subsectors under malathion spraying, respectively. In Tharparkar, Mr. Khwaja found ten cases of clinical illness among spray personnel, two of which fit the CDC definition of malathion intoxication. Neither had been confirmed by blood test at the time of his visit. There were three cases of illness among spraymen in Nawabshah, none fitting the CDC definition. Two of the three had not been reported to the Malaria Superintendent.

No deficiencies in equipment or supplies were noted. No Italian malathion was in use.

Results of tintometric tests done both for monitoring and for confirmation of individual cases were said by Dr. A. A. Ghumro, the Provincial Malaria Chief, to show good agreement between serological and clinical findings.

It should be noted that the findings of good conformity to safety standards by this writer and by Mr. Khwaja are in contrast to the mixed findings of earlier external monitors. Dr. Ghumro and his staff are to be commended for the rapid improvement in field work which they have effected.

3. Findings by Functional Area, with Recommendations

3.1 Transport, Handling and Storage

Restraints of time prevented this writer from devoting more field visits to problems of storage and transport of malathion. This writer's field observations in Muzaffargarh and Malakand Agency have been supplemented by conversations with Mr. Khwaja S. Ahmad, USAID/Karachi, DOMC officials, and a review of DOMC and USAID files on transport and storage of malathion.

Under present conditions, malathion is unloaded at the Port of Karachi and stored in the open for varying lengths of time until it can be loaded onto rail wagons and trucks for shipment upcountry. There is one DOMC officer at the port whose function is to oversee the handling. At its destinations, the malathion is turned over to local malaria personnel, who use local workers to offload it and transfer it to rented storage facilities. From there it is taken to the field in malaria vehicles.

Notwithstanding DOMC efforts to work with Karachi port officials, dispatches from USAID observers have noted deficiencies in port procedures. Urgent attention should be given to seeing that exposure of dockworkers to malathion and other insecticides is minimized. It is inevitable that, given the huge quantities being handled, some malathion boxes will be broken. It is recommended that DOMC continue its present practice of providing port workers with gloves and turbans to reduce the danger of dermal exposure. It is further recommended that the DOMC officer at the port be provided with atropine and trained in its use.

Since dangers of contamination do not end at the port, it is essential that continuing liaison be kept up with rail and trucking authorities. The soon to be appointed transport officer, DOMC, should contact the District Controller of Stores, Pakistan Railway, Karachi Cantonment, to look into implementation of Dr. Mujtaba's letter of 16 May, 1977, outlining procedures for washing at their destinations rail wagons used to transport malathion. Every effort should be made to secure the cooperation of trucking companies to assure that the same measures are taken with their vehicles. In the case of both rail wagons and trucks, malaria sector personnel at the destination should assist in washing out the vehicles.

The DOMC transport officer should make every effort to see that there is no offloading and reloading of malathion at intermediate points between Karachi and the destinations.

Properly packaged malathion should pose no danger in transit to its destination, but it is essential that, on arrival at the collection point, it be handled with due precautions. It is therefore recommended that the malaria personnel who collect the malathion from trains and trucks be given atropine, gloves and turbans and exercise the same precautions as malaria personnel at the Port of Karachi.

DOMC should look into the possibility of sending reboxing materials

to the field. If this proves impracticable, zone and sector personnel should be instructed to keep five or ten empty old boxes at the destinations into which contents of broken boxes can be transferred if necessary. It is also recommended that DOMC issue guidelines to field staff for handling of broken boxes. These should certainly include provision of uniforms and gloves to handlers of broken boxes, even if they are not malaria personnel. Turbans should also be used.

Although this writer found storage facilities to be generally satisfactory, malathion boxes were not always placed high enough to escape water damage in the event of rain. Moreover, an earlier report by Mr. Mushtaq Ahmad Rai, WHO Operations Assistant, found outdoor storage in one subsector of Lahore. Although these may be isolated incidents, it is necessary that all subsectors be brought into conformity with proper storage standards. It is therefore recommended that DOMC issue a directive to field staff to have malathion stored behind locked doors, up on bricks, pallets or platforms high enough to escape water damage. This requirement should be uniformly followed, even in areas where it is anticipated that malathion supplies will be exhausted before the beginning of the rainy season.

The problems associated with record keeping and storage of malathion are addressed at length in a memo of 22 July 1976 by Mr. Chaudhry Umar Hayat, USAID/Islamabad. This memo deserves the attention of the DOMC transport officer when appointed.

3.2 Training of Spray Personnel

Training of spray teams was found to be uniformly good, judged both by direct observation of Mr. Chaudhry Umar Hayat, USAID/Islamabad, and by field observations of spraying.

It is recommended that DOMC continue to give safety training to field staff, and that it reissue before first round of 1978 a revised Urdu version of the 1977 field guide for distribution in the Punjab and for translation into the respective languages in the other provinces. The revised booklet would embody all the instructions in the 1977 version, as well as the additions noted in 3.1, 3.3, 3.4. 3.5, and 3.8. See Appendix 7.5 for a summary of proposed additions to the training curricula and field guide.

3.3 Access to Safety Equipment and Supplies

Every squad visited had soap, atropine and uniforms, except as noted above, 2.2. However, several mixers were mixing with one glove because the other was punctured or had become gummy in the heat. It is therefore recommended that every Assistant Malaria Superintendent be provided with at least one pair of spare gloves. It is further recommended that spraymen be provided, on a trial basis, at least, with close fitting goggles to reduce eye irritation. Both of these recommendations should be implemented before second round, 1977.

Provision of goggles is desirable not only from the standpoint of reducing d ermal contact, but also from the viewpoint of improving quality of ceiling spraying.

Mr. Khwaja S. Ahmad, USAID/Karachi, reports that chec! s of spraymen's collars reveal that some spraymen fail to change their uniforms daily. It is therefore recommended that a) supervisors, AMSs and MSs do "collar checks" during morning inspections tc see that spraymen and mixers are wearing fresh clothing and b) that sets of protective clothing be marked "1" and "2," to be worn on odd- and even-numbered days respectively. These measures are essential for reduction of dermal contamination.

3.4 Quality of Mixing

Quality of mixing was generally found to be good. The following comments are worth noting, however, and apply to all three provinces visited:

a) airdrift of malathion powder to the ground during transfer of powder from scales or measuring cup to mixing bucket

b) dripping of suspension down side of bucket during pouring into pump

c) dripping onto bare feet.

Airdrift can be minimized by placing the malathion bucket next to the malathion box, downwind from it if there is a wind. Measuring or weighing should be done over the malathion box, not over the ground.

Most mixers have two buckets, one to receive the malathion, one to receive the water. To prevent dripping down the side of the malathion bucket, mixers should be trained to place the water bucket under the malathion bucket during pouring so as to catch the runoff. Water buckets which will later be dipped into human water sources, such as streams, must be cleaned before dipping.

3.5 Quality of Spraying

The quality of spraying was found to be generally good, both from the standpoint of safety and non-safety measures. A few houses were visited in which foodstuffs had not been covered before spraying, with resultant accumulation of malathion due to bounceback from ceiling spray. It is recommended that, in future, DOMC re-emphasize the need to cover all foodstuffs, both human and animal, before spraying.

One defect uniformly noted was the shortage of extension lances. This makes for poor ceiling spray. It is recommended that every squad be provided with one extension lance. It may be advisable to have the

lance assigned to one sprayman, who would be made responsible for spraying all high ceilings. This should be done at first on a trial basis, with careful monitoring to observe whether the "ceiling men" suffer intoxication as a result of their work.

Non-safety related defects sometimes noted were speedy spraying, excessive overlap, and failure to spray undersides of shelves.

3.6 Quality of Field Supervision

Quality of field supervision was found to be uniformly high. The isolated instances of defective supervision have been noted in earlier reports.

Maintenance of high supervisory standards requires that Assistant Malaria Superintendents (AMSs), on whom the brunt of supervision falls, be provided with sufficient transport allowances to carry out their duties. Transport allowances now in force are regarded by all malaria staff consulted as inadequate to the needs of their respective zones. The provincial health authorities place themselves in an anomalous position when they give the malaria field staff a job to do but deny them the resources to do it. No malaria staff consulted have named a figure for AMS monthly transport allowance lower than Rs. 120 as the minimum required for continued good supervision. Provincial health authorities should see to it that, with due regard for local differences in size and topography, adequate transport allowances, in no case less than Rs. 120 for AMSs, be provided, so that malaria field personnel can carry out the work entrusted to them.

3.7 Quality of Field Safety Measures

With the notable exception of one squad in Swat and one squad in Hyderabad, safety measures were closely adhered to. Both these squads have since been visited by local sector and zonal officers to rectify errors made.

The need for goggles has been noted above, 3.3. It is further recommended that all squad members be required to wear shoes as a safety measure. The sandals in common use are not a satisfactory substitute because their open tops expose squad members to contamination.

3.8 Cholinesterase Determinations

Limited observations of results from Punjab and the Frontier shows some discrepancy between results of tintometric monitoring and clinical picture. Most notably, two spraymen in the Frontier with tintometric readings of 25 per cent denied history of clinical symptoms. No data was available to this writer about consistency among tintometric, Michel and clinical results for the same spray personnel.

It is recommended that DOMC redouble its current efforts to monitor compatibility among Michel, tintometric and clinical results, and that Mr. M. S. Shah, DOMC/Lahore, be dispatched to zones which have equipment in order to observe that Michel and tintometric tests are being properly carried out and are consistent with clinical findings. If Mettler scales are found defective, the services of Mr. Syed Iftikhar Zaidi, Azam Instruments Ltd., Karachi, should be requested. Mr. Zaidi has rendered DOMC useful assistance in this respect before.

It is further recommended that, contingent on availability of funds, the next external review team include one member competent to evaluate the work of Michel and tintometric determinations.

Note is taken of Dr. Mujtaba'sdirective of 8 June 1977, which calls for monthly monitoring of a ten per cent or more sample of spraymen. This directive has not been carried out and cannot be carried out with the inadequate number of tintometric kits now in the field. It is therefore recommended that the international agencies, singly or together, donate to DOMC a number of tintometric kits sufficient to assure that every zone under malathion spray has one kit.

In the same directive, Dr. Mujtaba indicated that Michel tests were to be done only for confirmation of tintometric results. The five kits now in use are adequate for that purpose, and no new purchase of Michel kits is necessary.

This writer has not found any hard and fast criterion in use at the field level for taking squad members off the job. He recommends adoption of the following stringent standard: any member of a spray squad presenting one or more of the five CDC clinical symptoms -- blurred vision, giddiness, nausea, vomiting, abdominal cramps -- should be ordered to bathe and rest, and should be given atropine. The supervisor should make out two copies of the appended case report (7.2, below) and send them, with the affected squad member, to the District Safety Officer for a tintometric test. Any person with a tintometric reading below 62.5 per cent should be taken off work and kept off work until his reading returns to above 62.5 per cent.

This recommended standard is based on a conservative reading of reference (1), cited in 7.4, below, which states, "an individual who has been chronically exposed to organophosphate pesticides should be withdrawn from further exposure when his ChE activity values drop to 25-50% of normal and should not be allowed to return until these values rise to at least 75% of normal." This writer has reviewed the tintometric results from last year's tests of spray personnel exposed to Italian malathion, and believes that even the stringent standard recommended here would not lead to excessive layoffs or impairment of productivity. It should be noted in this context that the early USAID reports of this year showed only about one per cent of spray personnel to be suffering from clinical illness. Under the recommended standard,

even many of these men would be kept working if they had satisfactory tintometric readings.

3.9 External Monitoring of Field Operations

It is recommended that the present external monitoring continue, using the appended revision of the field observation form, 7.3, below. In light of their knowledge of the local languages, Pakistani personnel of USAID and WHO may be the most satisfactory persons for this job.

4. Future Requirements for Areas not yet fully Operationalized

4.1 Continuing Medical Education

Considerable efforts have already been made to educate the medical professio to clinical aspects of malathion poisoning. The increasing use of organophosphate in agriculture makes it likely that organophosphate intoxication will increase in the future. All practicing clinicians must be reached with information on this increasingly important subject. It is therefore recommended that DOMC explore ways and means of educating the medical profession on clinical aspects of organophosphate intoxication. This may include half-day seminars in large institutions, articles in the literature, or any other effective way of disseminating the relevant information. Such efforts should include approaches to medical colleges to see that they include this subject, perhaps through guest lectures, and are provided, where necessary, with the relevant literature. A constructive contribuation to this effort could be made by mimeographing and distributing to the medical profession an English language clinician's guide to organophosphate poisoning. In light of the very heavy workloads of DOMC physicians, the compiling of such a guide would best be done by USAID or WHO medical staff, using as a core the information in "Toxic Hazards of Malathion," which has been distributed in Sind by the provincial Malaria Headquarters. Such a guide should also be distributed to malaria supervisors, with instructions that they are to accompany any intoxication patients requiring physician's care to the medical facility, inform the physicians of the patient's exposure to malathion, and place in their hands a copy of the clinician's guide. Supervisors must be made to understand that such emergency situations are no place for deference to physicians.

4.2 Reporting of Clinical Illness and Serological Results

There is an excellent reporting system for results of tintometric monitoring in those zones where ten per cent samples of spray squads are regularly taken. However, it is recommended that a column be added to the form for recording any clinical symptoms noted in the men tested. Summary results of tintometric monitoring should be submitted to DOMC/Islamabad.

There is no written reporting system at present for informing zone and provincial offices of suspected intoxication cases. It is recommended that the appended uniform case report (7.2, below) be placed in the hands of malaria supervisors, and that they be instructed to send two copies to the zonal office with the suspected intoxication patient whenever they see one or more of the five symptoms of intoxication. For uniformity of interpretation, the symptoms should be listed on the form in the provincial languages as well as English, as on the appended example.

4.3 Disposal of Italian Malathion

DOMC and the international agencies have not yet formulated a common approach to the disposal of the Italian malathion. Ideas now under consideration by various parties include local reformulation for agricultural use, return to the manufacturers, donation to Cyanamid, and burial. Since USAID does not yet have an official position, the following comments are offered in lieu of a recommendation.

All of the methods of disposal now under consideration would entail considerable expenditure of money and manhours. This expenditure would be quite futile if the primary objective of disposal were not achieved, namely, the assurance that there will be no further cases of death or serious intoxication from malathion. The idea has been raised by DOMC that the Italian malathion might be reformulated locally for agricultural application. In considering this idea, one must bear in mind that agricultural spraying is not and cannot be done under close supervision by the health authorities. The only protection against serious intoxication under conditions of poor field supervision is to use a product of very low toxicity. In this connection, it is relevant to note that malaria spray squads have encountered intoxication this year despite good safety standards while spraying a product with oral LD_{50} of 1000 to 2000 mg/kg in white rats. The oral LD_{50} of any product reformulated for agricultural use would certainly have to be higher than this, and the testing would have to be done by a WHO-approved laboratory.

Whatever method is finally agreed upon, it should be implemented under the most rigorous safety precautions, with DOMC and foreign malaria personnel present, and under the supervision of a professional industrial hygienist with experience of the disposal method chosen. There must also be a knowledgeable clinician present equipped to treat any cases of intoxication which may occur during disposal or reprocessing.

4.4 Disposal of Empty Cartons

The unfortunate misconception persists among DOMC field staff that burning of empty cartons produce phosgene gas. USAID/Washington discussed the matter earlier this year with Dr. Jesse Hobbs, CDC, with American Cyanamid, and with Dr. Virgil Freed, Oregon State University. Their conclusions, set down in a USAID/Washington cable dated 9 April 1977, are worth quoting:

> "Malathion empty containers should be burned in small quantities well away from village. Burning should be complete and rapid if not allowed to smolder. People and livestock should be kept away from smoke. FYI -- according to Dr. Freed concern over phosgene gas arises when polyvinyl chloride is burned -- malathion is packed in polyethylene -- end FYI. If malathion boxes are buried possibility exists that shallow water table could be contaminated eventually contaminating wells."

DOMC should not enter into any new contractual arrangements for sale of

malathion cartons. Where such contracts have already been signed, malaria authorities should see to it that contractors are apprised of their responsibility for any consequences of failure to honor their terms. Cartons should be delivered to contractors wiped free of malathion, inside and out.

4.5 Compensation to Spray Personnel Taken Off Work

Implementation of the recommendations contained in 3.8 will certainly lead to spray personnel being taken off work from time to time. The present practice is not to compensate personnel for lost time. This may lead to concealment of symptoms on the part of personnel for economic reasons, with consequent underreporting of incipient cases and potentially unfortunate repercussions on DOMC.

On the other hand, full pay to spray personnel could lead to malingering. As a compromise solution, it is recommended that any spray personnel taken off work on grounds of suspected intoxication be placed on half pay for the duration of treatment.

5. Overall Conclusions

This writer finds DOMC in overall good compliance with safety standards pertaining to field use of malathion. Contingent on continued compliance with those standards and timely implementation of the recommendations contained in this and earlier reports, he recommends that USAID not discontinue assistance to DOMC on grounds of safety.

It is worth noting that the present report is the fourth report with original recommendations for DOMC to be written in the last twelve months. The other three are the original CDC report, the report of the external assessment team (EAT), and the report of Dr. Steven Miller, CDC chemist. It is no reflection on DOMC or the international agencies to point out that, absorbed as they are in reporting to their respective constituencies, they may have devoted less time than desirable to following up on individual points raised in various reports. These very expensive special reports can be cost-effective only if their provisions are carefully followed up. In respect to the CDC report, the Miller report, and the present report, it is recommended that AID/Islamabad detail Mr. Chaudhry Umar Hayat to follow up with DOMC on individual recommendations. The contents of these reports are largely administrative and logistical, and therefore well within the ambit of Mr. Chaudhry's competence. He can turn, as necessary, to AID and WHO technical people for guidance on technical matters, to Mr. H. B. Keller on loan questions, and to Mr. Khwaja S. Ahmad on matters relating to the Port of Karachi.

Follow-up on the EAT report must be the ongoing task of someone with a firm grasp of malaria from the technical side, probably from USAID, in order to fulfill the terms of the loan agreement.

6. Acknowledgements

This writer wishes to thank all of the USAID, DOMC and WHO staff who have assisted him in his work here. On the Washington side, special thanks must go to Mr. Lawrence Cowper, Technical Assistance Bureau, USAID. In Islamabad, timely advice and assistance were forthcoming from Mr. Walter Shurkin, USAID, and from Drs. Julian de Zulueta, WHO, James Martin, USAID, S. M. Mujtaba, DOMC, and G. Hashim Mallick, DOMC. Field tours were made in the amiable company of Messrs. Masud Siddiqui and Chaudhry Umar Hayat, both USAID/Islamabad, and Mr. Khwaja S. Ahmad, USAID/Karachi. Every courtesy was extended in the field by the three provincial malaria chiefs and their staffs, as well as by zonal and sectoral personnel in the field. To all of them go this writer's heartfelt thanks.

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Contract No. AID/ASIA-C-1237
Dated: April 25, 1977

MALARIA CONTROL PROJECT

Final Report

on

Evaluation and Redesign of the Project

by

Walter S. Shurkin
Malariologist
US AID/Islamabad

October 16, 1977

A. Purpose of Assignment

To assist the Mission with the evaluation and redesign of the malaria control program.

B. Statement of Duties

1. Assist the US AID with preparation of documentation required for second tranche of dollars 7.5 million of malaria loan funds which is scheduled for FY 1977.

2. Review and evaluate Government proposals for redirection of the program including alternate methods of malaria control, source reduction, mass radical treatment of fever cases in selected areas, and the addition of communicable disease control duties to the responsibilities of malaria workers in selected areas.

3. Assist the US AID in preparing program documentation needed to carry out any agreed upon amendments to the malaria loan.

4. Assist the Government in coordinating planning and start up activities in urban malaria control by Federal, Provincial and Local Governments to be procured in support of calendar year 1978 urban malaria control field activities.

5. All other duties as directed by the Mission.

C. Reports

1. The consultant will make oral reports to US AID on the progress of work during the course of the assignment. At the end of the period of assignment prior to departure from Pakistan, a written report of activities, accomplishments and recommendations, including further assistance needed for project development, shall be furnished to the US AID. Additional copies will be furnished to: (a) Two copies to the AID Reference Library, AID, Washington, D.C. 20523; (b) One copy to AID/ASIA/PD.

Introduction and Background

The Malaria Control Program is part of an on going effort started in 1961 and redesigned in 1974. The program was originally aimed at the total eradication of malaria in Pakistan by 1975. From 1961-67 the program was an outstanding success, reducing total malaria cases

in rural areas from an estimated 7,000,000 to 9,500 cases in 1967.

Resurgence of malaria became evident, particularly in the Punjab and Sind provinces by 1969. This resurgence was caused mainly by four factors: (1) Increasing resistance by the vectors to DDT (2) Unchecked urban malaria infiltrating back into malaria free areas (3) Lack of an organization in the permanent health services responsible for maintenance of malaria in areas freed of malaria (4) Severe reduction in the Malaria Eradication Program budget and manpower.

This situation deteriorated to such an extent that by 1973 it was estimated that Malaria had infected ten million people in Pakistan. Conditions were reported to be worse than in 1961 when the Malaria Eradication Program began. The slide positivity rate rose to 26.3% Even more alarming was the increase in the rate of the virulent form of plasmodium falciparum infections in relation to total malaria cases. Although no reliable statistics were available, it was estimated that thousands of Pakistanis died of malaria in 1974. The resurgence of plasmodium falciparum was of particular importance and concern because chloroquine resistance had been reported as near as Bangladesh.

In 1973 partly as a result of devastating floods in that year, Pakistan experienced a major epidemic of malaria in the Punjab and Sind provinces. The GOP became greatly concerned and in the summer and fall of 1973 held a series of meetings with the provincial officials to draw up a strategy and revise the 1961 original "Plan of Operation". These meetings, with the cooperation of WHO, GOP and provincial health officials, resulted in a five year extension, hereafter referred to as the Revised Plan of Operation (RPO) of the original fourteen year program. Because eradication was deemed to be impossible with resources available the program was renamed the Pakistan Malaria Control Program. The ultimate goal is to eradicate malaria in Pakistan when the economic and sanitary conditions, improved and sufficient resources are available.

The GOP requested US AID assistance in financing the substantial foreign exchange and local support costs of the program. After findings by a team of experts that the RPO would result in lowering the malaria rates to satisfactory control levels within three years, the US AID, in March 1975, approved a $35 million loan to finance 60% of the foreign exchange costs of the first three years of

Pakistan's Malaria Control Program. It was understood that AID would authorize the maximum amount from FY 1975 funds (Not to exceed $35 million) and then amend the authorization to provide the balance when additional funds become available. Accordingly, a loan of $20 million was authorized on June 30, 1975. In addition, a grant of U.S. owned Rupees equivalent to $25.3 million was approved.

The loan has been disbursed on a reimbursement basis. Foreign exchange amounts required for each year's purchase of imported insecticides have been committed and expended by the GOP: AID reimbursed the GOP for AID's appropriate share following the borrower's satisfaction of annual conditions precedent.

To date, AID has reimbursed $7.8 million for foreign exchange costs incurred for the 1976 spraying season, and plans to authorize an additional $8.0 million for reimbursement of 1977 spray season foreign exchange costs as soon as 1977 Conditions Precedent have been met. Thus a balance of $4.2 million in foreign exchange remains of the $20 million authorization. It is estimated that the GOP will require $13.4 million in foreign exchange to finance 1978 operations under the malaria control program. In addition to the $4.2 million available, approximately $3.8 million will be required to fulfill AID's commitment to finance 60% of the foreign exchange costs of the first three years of the program. Therefore, the Mission recommended that the authorization be amended to provide an additional $4.0 million.

Because of the delay in implementing the RPO in CY 1975 and CY 1976, and the decrease in actual costs of malathion, funds allocated for those years were not completely spent. The spraying period had to be extended two years if the target of control of malaria to an incidence of 500 cases per million population was to be met. In January 1977, the External Assessment Team recommended "that the GOP/US AID extend the period during which disbursements are made under the AID Loan 391-H-163 from three to five years i.e., from 1975/76 through 1979/80."

The Mission also recommended that an allotment of Rs. 120 million be made to the Mission, to be granted to the GOP, as reimbursement for local costs incurred in CYs 1977 and 1978. This would be part of the Rs. 250 million US $25.3 million approved in March 1975.

The above section has been taken from the "Recommendation for Amendment of Loan Authorization" of August 25, 1977 which the consultant helped to prepare.

The consultant during the contract period:

1. Prepared the monthly and interim safety reports.

2. Prepared memorandums of conversation of conference attended regarding malaria.

3. Prepared field trip reports regarding findings of safe spray operations. Effectiveness of spray operations and problems encountered.

4. Helped in the preparation of the "Recommendation for Amendment of Loan Authorization."

5. Gave support to Dr. Miller's efforts in his endevours setting up five laboratories for blood cholinesterse testing.

6. Prepared forms for use in spray safety monitoring and gave direction and guidance to AID personnel used to monitor the spray operations for conforming to recommenced safe spray procedures.

7. Kept the Mission informed on all aspects of the Pakistan Malaria Control operations.

8. Kept a constant contact with the DOMC and other malaria control officials.

9. Made recommendations to the DOMC and US AID on safe disposal of empty malathion cartons and unused Italian malathion.

10. Made frequent field trips to: (a) Monitor spray operations for safety and effectiveness (b) Uncover latent or potential problems which might affect the effectiveness of the Malaria Control Program. (c) Cathered epidemiological and entomological data in order to assess the effectiveness of the spray operations.

11. Reviewed COP documentation (plans of Action, Control of Urban Malaria, Proposed Malaria Research Center, and other documents relating to the Malaria Control Project), to determine whether these plans and documents would conform to the requirements of the Malaria Loan Agreement.

12. Attended the Provincial Coordination Committee meeting in Quetta, August 9-11 for the purpose of discussing 1977 progress made of all aspects of the MPC, and determining resources needed for the CY 1978.

Problems Encountered

1. Delayed Spray Operations:

Because of a series of events the 1977 spray operations was delayed in all provinces except for Baluchistan. The Sind province had the greatest delay. These delays were unfortunate as timing is of the essence if the spray is to be applied prior to the transmission season. Reasons for the delays are as follows:

(a) Late purchasing of insecticides because of changes of malathion specifications.

(b) Political disturbances which delayed off loading of insecticides and equipment for end use distribution.

(c) Lack of rail cars to ship insecticides and equipment and slow GOP approval to use trucks for distribution.

(d) Meeting of all safe spray recommendations prior to spraying. Protective clothing was not available for several weeks after planned spray operations were to start.

(e) Arrival of BHC on August 30, 1977 which precluded spraying in areas of the Sind province where BHC was scheduled to be used.

(f) WHO's and CDC's slow analysis of existing cyanamid malathion. Samples were taken in March and April but the results of the analyses were not available until the end of June. At that time, permission to use 1976 cyanamid malathion was granted.

All these delays were beyond control of the Malaria Control Program, but the time spent in the purchasing of insecticides and equipment could have been shortened if the DOMC had sufficient staff to carry out this assignment.

2. Urban Malaria

The plan for Urban Malaria Control was not approved until the end of July, a year and a half after it had been written. Heavy rains in Karachi had precipatated an epidemic of malaria. Muncipal resources were not able to cope with the situation. The WHO Sanitary Engineering Advisor, Mr. Tuazon was transferred to Islamabad to support the monitoring of safe spray procedures and was no longer available to advise the City of Karachi on engineering methods of malaria control.

The Special Covenants and Warranties Section, 4(a) of the Malaria Control Loan 391-H-163 states "The Borrower shall carry out the Malaria Control Program with sufficient man-power and funding so that both urban and rural malaria will be effectively controlled in Pakistan."

To accomplish this aim, an Urban Malaria Control plan was developed by the DOMC in collaboration with the Provincial Malaria Control officials and interested municipal agencies and approved in July 1977 by the GOP. This plan provides a budget to purchase equipment, supplies, larvacides and insecticides to be supplied by the GOP to the ninety-five municipalities over 25,000 population. The Provincial Malaria Control Official would supply technical guidance and would coordinate urban malaria control operations at the provincial level. Responsibility for the execution and funding of operational costs will, as in the past, rest with the municipal bodies concerned.

The DOMC is in the process of ordering equipment, supplies, insecticides and larvacides for distribution early in 1978. As of now, the provinces have not nominated or designated personnel who are to give the technical guidance and coordination to the municipal agencies involved. As of now, very little if any coordination has been established between the provincial officials and small muncipalities. A singular exception is the staffing of 23 activated passive case detection posts in Karachi hospitals and clinics by the Karachi Malaria Control District. These posts are averaging 3,000 blood slides per month. Bloods are taken from fever cases

referred by clinicians on duty. Cooperation between hospitals and clinics and the malaria control program personnel assigned to take blood slides is excellent. The number of blood slides taken at the activated passive case detection posts now exceeds that taken in normal active case detection operations by the Karachi Malaria Control District.

All persons sampled are given chemotherapy as prescribed by the clinicians. Large hospitals having Laboratory facilities to immediately stain and examine the blood slides for malaria parasites. A concerted effort is made to treat radically plasmodium falciparum cases fund. This has not been successful at the present time.

The plan for malaria control is based on long and short term control measures.

A. Short Term Measures

1. Larviciding
2. Adulticiding
3. Minor engineering works for source reduction
4. Case detection and treatment
5. Biological control of the vectors

B. Long Term Measures

Ultimate solution of the malaria problem by the elimination of the sanitary conditions which perpatrate and are conducive to the generation of vector breeding areas.

DCMC Staffing

The DCMC does not have sufficient staff to carry out its responsibilities of direction and guidance to the Provinces in their efforts to control malaria. The already overburdened staff were assigned new responsibilities over those which they already were unable to carry out. Spray operations monitoring by the DCMC staff was spordic and infrequent. Information regarding epidemiology, and operational progress was scanty and late.

The DCMC has four professions trying to cope with the responsibilities of advising and directing the Provincial Malaria Control activities, purchasing and distributing of $13,000,000 worth of equipment and insecticides, purchasing and distributing equipment and insecticides purchased with local currency, preparation of quarterly and annual reports, preparation of documents for the GOP and AID, preparation of budgets, scheduling and directing periodic meetings of provincial malaria control staff, monitoring of spraying operations for safe handling and procedures, evaluation of effectiveness of insecticides used, compilation of provincial epidemiological and entomological data, preparation and dissemination of health educational material, public relations activities to make known the scope and benefits of the malaria control and a myriad of other responsibilities.

To accomplish these tasks each staff member of the DCMC has been assigned two or more responsibilities many of which are not in the scope of the individuals training and experience. This overburdening and proliferation of duties resulted in very little being done effectively and timely.

Dr. Hashim Mallick, DCMC epidemiologist is also designated as safety officer and transport officer. As a Safety Officer, he should be in the field 75% of the time of spray operations, from June through October. I don't believe that he has spent over two weeks this year monitoring spray operations. Because of the myriad responsibilities he has been assigned at the DCMC his travel has been severely curtailed. He should be constantly making field visits and collecting epidemiological data so that timely evaluations of the effectiveness of malaria control activities could be made. He now depends on the Provincial Malaria Control staff to send him this data. Because of the nature of the bureacratical beast, transmission of reports and data is always late. The analysis of this data is usually too late to uncover potential or latent problems and take timely corrective actions.

The same could be said of the entomologist, Dr. Mujahid, Scientific Officer. Most of his time is spent in Islamabad. Dr. Mujahid spends most of his time at DCMC involved in the Logistics of the entomological activities of the Provinces.

The DCMC in order to meet its responsibilities listed above needs should review its responsibilities and evaluate past performance in the carrying of these responsibilities. Immediate steps should be taken to recruit personnel in those areas found not covered by existing personnel and for which the DCMC has prime responsibilities.

5. Technical Assistance

1) World Health Organization:

The Conditions Precedent A. 1. e., of the Malaria Loan Agreement specifies that the World Health Organization, at the Borrower's request, agrees to provide five malaria technical experts in fields such as malariology, epidemiology, program operations, laboratory administration and training. It was not until June 1977 that WHO recruited the above number.
Four of them are used in the monitoring of spray operations with emphasis on safe spray procedures. The WHO recruited three of the operations experts from the Pakistan Malaria Control Program. These men were then placed in the same province where they were previously working. The net result was no input of technical assistance into the program.

6. Safety

A major effort was made during the 1977 spraying season to prevent a recurrence of 1976's malathion intoxications and deaths. USAID was determined that if spray operations could not be executed safely, it would no longer support or associate with the program.

The success of this effort was far beyond expectations. No serious case of malathion intoxication was reported todate from any of the provinces. The GOP, WHO and AID constantly monitored spray operations for compliance with approved safety procedures. Orders were given that spray operations would cease if anyone was found in violation of these procedures. Spray operations were postponed from two weeks to a month until spray teams were supplied with protective clothing, impervious gloves, soap, and atropine was available in case of a case of a case of intoxication occured.

Five cholinesterase testing laboratories were set up for the Michel testing procedures and eighteen tintometric kits were distributed to the four provinces. Dr. Miller of CDC set up laboratories and trained personnel in the use of the Michel and Tintometric methods of blood cholinesterase level determinations. Dr. Baker also of CDC helped the Malaria Control Program set up cholinesterese testing schedules to determine baseline and subsequent levels of cholinesterase blood levels of spray team members. Dr. Baker scheduled that 10% of all spray personnel be tested prior to spraying and this control group be retested monthly throughout the spray season along with those workers suspected suffering from malathion intoxication. This proved to be impossible to accomplish with the number of trained personnel and tintometric kits on hand.

All malaria supervisors were trained to recognize physical symptoms of malathion intoxication and measures to take if a workman showed symptoms. Most of the supervisors were skilled in the injection of atropine, if not, then the suspect was taken to someone with expertise. Because the symptoms displayed by malathion intoxication are similar to many other ailments overtreatment resulted. As the treatment is benign there was no harm, with side or after affects.

AID/Washington was kept informed by monthly and special reports on the malaria control activities with special emphasis placed on safety.

The disposal of the 1976 Italian malathion has still not been resolved. The DCMC, at the writers recommendations, has contacted the Pakistan Department of Agriculture officials to determine if the insecticide could be reformulated and used for agricultural purposes. There has been no response at this time. Suggestions by CDC to neutralize with quicklime and burial were not appropriate for the large quantity to be disposed of and would have presented a grave health and environmental problem.

As stated previously, the prescribed safety procedures were adhered to, and constant monitoring and supervision by all concerned resulted in no serious reported cases of malathion intoxication. A remarkable record considering 1) the vast numbers of workers,

scattered throughout the country in primarily difficult areas to reach, 2) the high heats and humidities encountered by the workers when applying the malathion.

Integration

Integration of all vertical health programs, i.e., Malaria Control Program into the basic health services is the ultimate goal of the Pakistan health infrastructure. The integration, however, should be so paced that the vertical programs should be near the fulfilling of their objectives prior to the transfer of personnel and resources to an undeveloped or non-existent horizontal health structure. The process of integration should be a gradual one, starting with the confering of civil service status in the personnel of a vertical health program. Pilot studies are then made in specific areas where the vertical programs have reached or nearly reached their objectives. Vertical program personnel in these selected areas are given training in other health skills and existing basic health workers trained in the skills needed by the vertical program which is being absorbed. This transition continues until the entire area in which the vertical program is operating has reached the objectives designed for it. Before this is done, however, a fully developed plan, both technical and administrative, has to be made available. Personnel of both the vertical program and basic health services have to have close communion so that everyone knows their responsibilities and authorities in the new organization. This integration process is long, complicated and tedious and is usually accompanied by fear, frustration and hesitation by all parties concerned. It is a difficult task to accomplish even when all stumbling blocks are removed and conflicting responsibilities and authorities are resolved.

The North-West Frontier, Sind and Baluchistan provinces had already by 1976 administratively absorbed the Malaria Control Program into the health services by confering tenure and civil service status on the malaria personnel. The North-West Frontier Province had also developed a plan for functional integration of a number of areas where the malaria incidence was reduced to a manageable level and could be maintained by the basic health services given training and new responsibilities. This plan will be implemented late in 1977 and continue through 1978.

The Punjab Province on the 7th July integrated the Malaria Control Program both administratively and functionally into a Communicable Disease Center (CDC) which is part of the overal health services. In the integration, many trained malaria work were surplused and made available to other government organiz Responsibilities and authorities were not well defined and resul in confusion and loss of morale. Administrative procedures we not designed clearly designating how and by who had responsibil and authority to schedule work, make payments to personnel, casual labor and contracted services and supplies.

This integration coincided with the spray operation season and resulted in delayed payment of personnel and casual labor and reduced effectiveness of the entire spray operation. Casual lab was not paid for over two and one half months. There was no fu available to buy petrol so that supervision was hampered. Oper effectiveness was seriously reduced and the spray operations we delayed so that the second round of spray will, most likely not b complete.

A series of meetings were held between the Health, malaria offi WHO and AID staff to determine how to remove administrative road blocks which delayed supply, staff and casual labor payme Meetings were held in Lahore during the first week of October b the DCMC, Secretary of Health, Health Department officials, th Deputy Secretary of CDC and Punjab malaria control officials to determine how to release funds so that the second spray cycle w be restated. After the long delay, it is doubtful that the second spraying would be accomplished in time to prevent transmission of malaria. To spray after the middle of October when transmi is diminishing rapidly seems like a waste of insecticides, mone and manpower. The insecticides saved, by not spraying, could be used for the first 1978 spray cycle, which could then start pr to the first transmission peak (early June). Newly purchased insecticides would be distributed and ready for use long before the onset of the second transmission cycle peak in August.

The Laboratory analyses of 1975-76 malathion by both WHO and CDE in April 1977 showed that chemical deterioration did not oc as rapidly as expected and that the insecticidal properties of the

1975-76 had not diminished. There is no reason to believe that the 1976-77 malathion would not hold up as well. Because of the late start-up of the first cycle, high ratio-of refusal to spray and almost no second spray cycle in the Punjab, it is expected that sufficient insecticide will be available for use to fulfil the first 1978 spray cycle requirements.

Recommendations and Conclusions

As an adviser looking over a large complex program such as the Pakistan Malaria Control Program, a program which employs upto 25,000 people of various skills, experiences, talents and education or lack of these skills, it would be very simple to find a myriad of areas to suggest where the efficiency, effectiveness, and productivity of the program could be enhanced. To take this approach would have, in my estimation, a negative attitude and approach and complete disregard for the tremendous progress and impact the program has made in the economic and health environment of Pakistan. To expect perfection in an unperfect world using goals that are unobtainable even in highly developed countries is just wishful thinking.

The Pakistan Malaria Control Program has in the years 1976 and 1977 sprayed over 8.2 million houses annually and protected an estimated 47.6 million people from the ravages of malaria. The malaria slide positivity rate has gone down over 45% after the 1976 spray operations. Preliminary epidemiological data of the 1977 spray operations shown an even greater reduction of malaria. The falciparum vivax ratio has gone from 60% or better down to 5% or less in some areas. As a conservative estimate, tens of thousands of people are alive today and millions of people are well because of the Malaria Control Program.

Rather than recommending, as stated before, a myriad and large number of changes that would improve, to varying degrees, the Malaria Control Program, I would like to see improvement in the recruitment and training of technical and support personnel starting at the DCMC, Provincial and District Level which would improve all phases of the program.

Directorate of Malaria Control

The DCMC has the responsibility for direction, advising, evaluation and supplying the Provincial Malaria Control Programs with insecticides equipment and supplies. Only three persons are available to implement these responsibilities. Shortage of personnel is especially acute in the epidemiological and entomological fields. This shortage has resulted in slow and delayed reporting of project progress and results. Statistics and data are compiled at the district level forwarded to the Provincial level analysed and then mailed to the DCMC for analysis by the epidemiologist and scientific officer. A process which takes a month or more to complete. Latent and potential problems are not discovered in time for needed actions to be implemented. The DCMC should double its technical staff so that one of each discipline would be in the field at all times confering with their provincial malaria control counterparts, gathering and analysing statistics and data and recommending program changes as needed.

Provincial Malaria Control Centers

What has been said of the DCMC is also true at the Provincial levels. There should be improved coordination between District Malaria Control and the Provincial Control personnel. Staff should be strengthened so that supervision, consultation and gathering of data and statistics are constantly in progress.

The Provinces should also immediately recruit personnel needed to advise on and coordinate the urban malaria control programs in their respective provinces. Three months have elapsed since the GOP has approved the Urban Malaria Control Project, but because of personnel shortages very little has been done toward implementation.

This increase of personnel implies training of people for new responsibilities and skills. Curricula design, recruitment of trainers, selection of trainees and arranging for training facilities take long periods of time. The DCMC should start the process immediately if the additional personnel will be available as support in calendar year 1978 malaria control program.

Acknowledgement

The writer wishes to thank all of AID/W, USAID/Pakistan, DCMC, PMC, and WHO staff who have assisted and supplied him with necessary data and transportation needed to facilitate his work here. Special thanks must go to Mr. Lawrence Cowper, Mr. Edwin Smith, Dr. David Bennett of AID/W, Technical Assistance Branch.

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COWPER
TA/H (84)

REPORT OF MALARIA EXTERNAL REVIEW TEAM

December 1-20, 1975

ISLAMABAD, PAKISTAN

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I. Synopsis

The Government of Pakistan has undertaken a 5 year program to bring malaria infections under control. This program entails merging of malaria control methodologies with a developing system of general health services at the local level in each province. While each province has unique malaria problems and plans for the control of malaria, an attempt is being made to coordinate the 5 year program under the Directorate of Malaria Control.

During the past several years it appears that malaria incidence has increased in all areas of Pakistan to an estimated level of 5 million cases in 1975. Due to deficient and understaffed surveillance operations, precise data on the number of malaria case is not available in either urban or rural populations. In all provinces, many of the operational necessities for malaria control such as vehicles, sprayers, field workers, and insecticide are insufficient to launch a comprehensive program. The larger urban areas of Pakistan, in particular Karachi, have serious levels of malaria transmission. Improper sanitation practices and inadequate sewerage systems are the predisposing factors to malaria in the cities. The attempt to control malaria in urban areas in previous years has been pragmatic. Correction of these problems will require coordination among the responsible jurisdictions in the cities as well as participation of technical experts in sanitation, vector control, and water management.

The concept of integration as applied to the merger of malaria control and health services has several implications. Among the basic issues to integration is the demand for permanent status as a part of the health system for malaria workers. This issue should be resolved promptly at the provincial level. In a broader scope, it is recognized that until the general health services develop at the local level, malaria control may be difficult to attain or sustain (refer to Section 5.4).

At present, comprehensive plans for malaria control have been developed by the national malaria program and each province except the Sind. In the Sind, strong efforts must be made to assess the malaria problem and generate a workable plan. All provinces must reevaluate the current status of malaria and its vectors so that the malaria control activities will be effective.

In monitoring the progress of malaria control it is suggested that observations be focused on the subsector. This unit is of sufficient magnitude to document changes in the critical elements of malaria control: (1) surveillance, (2) spraying operations, and (3) integration of general health services.

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2. Introduction and Terms of Reference

The joint agreement signed on October 10, 1975 by the Government of Pakistan and USAID stipulated that external review teams should regularly assess the progress that had been made toward the renewal of malaria control activities in Pakistan. Originally the loan agreement was to have been signed in late 1974, and the external review would have been an assessment at the end of the 1st year of operation. Therefore, the external view, 1-21 December, 1975, was requested by the two governments to review the current status of malaria control operations and planning. The team members were:

1. Dr. Ghulam Hashim Mallick NMCP/Pakistan - Epidemiologist
2. Ch. A.A. Mujahid NMCP/Pakistan - Entomologist
3. Dr. Imtiaz Hussain Shah NMTC/Lahore - Malariologist
4. Mr. Rashed Bahar WHO/EMRO - Sanitary Engineer
5. Dr. Carlos Campbell USPHS/CDC - Epidemiologist
6. Mr. Roger G. Grenier USAID - Entomologist
7. Dr. L.A. Simeonov WHO/EMRO - Public Health Advisor.

The objectives of the Malaria Control Program (MCP) in Pakistan were generally stated in the 5-year plan of action dated 22 November, 1974.

(1) To apply a malaria eradication strategy which should conform with WHO revised strategy of the global malaria eradication programme envisaging conformity with the socio-economic conditions including the present health structure of the country and with due consideration to the epidemiological features of malaria in the various areas of Pakistan.

(2) To continue to apply simultaneously anti-malaria measures in all malarious areas of Pakistan with a view to reduce its endemicity progressively until the ultimate goal of malaria eradication is attained.

(3) To strengthen the basic health services through the timely absorption of malaria personnel into the general health services without jeopardizing the effectiveness of the anti-malaria program in reaching its ultimate goal of eradication.

The team interpreted the stated objectives as a control program for malaria. Inherent in the concept of control is the recognition that the newer, non-time-limited methodologies must be devised and rationally implement; specifically the renewed application of malaria eradication

methodologies over a prolonged, undefined time interval would not be feasible. Additionally, the control program was to be administratively and functionally merged with general health services in Pakistan. The team understood that this planned integration was being implemented.

Terms of reference supplied to the external review team were:

(1) begin the evaluation mechanisms for the Malaria Control Program, (2) assess the current malaria situation, (3) determine whether plans for the control of urban malaria and the integration of malaria control into general health services were proceeding satisfactorily (USAID cable # 8658 dated September 4, 1975).

The team focused attention on these specific guidelines. In addition, other issues integrally involved with the plans for malaria control were observed, and comments about such matters will be included when appropriate. Recent excellent documents form both the national malaria program and by international malaria authorities were utilized by the team. Several of these documents will be referred to particularly when they contain more detailed informations than this review group could collect during a 3 week visit.

The observations and suggestions contained in this report are intended as a constructive over view of the immense challenge posed by malaria control in Pakistan.

3. Background of Malaria Eradication Program;

Malaria eradication was initiated in Pakistan in 1961 according to the Plan of Operation prepared in consultation with WHO and USAID. The operation was entrusted to an autonomous organization under the Malaria Eradication Board (MEB) created by the Malaria Eradication Ordinance of 1961.

Malaria eradication measures were implemented progressively by stages to cover all of the country in eleven years. The operation was considered successful upto 1967 when the annual parasite rate fell below 1%. However, technical and administrative problems developed, namely the resistance of the vector(s) in some parts of the country, endemic malaria in urban areas, a premature shift of some zones from the attack to the consolidation phase and a lack of funds. Beginning in 1969, malaria cases increased over the entire country.

All health activities were decentralized in the country during 1970 so that the provincial health departments have since assumed full responsibilities for planning and implementing their health schemes. However, the malaria organization maintained its activities vertically under the

MEB according to the 1961 ordinance. During 1971, at the request of GOP, a review team visited the country to formulate a new strategy for the anti-malaria campaign.

The transition period between 1972 and 1975 was followed by the repeal of the MEB Ordinance and the anti-malaria program was placed under the responsibility of the respective Provincial Health Departments. Between 1973 and 1975, a series of meetings were held at the Federal level to formulate an extended Plan of Operations (Plan Ops) for the anti-malaria program. The extended plan was prepared and approved by a Governor's Conference (Provincial Coordination Committee) in November, 1974. In January 1975, the Plan Ops was accepted by the Executive Committee of National Economic Council (ECNEC). On the basis of this extended Plan of Operations, the GOP and USAID signed a loan agreement on October 10, 1975. Meanwhile, the number of malaria cases reached an epidemic level.

4. Method of Review

The team was divided into 2 groups with equal representation of external and national members. Each group visited 2 provinces during a 10 day period. The itinerary of the 2 groups is detailed in Annex A.

At the malaria provincial, regional and zonal offices visited, the responsible officials presented a short briefing on past and present malaria operations and problems; discussions were held with the responsible technical staff members concerning the technical and operational problems, urban malaria plans, integration, recording and reporting systems, training manuals, vector density studies, susceptibility tests, timing of spraying operations, laboratory procedures and time-lag, and questionaries were completed for surveillance and spraying operations. The technical and administration sections were visited at the three office levels where information and data were obtained concerning staffing, vehicles, spray pumps, G.R. data, insecticides, microscopes, spare parts for vehicles and pumps, etc., House cards were checked in several houses in the sub-sector localities visited and attempts made to locate Malaria Supervisors to observe their work procedures. Some units such as civil dispensaries and hospitals were also visited. The Punjab and NWFP were the only provinces to provide the team with the required technical briefing data for 1975. Reports and other documents utilized by the team are noted in the bibliography (Annex B).

5. Findings.

5.1. Surveillance

Under the guidelines of the malaria eradication program conducted in Pakistan, parasitological and entological surveillance activities adhered to the world-wide eradication pattern. All surveillance operations were based on accurate geographical information which permitted "total-coverage" either in insecticides spraying or malaria case detection and treatment.

The primary objective of malaria surveillance was to document when transmission was interrupted. Entomological surveillance was initially developed in order to determine the time and space distribution of the Anopheline vector(s) as a basis for insecticide spraying. With the emergence of DDT resistance, accurate surveillance assumed increased importance.

As the malaria operation adopts the control philosophy, it is important to review the surveillance systems currently in operation, the data which these systems have produced, and finally to consider the surveillance requirements for the 5 year program beginning in 1976.

5.1.1. Surveillance Unit.

Each province has been divided into subsectors as the basic unit of surveillance and operations. These subsectors correspond to an approximate population of 12,500. The most recent updating of the basic geographic and census data in each province is summarized:

	PUNJAB 1974	SIND 1973	NWFP 1975	BALUCHIS-TAN 1974/75	PAKISTAN 1974/75
Zones	19	8	8	2	37
Sub-Zones	-	-	-	3	3
Sectors	140	68	49	40	297
Sub-sectors	2,044	561	625	212	3,442
Localities	26,643	7,371	5,659	5,359	45,012
Houses	6,678,509	1,425.298	1,612,707	330,860	10,047,374
Rooms	19,826,746	4,310,233	4,958,952	898,166	29,994,097
Population	31,648,553	7,141,219	7,810,845	1,512,797	48,113,414

Each province except the Sind has attempted to stratify their zones or subsectors according to the malariogenic potential and operational feasibility. Only in Baluchistan have operational decisions been made based upon this stratification; and on close examination only the operational feasibility (i.e. access, weather, etc.) varies demonstrably among the areas.

5.1.2. Surveillance Operations

During 1975 active surveillance for malaria cases has occurred principally through monthly cycles of active case detection (ACD) in the provinces. The ACD was conducted exclusively in rural areas. In the Sind, less than half of established subsectors submitted malaria slides. Lack of transportation and supervision severely limited the surveillance of malaria in Baluchistan. Only in NWFP and the Punjab did adequate geographical ACD coverage exist during the current year. Activated passive case detection (A-PCD) based in health units fuctioned in some remoter area of Baluchistan, in the periphery of Peshawar City (NWFP) and in the Thatta district of the Sind (as will be described).

5.1.3. Malaria Cases, 1975

Province	Population	Slides examined*	P. vivax	P. falciparum
Baluchistan	1,512,797	24,928	120	88
NWFP	7,810,845	512,424	9,256	410
Punjab	31,648,553	1,571,788	75,718	22,718
Sind	7,141,219	12,914	16	67

* Total to August, except in NWFP where September is included.

The blood slide examination rates (BER) in the Sind and Baluchistan are very low and no conclusions concerning the incidence of malaria in these areas are justified. Evidence from the NWFP and the Punjab indicates that malaria rates are increased in 1975; in The Punjab, most zones have reported a higher incidence of P. falciparum cases in 1975 and there has been a dramatic rise in both species of malaria in NWFP during August and September.

5.1.4. Entomological Surveillance, 1975

Recent information concerning vector density by season is lacking in all provinces except for the Punjab. The most recent relating to vector susceptibility are summarized:

Province	No. of zones	Total Tests	DDT				DLD				Malathion			
			S	T	R	Total	S	T	R	Total	S	T	R	Total
Punjab	19	249	0	22	66	88	35	64	62	161	Vector species were susceptible to all			
NWFP	8	253	2	24	66	92	8	16	63	87	74	0	0	74
SIND	Thatta	16	1	1	10	12	4	0	0	4	No tests.			
Baluch.	Quetta	14	0	0	5	5	3	1	5	9	No tests.			
	29	532	3	47	147	197	50	81	130	261	74	0	0	74

* S=Susceptible T = Tolerant R = Resistant

While these data are not as adequate in the Sind or Baluchistan, they are consistent with previous reports. The history of the development of resistance by the vector species in Pakistan is clearly presented by G.R. Shidrawi. EMRO Entomologist, in his report dated February 1975. The problem of vector resistance to DDT and BHC in Pakistan was also brought to the attention of the program officials in a report by an internal review team during 1971 and which also recommended that Malathion should be used in the spraying operation in DDT and BHC resistant areas. Resistance to both BHC and DDT appear to be uniform.

5.1.5. Surveillance plans for 1976.

The 4 provinces vary noticably in their plan of surveillance operation for 1976. The Punjab and NWFP will retain a vertical malaria reporting system emphasizing ACD rounds throughout most of the year. The primary objective in these areas will be to increase supervision at the subsector level and to establish ACD in those areas currently lacking such reconnoissance. In the NWFP, activated-PCD in urban areas will be established. In Baluchistan those subsectors with low transmission potential will be surveyed twice annually for parasite rate in addition to activated-PCD available through a health post. The more malarious area of Quetta zone will be under ACD coverage.

At present the projected surveillance plan for the Sind, exclusive of Thatta, are not available in sufficient detail to consider their adequacy. It is not clear whether malaria surveillance as a vertical activity will be rejuvenated for an interim period, or whether the centre operation will evolve from 1976 under the general health services.

5. 1. 6. Summary

The success of a well-integrated malaria control program in Pakistan will depend upon the precision of parasite and vector surveillance The essence of surveillance in a control operation is basic, accurate reporting from subsector and locality levels of the program. Total coverage by any single control methodology is no longer financiilay or logistically realistic. Based upon documented local malaria characteristic the most efficient and economical program for each area can be constructed. It is not essential that provincial surveillance systems be identical. Malaria transmission characteristics vary considerably among zones, and surveillance systems should adopt to local conditions.

Guidelines for malaria surveillance are well presented in the National Plan of Operation. Stress is given to the development of PCD, not only on an activated basis in health posts, but also as a voluntary collaborator basis. Development of PCD in all provinces will be necessary to provide immediate therapy for parasitemias during peak transmission and to increase time coverage in surveillance operations. The following specific details of surveillance should be considered in the coming year.

A. Irrespective of whether malaria operations remain as a vertical operation or are integrated under the General Health Services, a current census must be maintained at the subsector level. This census should permit the calculation of malaria rates and meet the specific operational requirements.

If the stratification of provinces into high, medium, and low malariogenic potential is to be employed, precise definition of each parameter must be given. Otherwise it may be preferable to consider each subsector as an individual unit.

B. Only the Punjab currently has a provincial epidemiologist. If planning for 1976 surveillance activities is to proceed, the vacancies in other 3 provinces must be filled with qualified individuals. Until these planning capability is available in the provinces, the DOM should extend epidemiological assistance.

Under the technical direction of the malaria control program surveillance programs must be developed in all urban areas. PCD with full geographical coverage extending into slum zones is important.

C. Particular attention must be given to surveillance in the Sind. With the MCP dormant for the past 2 years, historical data cannot be trusted for planning. The Thatta system of a public health worker per 10,000 population, when functional, could provide reliable data. If operational decision are made before base line data is collected, much time and money may be lost. Unless the vacant posts in the other subsectors are filled with trained malaria personnel, no adequate surveillance operations or reliable base line data will be possible.

D. The objectives of the malaria control program in Pakistan must be defined with clear epidemiological parameters. Such parameters should be based upon adequate geographical and temporal surveillance for malaria cases and a systematic epidemiological analysis of these data.

5.2. Malaria Control Program

5.2.1. Plans of Action for 1975-76

As required by the Plan of Operation for an Extended Malaria Eradication Program and upon request by the DMC, the four provincial offices submitted separate Plans of Action for 1975/76. The DMC, WHO and USAID approved the plans for the Punjab, Baluchistan and N.W.F. Provinces whereas the plan for the Sind was not acceptable. The team has not been provided with a Plan of Action for Azad Kashmir although the revised Plan of Operation does mention that malaria control work will be started in this area.

5.2.2. Spraying Operations

Emergency spraying operations were carried out to protect the population against the ravages of malaria this past year.

SPRAYING OPERATIONS REPORT FOR THE YEAR 1975 (10)

Province	Existing Houses	Sprayed Houses	Insecticide Type used	Dosage Gm/M	Houses % of spray coverage
Punjab	6,678,509	2,265,799	BHC/DDT	0.3/2.0	34.0
NWFP	1,612,707	744,917	BHC/DDT	0.4/2.0	46.8
Sind	1,425,298	38,591	BHC/DDT/ MAL	0.3/2.0/2.0	2.7
Baluchistan	330,860	88,326	BHC/DDT	0.3/1.0	37.5
	10,047,374	3,137,633	-	-	31.2

Insecticide supplies provided to the Punjab, Baluchistan, N.W.F. Provinces were fully consumed, whereas the Sind province was unable to utilize their allotment because of the non-availability of operational funds.

SPRAYERS (DECEMBER 1975) (10)

Province	No Assigned (Allocation)	No. Working	+ No. Repairable	No. Operational	No. Deadlined	No. Procuremer
Punjab	8,000	-	-	4,700	-	3,500
	(8,141)*	(3,899)	(3,477)	(7,376)	(765)	-
Sind	2,901	-	-	2,000	-	600
	(3,001)	(1,370)	(1,336)	(2,706)	(295)	-
NWFP	3,172	-	-	2,000	-	1,200
	(3,172	(1,546	(326)	(1,872)	(1,304)	-
Baluchistan	570	-	-	450	-	-
	(646)	(260)	(196)	(456)	(190)	1,000
A. Kashmir	0	-	-	0	-	0
TOTAL:	14,643	(7,075)	(5,335)	9,150	(2,454)	6,300
	(14,960)			(12,410)		

*The numbers enclosed in parantheses were obtained from Provincial reports whereas the others were provided by the NHQ briefing paper.