PD-AAT-122

ISN 14593

A.I.D. EVALUATION SUMMARY - Part I

BEFORE FILLING OUT THIS FORM, READ THE ATTACHED INSTRUCTIONS)

004210

A. REPORTING A.I.D. UNIT (Mission or AID/W Office) (ES # 2)

B. WAS EVALUATION SCHEDULED IN CURRENT FY ANNUAL EVAL. PLAN? ☒ yes ☐ slipped ☐ ad hoc

C. EVALUATION TIMING ☒ interim ☐ final ☐ expost ☐ other

D. ACTIVITY OR ACTIVITIES EVALUATED (List the following information for project(s) or program(s) evaluated; if not applicable, list title and data of the evaluation report.)

Project #	Project/Program Title (or title & date of evaluation report)	First PROAG or Equivalent (FY)	Most Recent PACD (mo/yr)	Planned LOP Cost ('000)	Amount Obligated to Date ('000)
391-0472	Malaria Control	1982	9/30/1987	41,000	35,500

E. ACTION DECISIONS APPROVED BY MISSION OR AID/W OFFICE DIRECTOR

Action(s) Required	Name of Officer Responsible for Action	Date Action to be Completed
To implement major recommendations.	1. Mr. A.A. Mujahid, Director Dte. of Malaria Control MOH Government of Pakistan 2. Dr. Rifaq Ismail, Project Officer, MCP II	Preliminary achievement by 10/1/86 but continued implementation for the duration of project

(Attach extra sheet if necessary.)

F. DATE OF MISSION OR AID/W OFFICE REVIEW OF EVALUATION mo. October day 21 year 1985

G. APPROVALS OF EVALUATION SUMMARY AND ACTION DECISIONS:

	Project/Program Officer	Representative of Borrower/Grantee	Evaluation Officer	Mission or AID/W Office Director
Signature				
Typed Name	Dr. Rifaq Ismail	Dr. Bano Agha	Mr. W. McKinney	Mr. Eugene Staples
	PO, MCP II USAID, Islamabad	DDG(PH), MOH	Prog. Officer USAID/Islamabad	Director, USAID Islamabad
Date				

H. EVALUATION ABSTRACT (Do not exceed the space provided.)

The 5-year (1982-87) Malaria Control II Project (391-0472) provides U.S. $41 million grant to assist the Malaria Control Program (MCP) Pakistan. The Primary goals are: (1) to maintain a low level of malaria incidence at no more than 500 cases/million population; and (2) to convert the program, formerly based on evaluation strategy relying exclusively on house spraying with an insecticide, to one of control which emphasizes the use of various control methods including the depletion of the parasite reservoir through case detection and treatment, to be implemented by an integrated staff of malaria workers and general health services.

The purposes of this mid-project joint USAID and WHO evaluation, held from 10/6-24/85, were to assess the present status of the MCP and to formulate recommendations for further improvement of the program. The evaluation teams visited the 4 provinces and reviewed district and provincial data compiled for the teams.

Operationally, the team found the MCP to be in transition from eradication precepts to one based on the use of control methods selected on the basis of local epidemiologic conditions and available resources. While progress was noted in many areas, the team also found significant problems including a rising incidence of malaria which in 1984 was at least 2 times the program goal; an increase in falciparum malaria from 17.4% in 1982 to 33.3% of the total cases in 1984; continued weaknesses in malaria surveillance operations and recent emergence of 2 major technical problems - chloroquine resistant falciparum malaria and malathion resistant vectors.

The team also identified major needs to intensify operational research and train personnel at all levels particularly the staff of the PHC service, on malaria control methods. A series of recommendations were made by the team to further improve program operations.

I. EVALUATION COSTS

1. Evaluation Team

Name	Affiliation	Contract number OR TDY Person Days	Contract Cost OR TDY Cost (US$)	Source of Funds
1. Mr. Larry Cowper	AID/W	25	Rs.56,000 $400	O.E.
2. Dr. G.P. Georghiou	U/California	20	Rs.55,000 $6,600	ESF Project Funds
3. Dr. W. J.O.M. van Dijk	WHO Malariologist	-	N.A.	WHO Sponsored
4. Dr. I.H. Ismail	WHO Entomologist	-	N.A.	WHO Sponsored
5. Dr. Imtiaz H. Shah	GOP Malariologist	-	N.A.	GOP Sponsored
6. Dr. Ghulam Hashim	GOP Epidemiologist	-	N.A.	GOP Sponsored

2. Mission/Office Professional Staff Person Days (estimate)

Dr. William Chin	USAID/L.T.A.	25
Dr. Rifaq Ismail	Proj. Officer, MCP II USAID/Islamabad	35
Ray Martin	Chief/HPN USAID/Islamabad	18

3. Borrower/Grantee Professional Staff Person-Days (estimate)

DOMC - 30

GOP/Provincial personnel - 30

A.I.D. EVALUATION SUMMARY - Part II

SUMMARY OF EVALUATION FINDINGS, CONCLUSIONS AND RECOMMENDATIONS (Try not to exceed the three pages provided)

Address the following items:

- Purpose of activity or activities evaluated
- Purpose of/reason for this evaluation
- Key issues or questions addressed
- Types and quality of evidence used to assess short-term effects, trends and/or potential for impact
- Findings
- Conclusions
- Principal recommendations

1. Office of HPN/USAID initiated the evaluation as part of annual evaluation program designed in the Malaria Control II (391-0472) Project.
2. The purposes of this joint WHO/USAID external evaluation, held from October 6 to October 24, 1985 were to: (1) assess the present status of the MCP Pakistan, with an emphasis of progress made to meet program objectives, and, (2) formulate recommendations for the further improvement of the program.
3. The team used annual and special reports of the MCP, both provincial and federal of the WHO and of the A.I.D. during this evaluation. Specifically, the team was requested by the MCP to evaluate the following areas of its program:

Current status of the provincial MCP with emphasis on efficiency of surveillance operations; current status of integration of the MCP into the primary health care (PHC) service; adequacy of planning and efficiency of spray operations; suitability of a continued sole reliance on malathion for use in the MCP by the assessment of significance of early emergence of vector resistance; current status of the chloroquine resistant falciparum malaria problem; malaria control activities in urban areas; and, adequacy of operational research and training capabilities and facilities.

Since 1979 when the total reported cases reached the lowest level for the past 10 years, there has been a slow but steady increase in the annual cases which in 1984 were reported as 72,996 a level of approximately 2 times the program goal. More significant was the finding that the increase in malaria cases is due to a large extent to an increase in cases of falciparum malaria which increased from 17.47% in 1982 to 33.3% of the total reported cases in 1984.

4. The anti-malaria activities in Pakistan rely on two major technical tools - spray operation and surveillance. The team recognizes the need to decrease the reliance on insecticide usage as a major control method. However, the present high level of parasite reservoir coupled with a weak surveillance system would indicate that aggressive anti-vector measures must remain an essential strategy for the MCP in Pakistan for the foreseeable future. The major difference in the present spray operation as compared to the past is the selection of spraying sites by criteria rather than on a total coverage basis. This stratification has evolved over several years as the program progressed. Surveillance remains a weak activity of the MCP and is in need of continued improvement in order to provide reliable epidemiological information to guide program activities, including the targeting of spray operations.

5. Findings:

There are two major technical problems confronting the Pakistan malaria control effort - chloroquine resistance in P. falciparum and insecticide resistance in the vectors. The general finding of the team was that chloroquine resistance is presently an operational problem in limited areas of the Punjab province and requires the closest watch, intensive studies and additional control measures in order to keep this problem from getting out of hand. Insecticide resistance is an equally serious and urgent

SUMMARY

problem as there are strong indications that malathion is not as effective as in previous years in some districts of the Punjab and Sind provinces. Prior to the replacement of malathion, the sole insecticide used by the MCP. Currently, the team emphasized the need to fully justify the change with compelling evidence, both entomologic and epidemiologic that malathion no longer accomplishes the desired objectives.

The need for more in-country training for all categories of staff is continually highlighted in the report. The report recognizes the important role of the National Malaria Training Center (NMTC). A training plan and support for such training are essential in the orientation of personnel within the general health services to a malaria control concept. Operational research to keep abreast of the dynamic malaria situation was strongly supported by the team and specific projects are described in the report.

No public service program is possible without the operation and support of the community. The proposal to include a major community participation effort through use of volunteers, increased health education and mass media, is strongly supported by the team.

6. Conclusions:

Based on the observations of the team, it is apparent that operationally the MCP Pakistan is in a state of transition from the rigid comprehensive house spraying approach of the eradication era to one of flexible application of alternative control methods based on local epidemiologic conditions and available resources. From the assessment of the objectives of the MCP and the USAID project, the team concluded that the program progress is variable as might be expected, but there has been achievements in many fields - laboratory services, passive case detection and others. When one considers the field difficulties of implementing such a massive health program over a population of some 85 million, it becomes obvious that a major effort has been made and accomplishments can be shown. There is much more to do in the years ahead, but a working base is available to provide the level of malaria control desired by the country it supports is provided as planned in the basic operational documents.

7. Recommendations:

Efficiency of a malaria control program is dependent on the availability of reliable epidemiologic data to guide its operations, a technically competent senior staff to modify control measures as required and a well-trained and well-motivated field staff to implement the program. To assist the MCP in improving its program operations, the following recommendations were made under areas of program operations as under:

a. Epidemiology

Reporting of malaria cases should be by sprayed and unsprayed areas; the development of out-reach preventive medical teams like those established in Punjab for active case detection should be encouraged; and, training of PHC personnel on passive case detection is essential.

b. Laboratory Services

Decentralization of malaria smear examination should be through supplementation of retrained laboratory technicians/assistants as microscopists and not through the reassignment of existent microscopists.

c. Operational Entomology

Filling of vacant assistant entomologist post is essential; annual meeting of MCP entomologists to discuss fundings and review work plans should be encouraged; evaluation of impact of spraying by pre and post spray serial entomologic and

parasitologic monitoring in fixed indicator villages is important; and, annual work plan should be developed and coordination with district health officer is essential to justify funding requirements for field work.

d. Insecticide Resistance

Improve efficiency of resistance monitoring by:

Verification of resistance in progency of survivors; proper selection of localities to evaluate resistance; strengthening of susceptibility testing in NWFP, Sind and Baluchistan; use of bioassay tests as part of standard resistance monitoring method; and, intensive studies in areas with insecticide resistance and increasing malaria transmission.

e. Spray Operations

Retraining of malaria (CDC) supervisors must be conducted annually; intensify cholinesterase testing to monitor passive insecticide toxicity problems in spraymen; modify spray planning criteria to include only indigenous cases of falciparum malaria; and, adjust timing of spray operations to epidemiologic needs and include need for focal spray in annual spray plan.

f. Chemotherapy

Intensify monitoring activities of chloroquine resistant falciparum malaria by use of WHO micro-in-vitro test; evaluate alternative antimalarials; evaluate wider use of primaquine as part of falciparum malaria containment strategy; intensify vector control activities in areas with chloroquine resistant falciparum malaria transmission; and, evaluate radical treatment for vivax malaria.

g. Urban Malaria

Develop and implement training plan for urban malaria control staff; provision of supplies and commodities to urban centers from federal MCP through provincial MCP; a work plan must be developed if urban centers are to receive assistance; the federal MCP should develop plans for technical assistance to urban centers; and, provincial MCP personnel should conduct malaria surveys in urban fringes at least once/year until surveillance mechanisms are fully developed by the urban centers.

h. Operational Research

Evaluation of vector bionomic and behavior under various ecological conditions; further clarification of role of A. stephensi as malaria vector in rural areas is essential; studies on selective spraying (concentrating spraying to known preferred resting sites), are important; study is required to define the role of suspected vectors in malaria transmission; evaluate alternative methods of vector control; and, studies are greatly needed to improve surveillance operations.

i. Training

Intensify retraining of PHC personnel ensuring adequate provisions for travel and board and lodging of trainees; "back to basics" for MCP staff at all levels should be stressed; the recruitment and provision of long term training for future entomologists and malariologists must be viewed as an action of the highest priority; and, conduct workshop on alternative malaria control methods in 1986.

j. Integration and Community Involvement

Until system of CHWs is fully functional, develop use of village volunteers for malaria detection and administration of presumptive treatment.

ATTACHMENTS

K. ATTACHMENTS (List attachments submitted with this Evaluation Summary; always attach c of full evaluation report, even if one was submitted earlier.)

1. Copy of Evaluation Report

MISSION COMMENTS ON FULL REPC

L. COMMENTS BY MISSION, AID/W OFFICE AND BORROWER/GRANTEE

The Mission has been briefed and discussed this evaluation with the Evaluation Team. Dr. Rifaq Ismail and Dr. William Chin of the Office of HPN will be following up with the Government of Pakistan on the recommendations and conclusions set out in the Evaluation Report. We find the report to be a well balanced presentation of the current state of the Government's Malaria Control Program. Continued monitoring of the program will be provided by the Project Office and Malaria Control Advisor.

XD-AAT-122-A

ISN 44574

REPORT OF THE

EXTERNAL REVIEW OF THE PAKISTAN MALARIA CONTROL PROGRAM

October 6, 1985 - October 24, 1985

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October 24, 1985

Islamabad, Pakistan

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FACE SHEET EXTERNAL EVALUATION REPORT : 1985

October 6 - 24, 1985

Basic Project Identification Data

1. Country — Pakistan
2. Project Title — Malaria Control II
3. Project Number (Grant and Loan where applicable) — 391-0472 (Grant)
4. Project Dates:
   - a. First Project Agreement — May 19, 1982
   - b. Final Obligation (last) — August 23, 1983
   - c. Project Activity Completion Date (PACD) — September 30, 1987
5. Project Funding:
   - a. AID Bilateral Funding (Loan or Grant) — GRANT $41,000,000
   - b. Other Major Donors — 1. World Health Orgn. 2. Japanese Govt.
   - c. Host Country Counterpart Funds — Rs.414,070,000 $39,699,904 @ Rs.10.43 $1.

   Total --- $80,699,904
6. Mode of Implementation (Specify contractual arrangements and numbers) : 1) PSC-1; 2) Invitational Travel - 1
7. Responsible Mission Officials:
   - a. Mission Director — Mr. Eugene S. Staples
   - b. Project Officer — Dr. Rifaq A. Ismail
8. Previous Evaluation and Reviews (include title, type and date): External Evaluation Part II - Sept.12-30, 1983
9. Cost of Present Evaluation:

		Amount Committed Rs.	$
a. Direct hire:	Larry Cowper	56.000	400
b. Contract:	Dr. G. P. Georghiou	55,000	6,600
c. Other (invitational travel)	Nil	111,500	7,000

I. EXECUTIVE SUMMARY

The purposes of the External Evaluation of the Pakistan Malaria Control Program (MCP) held from October 6-24, 1985 included: (A) to assess the present status of the malaria control program with an emphasis on the progress made to date to meet program objectives within the available resources; and, (B) to formulate recommendations and guidelines for further improvement of the program. A detailed scope of work was provided to guide the evaluation. The team consisted of World Health Organization (W.H.O.), Agency for International Development (A.I.D.), and national malaria specialists who reviewed available documentation at federal, provincial, district (zone) and, in some cases, municipality levels in all four provinces as well as at the Directorate of Malaria Control (DOMC) in Islamabad. The team was assisted in their field observations by senior DOMC officers and provincial officials. A proforma prepared by the DOMC and provided to the provinces served as the basic working document to standardize the province and district data presentations. A final report was prepared and presented by the team to the Government of Pakistan (GOP) on October 24, 1985.

The report and the recommendations provided were prepared with the intent of improving the existing program and assisting it to meet its stated program targets and objectives. It was with this spirit that the team took on the difficult task of evaluating this complex program which has great importance to the social and economic development of Pakistan.

The rise of reported malaria cases in the period 1981-1984 from 37,923 to 73,996 is a matter of concern. More importantly, P. falciparum has risen from 13.32% to 33.39% of the detected total positive slides. There are provincial differences as to the P. falciparum rise, but its major increase during 1981-1984 occurred in Punjab province. The reasons for this rise of malaria and especially the increase of P. falciparum formed the technical platform upon which the evaluation was based and which are reviewed in detail in the report.

The anti-malaria activities in Pakistan rely on two major technical tools - spray operation and surveillance. The team recognizes the need to decrease the reliance on insecticide usage as a major control method. However, the present high level of parasite reservoir coupled with a weak surveillance system would indicate that aggressive anti-vector measures must remain an essential strategy for the MCP in Pakistan for the foreseeable future. There are alternative control methodologies being used such as larviciding and ultra low volume (ULV) applications in some urban situations but the major control efforts remain similar to the procedures used in the past. The major difference in the present spray operation as compared to the past is the selection of spraying sites by criteria rather than on a total coverage basis. This stratification has evolved over several years as the program progressed. Surveillance remains a weak activity of the MCP and is in need of continued improvement in order to provide reliable epidemiological information to guide program activities.

There are two major technical problems confronting the Pakistan malaria control effort - chloroquine resistance in P. falciparum and insecticide resistance in the vectors. The general finding of the team was that

chloroquine resistance is presently an operational problem in limited areas of the Punjab province and requires the closest watch, intensive studies and additional control measures in order to keep this problem from getting out of hand. Insecticide resistance is an equally serious and urgent problem as there are strong indications that malathion is not as effective as in previous years in some districts of the Punjab and Sind provinces. Conditions for determining whether these districts or portions of these districts should be sprayed with alternative insecticides are discussed in the report.

Training and operational research are subject areas of the report which are given great importance. The MOH action to establish a National Institute of Malaria Research and Training (NIMRT) should be a positive step towards streamlining operational research services to the malaria control program. It is essential that the NIMRT be responsive to the operational research needs of malaria control program. A major need is to assign a competent director and scientific officers to the NIMRT. The opportunity to establish such an institute comes infrequently in a country. The team is hopeful that this opportunity will not be lost.

The need for more in-country training for all categories of staff is continually highlighted in the report. The report recognizes the important role of the National Malaria Training Center (NMTC). A training plan and support for such training are essential in the orientation of personnel within the general health services to a malaria control concept. Operational research to keep abreast of the dynamic malaria situation was strongly supported by the team and specific projects are described in the report.

No public service program is possible without the cooperation and support of the community. The proposal to include a major community participation effort through use of volunteers, increased health education and mass media, is strongly supported by the team.

The report evaluates the program objectives of the pending PC-1 and the USAID project. The results are variable as might be expected, but there has been progress in many fields - laboratory services, passive case detection and others. When one considers the field difficulties of implementing such a massive health program over the entire country, it becomes obvious that a major effort has been made and accomplishments can be shown. There is much more to do in the years ahead, but a working base is available to provide the level of malaria control desired by the country if support is provided as planned in basic operational documents.

In addition to activities connected with the evaluation, the team members joined federal and provincial malaria and health personnel as well as other scientists in a workshop on malaria and other vector control programs on October 19 and 20 to discuss a wide variety of technical subjects concerning the Pakistan anti-malaria effort.

The team as a group expressed its deep appreciation for the assistance of the many federal, provincial, district and municipal officers who gave freely of their time and talents to the team.

Malaria control in Pakistan is an important long term health activity which must receive continued priority if regression is not to occur. The disease has a history of cyclic epidemics in Pakistan which caused great economic and social damage. The investments made in this program are sound but need to be based on technical considerations with cost effective methodology to meet program objectives.

II. INTRODUCTION

2.1 Purpose

The Government of Pakistan (GOP) with the assistance and cooperation of the Agency for International Development (A.I.D) and the World Health Organization (WHO) constituted an external review team from October 6, 1985 - October 24, 1985 for the following purposes: (A) To assess the present status of the Malaria Control Program with an emphasis on the progress made to date to meet the program objectives within the available resources, and (B) To formulate recommendations and guidelines for further improvement of the malaria control program in the future.

2.2 Scope of Work for the Evaluation

1. To visit the provincial programs and analyse data on surveillance operations and assess the efficacy of the laboratory services as well as entomological activities.

2. To discuss with the provincial authorities the current status of integration of the MCP into the primary health care service and to assess its impact in controlling malaria in the country.

3. To evaluate the adequacy of spray planning and efficacy of spray operations in the reduction of malaria incidence.

4. To assess the suitability/efficacy of a continued reliance on malathion for future use in MCP.

5. To assess the problem of chloroquine resistant *P. falciparum* to determine its impact on malaria control efforts.

6. To evaluate the present status of malaria control activities in urban centers.

7. To evaluate the present status of operational research and training capabilities and facilities.

8. To participate in a workshop which will highlight current status of malaria control effort world-wide with discussions of present status and future strategies of MCP in Pakistan.

9. To prepare a final report in the light of the ERT findings.

2.3 Participants

Government of Pakistan

Dr. Imtiaz Hussain Shah	Malariologist
Dr. Ghulam Hashim	Epidemiologist

USAID

Dr. George Georghiou	Entomologist
Dr. William Chin	Malariologist
Mr. Larry Cowper, (Team Leader)	Health Science Administrator
Dr. Rifaq A. Ismail	Public Health Physician

W.H.O.

Dr. Willem J.O.M. van Dijk	Malariologist
Dr. I. A. H. Ismail	Entomologist

The team was assisted in the evaluation process by the Director (A) and senior officers at the Directorate of Malaria Control (DOMC), provincial government officers from the Health and malaria programs as well as other concerned offices in the districts, sectors and municipality organizations. The WHO country representative, Dr. N. Al-Tawil, and Mr. Ray Martin, Chief of the Health, Population and Nutrition Division of USAID, along with their respective staffs provided background briefing and valuable assistance to the team.

2.4 Evaluation Schedule

The team was provided initial briefings on October 6, 1985 on the objectives and purposes of the evaluation from the GOP/DOMC, the Federal Ministry of Health, Social Welfare and Special Education; the World Health Organization (W.H.O.) and the Agency for International Development (A.I.D)

The period from October 7-16, 1985 was used for field review activities by the Evaluation Team. The evaluation participants were divided into two teams. Team A was lead by Dr. van Dijk and reviewed malaria control activities in the NWFP and Punjab Provinces. Team B was lead by Larry Cowper which assessed MCP work in the Sind and Baluchistan Provinces. At each province the teams visited provincial headquarters and field areas except in Baluchistan. The teams returned to Islamabad to prepare the final report. A copy of the travel schedule is attached as Annex 6.1. A list of contacts made during the field travel is provided in Annex 6.2.

On October 19 and 20, members of the evaluation team participated in a national malaria workshop to exchange views and findings with national and provincial malaria personnel on the present situation of malaria in the country.

The presentation of the Evaluation Team's report was made on October 24, 1985 to the Government of Pakistan.

2.5 Documentation Process

The team made extensive use of existing GOP, DOMC, Provincial, WHO and A.I.D documentation during the evaluation on the malaria control program which included annual reports, special study results, project papers and PC-1 documents, previous assessment reports and other technical and administrative materials including the malaria control program evaluation report made by the Pakistan Medical Research Council in 1983/84. The team made every effort to verify the presented data and to concentrate its focus of progress made by the MCP during the 1981-85 period. This report does not include extensive historical or program information before 1982 except where such information is required to complete a discussion or reflect a technical point for comparison purposes. There are a variety of excellent documents readily available on past performance and historical perspective of the Pakistan Malaria Control Program.

III. CURRENT STATUS OF THE MALARIA CONTROL PROGRAM AND PROGRESS MADE TO DATE TO MEET PROGRAM OBJECTIVES

3.1 Epidemiology

3.1.1. The Malaria Situation in Pakistan

The malaria situation, as reflected in the total number of malaria cases reported annually during the last 10 years is shown in the following Table:

Table - 1 Annual Number of Malaria Cases Reported by DOMC during the Period 1975-1984

Year	Blood Smears Examined	Blood Smears Found Positive	Slide Positivity Rate (SPR) in %
1975	3,205,689	238,315	7.43
1976	2,857,854	122,219	4.28
1977	2,667,315	47,571	1.78
1978	2,588,257	16,160	0.62
1979	2,682,351	12,304	0.46
1980	3,006,264	17,707	0.59
1981	3,018,468	37,923	1.25
1982	3,303,067	56,360	1.70
1983	2,587,920	51,596	1.99
1984	3,255,853	73,996	2.27

The table clearly shows that the malaria incidence reached during this period its lowest level in 1979, after which there is a steady but slight increase in the SPR.

The trend in malaria transmission in Pakistan from 1960-1984, as reflected by SPRs is depicted in Annex 6.3.

In Table 2 the positives found during 1981-1984 are given by parasite species:

Table - 2 Positive Blood Smears Recorded by DOMC during the Period 1981-1984 by Parasite Species

Year	Total Positives	Pv.	Pf.	SPR-Pv.	SPR-Pf.
1981	37,923	32,988	5,053	1.09	0.16
1982	56,360	46,686	9,845	1.41	0.30
1983	51,596	36,119	15,696	1.40	0.61
1984	73,996	49,539	24,708	1.52	0.76

From this Table it appears that the increase in SPR over these years is due to a large extent to an increase in cases of P. falciparum. The SPR for P. vivax showed a very moderate increase from 1.09% in 1981 to 1.52% in 1984, whereas the SPR for P. falciparum increased nearly 5-fold in this period.

Province-wise, (see Annex 6.4) the SPR's over this period in Baluchistan, NWFP, and Sind show a somewhat erratic course with Baluchistan and Sind having a peak in 1983, and the NWFP recording a peak in 1981 (in the 1984 figure, Afghan refugee camps are no longer included). In the Punjab there is a steady rise throughout the period from 1.02% in 1981 to 2.58% in 1984. This same rise also is seen in the total number of cases detected. See Table 3:

Table - 3 Total Number of Cases Detected during 1981-1984 in Punjab Province and the Other Provinces Respectively

Year	Total Cases		In Punjab		In other provinces	
	Pv.	Pf.	Pv.	Pf.	Pv.	Pf.
1981	32,988	5,053	14,863	2,346	18,125	2,707
1982	46,686	9,845	18,164	6,289	28,522	3,556
1983	36,119	15,696	19,773	9,927	16,346	5,769
1984	49,539	24,708	34,275	19,648	15,264	5,060

The Table confirms the somewhat erratic course of both the vivax and falciparum malaria incidences and general rise in falciparum cases over the 1981-1984 period in other provinces, but the bulk of the increase is clearly in Punjab Province. In this province, particularly in 1984, not only did the incidence of P. vivax increased, but the incidence of P. falciparum increased as well from 2,346 cases in 1981 to 19,648 in 1984, i.e. more than 8-fold.

If the steady increase in incidence is to be halted, attention should be focused on the Punjab. It should be kept in mind that the falciparum incidence in the other provinces is rising as well with the exception of the NWFP.

3.1.2 Evaluation of Spraying Operations

It is, unfortunately, not possible to determine the exact cause of the increased incidence with certainty. It is suspected that the dramatic increase in falciparum cases and the shift in the Pf. ratio from 13.6% in 1981 to 36.5% in 1984 in the Punjab is at least partly due to the emergence of strains resistant to chloroquine. A further analysis is difficult because of: (1) the variable outputs of the various case detection mechanisms; and, (2) the irregular indoor spraying coverage with different insecticides during the 1981-1984 period.

To improve on this in the future, it is suggested that:

1. The malaria incidence in the district be recorded for sprayed and unsprayed localities separately. The team had this recorded for the 1984 incidence in Kohat district, NWFP taking into account that the malaria year 1984 starts in July 1984 and ends in July 1985. It turned out that of the total of 548 cases of P. vivax, 509 cases were found in unsprayed areas and only 39 in sprayed areas. Of 88 falciparum cases, only one was found in sprayed areas and 87 in unsprayed areas. Although a number of cases were found in 3 or 4 clusters in unsprayed areas, the great majority of detected cases appeared to be more or less isolated. It is concluded that the indoor spraying (one cycle) in the district has been extremely effective considering that a considerable number of the cases detected in the sprayed area could have been relapse or imported cases.

2. In order to measure the true impact of spray operations, it is suggested that a malariometric survey be carried out two weeks after the date of spraying (this is the pre-operational survey, taking into account cases that might have been in the pre-patent period at the date of spraying) and again at two months, three months and ideally again at four months later. These serial surveys should show a gradually declining parasite rate (PR) if transmission is completely interrupted. The surveys would also indicate when the residual insecticide may have lost its impact on the transmission, and thus indicate the need and timing for a second spray cycle. In case subsequent surveys show an increased PR or insufficient decline of PR, this could be due to vector resistance, short residual life of the insecticide as well as poor spray coverage

including replastering of walls, and/or to a massive influx of cases. It is envisaged that these surveys could be carried out in a number of selected fixed indicator villages particularly in areas where there is reason to doubt vector sensitivity and the effectiveness of one spray cycle. Schools may provide a convenient and representative sample for such surveys.

3.1.3 Malaria Case Detection

The objective of dividing the country into areas with a high, medium and low malariogenic potential respectively and developing specific criteria for spraying, was to classify the country into strata where different antimalaria measures would be applied to keep malaria under an acceptable level of control.

Indoor spraying operations were introduced in several areas considered to be of medium or high malariogenic potential using these improved criteria for spraying. However, the areas of low malariogenic potential where control of malaria was carried out through systematic detection and treatment of cases and limited focal spraying remained virtually ignored.

3.1.3.1 Passive Case Detection

Genuine passive case detection, or rather its absence in Pakistan has been reported for many years. The team is happy to note that genuine PCD does exist today, still on a very small scale, but indicating that this mechanism can be productive. As an example of PCD, it was recorded that the physician at an Afghan refugee's camp near Bannu (NWFP) accommodating about 9,000 refugees of whom about 3,000 could be considered to be regular residents of the camp, could institute PCD and achieve the following results since the camp was established 9 months ago (see Table 4 below):

Table - 4 Attendance and Malaria in Afghan Refugees Camp near Bannu, NWFP

	Total Attendances	Bloodsmears Collected	Positives
February	1,328	27	2 Pv
March	2,615	25	3 Pv
April	2,452	34	8 Pv
May*	535	4	0
June*	218	9	3 Pv
July	651	56	20 Pv + 1 Pf
August	681	90	12 Pv
September	752	53	7 Pv

* The camp was shifted in May/June to another locality which may explain the low outputs.

At least the refugees in this camp did not show a high number of imported falciparum cases, but Table 4 does indicate local transmission at the camp site in July/August. As these findings may have some bearing on the situation in neighboring localities, the district health officer should endeavor to obtain this type of information from the UNHCR authorities for planning his own MCP activities. The same may hold for information on malaria that may be available with the military.

Other achievements were recorded by the team pertaining to PCD activities in Punjab province, which seems to have found the key towards progress in establishing PCD. For example, Table 5 provides the information collected at a rural health center in Kasur which sees about 80 patients daily:

Table - 5 Malaria Cases at a Rural Health Center (RHC) in Kasur, Punjab

	Bloodsmears Collected	Positives
January 1985	15	0
February	56	13
March	118	14
April	145	5
May	87	6
June	35	4
July	46	0
August	45	4
September	78	1
	625	47

Tentatively, it can be concluded that the 1985 malaria incidence in the catchment area of this RHC may show an improvement over 1984, as there is a considerable number of cases in early 1985 (a spill-over of 1984) and few cases in August/September which reflects 1985 transmission. As to the PCD facility at this RHC, it should be noted that in the absence of the laboratory technician - who needs and will receive shortly retraining in malaria microscopy - the collection of bloodsmears is done by another staff member of the center.

It should be added that similar successful PCD operation was observed at a Local Council dispensary near Gujranwala where blood smears were collected by the officer-in-charge. This Health Inspector collected 56 bloodsmears in September, 13 of which proved to be positive. Additionally, another RHC in the same district collected 55 bloodsmears in August, and 51 bloodsmears in September 1985.

Considering the output of these facilities and the total PCD output of the province, it can be conclude that the output of other PCD posts need further stimulation. However, a promising start has been made in the Punjab.

3.1.3.2 Activated Passive Case Detection (APCD)

While banned in the Punjab, PCD activities in the other provinces are virtually all activated PCD, where a malaria supervisor spends a couple of hours at a health institution collecting blood smears from suspected cases of malaria before starting his ACD rounds. This procedure could be justified at a large hospital (or health center) OPD's where several dozen blood smears might be collected daily. However, at an average rural health institution, where 1-5 bloodsmears are collected daily, it is difficult to see why the health institution's own staff can not find 5 minutes per day for collecting these smears. Orientation/training and motivation by the DHO may help to correct this situation.

3.1.3.3 Active Case Detection (ACD)

In view of the distance between outlying villages and the nearest health institution, some form of ACD remains indispensable for covering the more remote rural areas, regardless of the limitations inherent to the system. These limitations include:

(a) that ACD, like any mobile service, for the treatment of an acute disease provides a very limited service (coverage in time) and, (b) that ACD in its classical unipurpose approach leaves about 90% of patients seen during the house-to-house visits without treatment for their complaints; and, (c) that ACD is doomed to failure unless adequately supervised. There are several ways open to the house visitor to submit at the end of the week a package of bloodsmears to the laboratory without having visited the assigned villages; such samples are well known to the MCP and are aptly termed "bogus smears". As a result, many areas under ACD are poorly covered or not at all giving rise to a recent phenomenon of "silent localities". The phenomenon occurs throughout the provinces; a number of malaria flare-ups may be ascribed to a lack of ACD during the preceeding months.

The mobile health teams which are under consideration in the Punjab would improve on the items (b) and (c) above. These teams are planned to consist of a malaria worker for ACD, an EPI worker and a sanitarian. The team would carry with them some medicine for common ailments. Supervision would be available from a variety of sources within the health structure.

Surveillance data for Sind in 1984 are given in Table 6 by sex to illustrate the relative value of case detection data:

Table - 6 Surveillance Data 1984, Sind, sex-wise

Bloodsmears Examined	Total Positives	Bloodsmears Collected		Positive Found	
		Male	Female	Male	Female
441,679	9,582	404,084	37,595	7,146	2,436

3.2 Laboratory Services

The impression of the team is that laboratory services are in general competent. Although at some instances the blood smears submitted by the district to the provincial reference laboratories for cross-checking were selected by the senior microscopist of the district laboratory rather than by an independent, unbiased officer, the error rate was generally very low with the notable exception of a few district laboratories in Sind.

Laboratory equipment and supplies were reported to be sufficient. Processing of blood smears could be improved: slides were frequently not properly cleaned and blood smears understained. There was a complaint on the Nikkon microscopes with built-in light source which heated up after about one hour's use.

On the average, malaria microscopists were found to have a full workload. There were no serious backlogs of smears awaiting examination, but in some districts these could only be avoided by having the microscopists examining either continuously or during a number of months of the year substantially more smears per day than the generally recommended number of 40 to 50.

Despite the use of a special MCP courier service for the despatch of blood smears from outlying areas to the laboratory such as in Baluchistan, long time-lags between collection, examination and reporting of results remain the major shortcoming of the services throughout the provinces.

A decentralisation of the laboratory services should improve this situation considerably, and is strongly supported by the team. However, this decentralisation of services should not be translated into a distribution of existing malaria microscopists over peripheral health institutions. On the contrary, it is felt that wherever (assistant) laboratory technicians are posted in health centers and hospitals, these technicians should be retrained in malaria microscopy. The officer-in-charge of the institution should be encouraged to utilize these technicians for arriving at a microscopically confirmed diagnosis of clinically suspected cases of malaria. A short orientation workshop on malaria is suggested for these technicians. An inventory should also be made of the laboratories in terms of equipment and supplies required for the processing and examination of blood smears for malaria.

Although not opposed to a re-location of the present malaria microscopists to more strategic sites, whenever this would greatly enhance a speedy delivery of blood smears to and from the laboratory, the team suggests not to dismantle the present malaria laboratories as the valuable 'communal' expertise these microscopists have acquired in this field might be lost within a very short time. Instead, these laboratories should function as reference laboratories for the peripheral health laboratories, and for technical assistance to the peripheral assistant laboratory technicians. It can be expected that there will be an increased output from the assistant laboratory technicians which will increase the total number of blood smears to be examined. The malaria laboratories should be prepared to handle any surplus slides to avoid backlogs of unexamined smears. At the same time, the malaria microscopists would remain available for special surveys conducted for the evaluation of operations and for emergencies.

3.3 Operational Entomology

3.3.1 Manpower

Entomological staff in the program consist of; one senior Scientific Officer at the Malaria Headquarters; three entomologists, one each at the provincial level in Sind, Punjab and NWFP, and; a number of assistant entomologists in the zones except in Baluchistan where an assistant entomologist is stationed in the Provincial Headquarters, responsible for all field activities in the province.

Other categories of entomological staff include a few technicians stationed in Provincial Headquarters and a number of insect collectors. The present staff position is as follows*:

	Sen. Sci.	Ent.	Asst. Ent.	Tech.	Ins. Coll.
DOMC	1/1	-	-	-	-
Sind	-	1/1	13/7	1/-	27/27
Baluchistan	-	-	2/1	2/2	8/8
Punjab		1/1	27/17	2/2	54/50
NWFP		1/1	8/8	4/4	32/32
Total	1/1	3/3	50/33	9/8	121/117

* No. of posts/No. of posts filled.

In Sind province there are six vacant posts of assistant entomologists at the district level. Three out of the seven existing assistant entomologists did not attend the senior entomology course at the malaria training center in Lahore due to shortage of provincial funds. An entomologist stationed in the Provincial Headquarters in Hyderabad, assisted by a technician (post vacant at present) and an insect collector is in charge of the entomological activities in the province. In each district there are two insect collectors who assist the entomological assistant in carrying out field activities. The services of these insect collectors are utilized for other purposes in those districts where the post of assistant entomologist is vacant.

In Baluchistan province there are two posts of assistant entomologists, one of which is vacant. The assistant entomologist in position is in charge of all activities in the province. Other entomological staff include two technicians and 4 insect collectors in Provincial Headquarters in Quetta and four insect collectors, one each in every Divisional Headquarter.

In Punjab Province, four of the 21 authorized posts of assistant entomologist remain unfilled. Additionally, six new posts of assistant entomologist have been created, effective 1 July 1985.

In NWFP, all posts are filled.

3.3.2 Malaria Vectors

An. culicifacies is considered as the principal malaria vector in the country where it is widely distributed. Throughout the rural

areas of central and southern Pakistan, it is commonly associated with An. stephensi which occurs in varying densities.

Earlier studies showed that An. stephensi mysoriensis occurs in Karachi, Sukkur and Hyderabad districts, though the type form was either absent or, if present, occurs in such small numbers that it could not be detected. Positive gland dissections were reported from the urban area of Karachi. Recently, in a trial carried out in Lahore, the sporogonic cycles of both P. vivax and P. falciparum were successfully completed in female mosquitos of An. stephensi collected from rural areas, fed on gametocyte carrier and kept in captivity.

Both species, An. culicifacies and An. stephensi are found all the year round. However, the former appears in high density in April, declines in May-June, but increases again from July-August to reach a peak in September-October. The latter declines in July but increases again in August, reaching a peak in September. Both species are endophilic and mostly zoophilic but feed freely on man.

3.3.3 Entomological Activities

According to the entomological work plan for the whole program there are two main activities:

a. Entomological observations in sprayed and unsprayed localities to determine the impact of insecticide spraying on vector population, their behavior, longevity and man/vector contact.

b. Susceptibility tests.

Broad outlines of the work plan are sent from Malaria Headquarters to the provinces and similarly from the provinces to the districts, with the exception of Baluchistan, as explained in 3.3.1. Implementation of field activities is subject to availability of staff, transport, travel allowance and funds for petrol.

Entomological activities carried out in the two provinces of Sind and Baluchistan in 1984-85, are as follows:

3.3.3.1 Sind Province

a. Evaluation of Spraying Operations

Entomological observations to determine the impact of insecticide spraying in Sind province were restricted to the collection of mosquitos by pyrethrum spray. Data presented to the assessment team are consolidated in the following table:

Year	Spraying*	No. of Districts	No. of Localities	No. of Rooms	An. cul. Tot.	An. cul. Den.**	An. steph. Tot.	An. steph. Den.**
1984	Pre-	4	241	1260	2168	1.7	1828	1.5
	Post-	3	81	453	356	0.8	274	0.6
1985	Pre-	11	249	1209	3345	2.8	3833	3.2
	Post-	2	14	72	0	0	118	1.6

* Data presented to the assessment team on post-spraying observations represented the sum of mosquitos collected from localities sprayed with malathion and localities sprayed with fenitrothion.

** Average number of mosquitoes per room.

After examining the available data and based on the discussions made, it can be stated that no valid conclusions could be made regarding the impact of insecticide spraying, for the following reasons:

- Considering that post-spraying observations were carried out in some localities sprayed with malathion and others sprayed with fenitrothion, relevant data should have been presented separately in order to illustrate the impact of each insecticide.

- The number of localities and rooms in post-spraying observations were very low in comparison with those in pre-spraying observations especially in 1985.

- In view of the fact that spraying is carried out on selective basis, entomological surveys, therefore, should be conducted in the same localities in pre- and post-spraying observations with parallel surveys in unsprayed localities, as control.

b. Susceptibility Tests

A total of 50 and 93 tests with malathion and fenitrothion were conducted in both years, 1984 and 1985 respectively. Tests of 1984 were reported from only four districts whereas those of 1985 covered eleven districts. Mosquito samples varied between 20 and 25 in most of the tests except in few when the number was higher. Results of these tests are summarized in section 3.5 (Insecticide Resistance).

c. Urban Mosquitoes in Karachi

From the information provided by the Malaria Superintendent in the Municipality of Karachi, five species of mosquitoes, *Culex quinquefasciatus*, *An. subpictus*, *Culex tritaeniorhyncus*, *Aedes aegypti* and *An. stephensi* are prevalent in the city. It was stated that mosquitoes

continue to show susceptibility to diazinon and dursban, the two larvicides in common use. However, due to the absence of the entomologist-in-charge during the visit, this statement could not be verified and results of susceptibility tests were not available.

3.3.3.2 Baluchistan Province

a. Evaluation of Spraying Operations

In 1985, entomological observations were restricted to the collection of mosquitos from unsprayed localities. A total of 37 surveys covering 141 rooms revealed an average density of 3.8 and 2.7 mosquitoes per room for An. culicifacies and An. stephensi respectively.

b. Susceptibility Tests

A total of 30 susceptibility tests with DDT, dieldrin and malathion were carried out in Baluchistan Province during 1984-1985, the results of which are summarized in section 3.5 (Insecticide Resistance).

From the discussions made it became apparent that the scarcity of entomological activities in Baluchistan Province is mainly due to shortage of staff and insufficient funds for petrol.

3.3.4 General Comments

Entomological activities carried out to determine the impact of insecticide spraying do not provide the required information. In a program where only selective spraying is carried out, entomological activities should be adjusted and planned accordingly. A detailed entomological work plan should be prepared at an early stage, at the same time when the decision is made in consultation with the malaria superintendent concerned regarding the villages or localities which will be sprayed in the following season. Two series of villages or localities should be selected, one representing those which will be sprayed and the other representing villages which will not be sprayed, as control. Surveys for pre- and post-spraying observations are to be carried out in both series at approximately the same time. The work plan should be prepared in detail and discussed at a meeting to be held in the Provincial Headquarters and attended by all district assistant entomologists and the entomologist-in-charge in the province. Efforts should be made to secure sufficient funds to cover travel allowances and cost of transport.

Results of susceptibility tests in several districts show that in certain villages or localities An. stephensi has developed resistance or tolerance to malathion. On the other hand, An. culicifacies the main malaria vector in the rural areas of Pakistan continues to show susceptibility to the insecticide except in a small number of localities where a very few mosquitoes survived the diagnostic dosage of malathion. Results of other entomological studies to determine the impact of insecticide spraying on mosquito populations, their behavior, longevity and man-vector contact, if carried out properly and adequately could have thrown some light on the implications of the resistance of An. stephensi to malathion, if any. The

answer to this problem becomes even more difficult in the absence of concrete information on the role of An. stephensi in malaria transmission in the different ecological situations in the country, in relation to the role played by An. culicifacies the main malaria vector. Basic studies are required to fill the gaps in knowledge on the present role of malaria vectors and also suspected vectors, i.e. An. pulcherrimus and An. fluviatilis

Spraying with chemical insecticides is the only method of vector control, applied in the program. In order to decrease reliance on this method in the future, it is necessary to explore and carry out field trials with supplemental methods of vector control such as the use of larvivorous fish and other biological control agents, elimination of breeding places and personal protection with the ultimate objective of using these methods in an integrated manner with community involvement.

3.4 Spray Operations

The residual spraying operations in the MCP for 1984 and 1985 consisted principally of one application of malathion, 50% wdp during the mid July - September period to selected localities with limited additional applications of focal spraying. This methodology was adopted for the 1982/83 - 1986/87 activity period and represents a continuation of the planned evolution of the Pakistan malaria eradication program to one of long term malaria control. The 1975-1980 period emphasized the classification of the country into low, medium and high malariogenic areas with specific activities attached to each specific area over the five years. It was a major step in using epidemiological skills to guide the spray operation program towards more selective and cost effective interventions and away from the total coverage concept of the malaria eradication period of the 1960s and early 1970s. As the program moved ahead in its control approach in the 1984 and 1985 period, a series of spray criteria were established to guide the provinces and districts in the selection of localities to be sprayed. These selection criteria included: (1) 2.0 cases per 1,000 population of P. vivax in a specific locality; (2) a positive P. falciparum case in a specific locality; (3) movement of population particularly Indians by pilgrimages and migration; (4) a historical consideration of areas of high malariogenic potential; and (5) a reserve for special areas. There was also a low percentage of insecticide provided for focal use.

The basis for the development of a spray operation is the geographic reconnaissance (GR) of the malaria areas in each province. Previously, the provinces were divided into administrative areas/zones for operational purposes. Each zone was further sub-divided into sectors, sub-sectors and localities. Under the present program, these divisions have been abolished in Punjab and Sind provinces and are expected to be changed as well in the NWFP in the near future. In Baluchistan, the two zones have now been divided into four divisions which supervise the 17 districts. The divisions are now made on political boundaries. The sub-sector division remains the same while the zones are restricted to each district and where tehsil boundaries are now substituted for the sector boundary pattern. The up-dated G.R. for 1981-1985 is presented as follows:

Comparison of Updated G.R. Data for 1981 and 1985*

Province	Year	Sector	Sub-Sector	Localities	Population	Houses	Rooms
Punjab	1981	145	2,049	26,622	37,048,855	7,329,672	23,505,186
	1985	145	2,039	26,426	39,745,075	7,833,591	25,371,017
Sind	1981	68	563	7,394	9,163,729	1,730,189	5,294,446
	1985	68	563	7,294	9,956,528	1,845,390	5,775,303
N.W.F.P.	1981	49	625	5,660	8,608,917	1,766,226	5,649,089
	1985	49	626	5,668	9,542,715	1,933,106	6,367,152
Baluchistan	1981	29	124	3,396	2,113,076	384,615	1,257,800
	1985	29	192	5,712	2,888,965	461,132	1,625,954
Total:	1981	291	3,361	43,072	57,034,607	11,210,702	35,706,518
	1985	291	3,420	45,100	62,133,283	12,073,219	39,139,427

* Data presented by DOMC

The purpose of presenting these data is to demonstrate the increase in population and houses which are at risk of malaria in Pakistan. Updated locality maps assist in planning, implementation and evaluation, but apparently have not been made for some time. The application of malaria control interventions such as residual spraying, drug treatment or any other activity requires careful and accurate epidemiological techniques which can only be provided by timely and adequate data. The skill levels needed in a malaria control effort are much higher than in malaria eradication as total coverage is not normally desired.

The 1984 national spray operation reports present the results of this selective spray effort and are given in Annex 6.6. It can be seen that where the 1985 GR indicates a current total of approximately 62.1 million population at risk of malaria, the selected residual spray program in 1984 protected approximately 13.0 million.

The 1981-1984 reported MCP coverage with residual insecticide is summarized as follows:

Year	% Coverage of Houses		% Coverage of Population-at-risk	
	GR	Planned	GR	Planned
1981	13	81	13	85
1982	13	77	13	77
1983	26	82	21	64
1984	21	92	20	91
1985	(Not Received)			

The table indicates that the per cent coverage of the population-at-risk was from 13% - 21% in the 1981-84 period. However, the per cent of the target population covered by use of the DOMC spray criteria was 85% ('81), 77% ('82),

64% ('83) and 91% ('84). In 1983 only 64% of the planned population was actually provided protection or less than 2/3 of the target even under the selected spraying methodology or, stated another way, the program covered only approximately 14% of the total population-at-risk in 1983. Fortunately, an improvement was shown in the 1984 period. The result of not having sprayed even the targeted selected population may be the partial cause of the rise in malaria from 17,707 cases in 1980 to 73,966 cases in 1984. There are, of course, many other factors to consider in this rise such as quality of field operations including field supervision, timing of the spray application, insecticide resistance and epidemiological input data. The team did not visit any spray operations in the field during the evaluation as the residual spray program for 1985 had been completed. As a result, specific field observations on spray technique, training of spraymen, field reporting and equipment cannot be made. The 1983 evaluation report indicated serious defects in the spray operation (pages 11, 12, External Evaluation Part II : Entomological Aspects). The External Review Team 1985 can only underscore the recommendations that spray operations must be based on epidemiologic grounds as to timing, area and suitable insecticide and be conducted efficiently under good supervision.

In reviewing the available operational data from the four provinces and in discussions with provincial officers, it appears to the team that not enough flexibility is provided to select the localities to be sprayed. It was the team's understanding that the spray operations are calculated in November of one year for operations in July/August of the following year. This procedure enables the DOMC to place off-shore procurement orders so that insecticide will arrive in time for distribution and use in the field program. It was explained to the team that provincial spray operations are carried out on the epidemiological basis used in this planning and very little variation is made at the time of actual spraying even though the epidemiological selection is a number of months old. The team questioned the validity of the selection criteria especially for P. falciparum where epidemiological investigation is not done to determine the source of the infection. The implication that one P. falciparum case in a locality which may not be indigenous triggers a spraying response to cover the locality is worrisome and can lead to spray operations expenditures which are not necessary in low endemicity areas.

The team took particular interest in the safety measures being used in the program especially the schedule of cholinesterase testing. The results of cholinesterase testing in the Sind is as follows:

Year	No. of spraymen/ supervisors*	No. of cholinesterase tests*	No. of cholinesterase tests under 62.5%*
1984	1401	231	9
1985	1469	241	12

* Data from Sind

The cholinesterase results from Baluchistan were reported by the province as follows:

Year	No. of spray personnel	No. of tests	No. of tests below 62.5%
1984	350	Nil	N.A.
1985	220/20	84	Nil

It was the team's understanding that cholinesterase tests were to be provided to operational personnel at least two times during the spray operation. The presented data from Sind and Baluchistan indicate that the accepted standard is not being followed. Other provinces had similar patterns. A frequent complaint heard from the provinces was the poor quality of the uniforms provided for the 1985 season and except for the Punjab, that spraymen were given only one set of uniform in 1985. One province suggested that supervisors should have a different colored uniform than the spray personnel.

The spray pump problem is of major concern and certainly requires immediate attention. For example, in the Sind there was a total of 6126 sprayers of which 1347 were in working condition and 1263 were temporarily inoperable and needed parts. The permanently inoperable sprayers are 3516. The province reportedly requires at least 2500 sprayers to complete a spray round. Even with a major effort to repair the existing sprayers, additional pumps will have to be procured for the 1986 operation. The first step in improving the situation is to obtain an accurate count of what parts are required to repair existing pumps in every district, consolidate this information and order the spare parts. The additional pumps required for the 1986 operation can then be determined and procured. The pumps obtained in 1984 had a number of defects such as leakage from the dip tube adapter and pump cylinders which cracked under pressure. Problem sprayers were reported to be as high as 35% - 40% of the new sprayers in some areas. It is understood that the supplier is replacing these defective parts, but future orders should be properly certified as to their meeting WHO specifications prior to shipment and payment.

The subject of house cards and their utility in the program were discussed. At present, house cards are not being procured and the card system is being partially replaced with wall stencils. The idea of a house card which would serve two or three health programs (Malaria, EPI, Family Health) has some merit and usefulness for supervision and evaluation.

In summary, there needs to be a specific review of the present criteria for spray operations and agreement by the provinces that the selected procedures will be observed. The use of a selective technique is supported by the ERT-85 but such methodology should not be applied simply to cut the quantity of the spray operation. The area now being protected is very much reduced from previous years and should be operationally covered and be evaluated for its suitability to Pakistan conditions if the present malaria control system is to work. The ERT-85 believes that epidemiological guidance be the primary control in planning and implementing the spray program and not the quantity of insecticide or local program support funding. The team stresses the importance of developing and using alternative methods of control in the MCP in order to reduce the reliance on insecticide, and encourages the GOP/DOMC to actively try new methods and techniques in its program.

3.5. Insecticide Resistance

3.5.1 Scope of the work

Extensive exposure of an insect population to an insecticide over several generations almost invariably results in the development of resistance to that insecticide. Exposure to insecticide may be direct, as a result of treatment of the breeding or resting sites of the insect, as is frequently the case with chemical control of vectors. In a number of instances, the selection for resistance may be accelerated, or may be caused entirely by indirect exposure of the vector to the pesticides that are applied on various crops and which also reach the breeding or resting sites of the vector.

The ability to detect emerging resistance and to monitor changes in its frequency and intensity, are essential requirements of organized pest control programs. By this means, it is possible not only to appraise the impact of resistance on the level of control that is obtained, but also to identify factors which may directly or indirectly exacerbate the problem. Thus, through an accurate system of resistance surveillance and monitoring it is possible to plan control strategies that could minimize the economic costs and consequences of resistance. Such measures might consist of the appropriate choice of an alternative chemical, the timely change to that chemical, the introduction of insecticide usage tactics that would limit the degree of selection pressure, or the inclusion of supplementary non-chemical measures that would reduce the need for frequent chemical interventions.

Reports of the appearance of resistance to organophosphorus insecticides in *An. stephensi* and *An. culicifacies* in other countries, and evidence of emerging resistance in *An. stephensi* in certain areas of Pakistan, have prompted us to examine the questions of resistance in detail.

3.5.2 Resistance surveillance in Pakistan

3.5.2.1 Sources of Information

There are essentially three sources of information regarding the occurrence and status of resistance to insecticides in Pakistan: The Resistance Surveillance function of the MCP, research projects conducted by Dr. I.H. Shah, NMTC and Dr. H. Rathor, NIMRT and publications of foreign laboratories that have studied aspects of resistance in the species concerned. Information from all these sources is included in this Report, but the bulk of the data is derived from the extensive Resistance Surveillance activities of the MCP.

3.5.2.2 Resistance surveillance within the Malaria Control Program

During the past several years the Malaria Control Program has included resistance surveillance among its activities. This function utilizes the specific test method recommended by the WHO, i.e. collection of adult mosquitoes from indoor resting sites, and their bioassay

for a definite length of time (60 minutes) on insecticide-impregnated filter paper in special test kits that are provided by WHO. Following the 60-min exposure, the mosquitoes are held for an additional period of 23 hours at the end of which a record is taken of the results. In most cases, the exposure is conducted near the collection site. The mosquitoes are then transported to the District headquarters where they are held for the 23 hr observation period.

Treated papers are received from WHO by the DDMC at six-month intervals and are distributed to the Provinces and from there to the Districts as necessary. These papers contain a diagnostic concentration of either DDT (4%), dieldrin (0.4%), malathion (5%) or fenitrothion (1%). Each of these doses is known to cause 100% mortality of susceptible mosquitoes. Thus individuals surviving the test are considered to be resistant. Assuming that adequate numbers are tested, and the tests are repeated seasonally (usually just before and just after the spraying season), it is possible to maintain a fairly accurate index of the relative frequency of resistant individuals in a mosquito population, which can be used together with other relevant data in the regular assessment of the control program.

The intensity of the resistance surveillance operations has varied with the years, province and district. In general, surveillance has been more intensive and extensive in the Punjab, less so in the NWFP and Sind and least in Baluchistan. There has been a commendable increase in the number of tests conducted in the Punjab in 1984 (some 13,400 specimens of An. stephensi and 11,000 of An. culicifacies were tested) and in 1985 (7,593 An. stephensi and 4,920 An. culicifacies were tested by mid September), compared to 1981 (1,784 An. stephensi and 3,499 An. culicifacies). These increases for Punjab are also reflected in the number of districts sampled (22 in 1985 vs 15 in 1981) but numbers tested differred considerably from district to district. In some instances these differences reflected correctly the need for more testing in certain districts due to evidence of resistance (e.g. 2344 specimens tested in Sahiwal in 1985) but not always so (e.g. limited testing was done in D.G. Khan -- 226 specimens, and in Gujranwala -- 49 specimens despite evidence of equally high resistance). There is obviously a need for close monitoring of the results of resistance surveillance as they are obtained, so that they may serve as a guide for placing emphasis where it is most needed.

3.5.3 Limitations of the resistance surveillance activity

The resistance surveillance activity has certain limitations which must be borne in mind in the interpretation of the results. Some of these limitations are inherent in the test method itself, while others are consequences of the local environment or practices.

3.5.3.1 Aging of test papers and loss of toxicity

The shelf life of malathion and fenitrothion treated papers is considered to be approximately 6 months, unlike the case with DDT or dieldrin papers which remain active for several years. In Pakistan, new malathion and fenitrothion papers are received at 6-month intervals and the old papers are discarded. There is recent evidence that if

such papers are kept in a refrigerator, their effective life is considerably extended. Storing papers in a refrigerator could be adopted as a routine measure to reduce the likelihood of deterioration due to climatic extremes.

We have no evidence that the observed increased survival of An. stephensi in several of the tests is due to loss of activity in the test papers. It must be pointed out that many parallel tests conducted on An. culicifacies yielded complete mortality, thus providing evidence of adequate activity in these papers.

3.5.3.2 Increased mortality of test mosquitoes due to handling

Injuries to insects due to poor handling and excessively vigorous aspirating, exposure to extremes of high temperature and dryness, and a long waiting period between collecting and testing, often increase the insects' sensitivity to insecticides and result in higher mortality than would occur under normal circumstances. Thus, human error or environmental stress would tend to conceal rather than enhance the evidence for resistance.

3.5.3.3 Influence of age of test mosquitoes on susceptibility to insecticides

It has been demonstrated that the level of carboxylesterase enzyme, which is responsible for the malathion resistance of An. stephensi, is greatest in newly emerged adults, declining rapidly as the mosquito ages. This is associated with a reduction in the level of resistance, as assessed by the WHO test. Thus, if the test sample contains a large proportion of older mosquitoes, the frequency of resistance may be grossly under estimated by the test. This is an unavoidable influence which must be considered in the interpretation of data.

3.5.4. Relating susceptibility test data to field performance of insecticide

A question of paramount importance is whether mosquitoes which survive the diagnostic dose of 5% malathion in the WHO test are also able to survive the malathion residue on sprayed wall surfaces. In the absence of direct evidence to this effect (which can be obtained by bioassaying the survivors of the WHO test in turn onto wall surfaces), this question can be answered only from indirect evidence.

It would appear from vector density data obtained post-treatment, that adult mosquitoes are almost entirely absent from sprayed premises for at least one month, their numbers gradually increasing thereafter. In some districts with relatively high resistance in 1984, e.g. Banawalnagar (20% avg. survival in WHO susceptibility tests) the first post-treatment vector density count in animal sheds showed 4.3 An. stephensi and 1.5 An. culicifacies per sprayed room vs. 24.3 and 11, respectively, per unsprayed room; i.e. almost the expected 20% survival rate for An. stephensi (24.3 x 0.2 = 4.86) and less for the still susceptible species An. culicifacies. However, data from other districts with equally high or higher

resistance, e.g. Faisalabad and D.G. Khan, show absence of mosquitoes in the sprayed sheds. Whether this is due to the known low repellency of malathion, or to practical difficulties in obtaining accurate counts when density is very low remains a mute question.

Of interest are data obtained by Dr. I.H. Shah in 1984 in a field experiment with malathion and fenitrothion. Susceptibility tests with malathion on the local An. stephensi (301 mosquitoes) showed an average mortality of 87.2%. Bioassay of malathion residues on the more typical sprayed surfaces, using reared mosquitos, showed the following mortality levels:

	Percent Mortality post-spray (days)				
Surface	2	12	24	31	37
Unlimed kacha	93.2	71.7	41.9	24.1	15.6
Limed kacha	98.0	97.9	83.3	60.0	3.7
Brick	93.3	51.4	48.4	35.4	11.7
Avg.	94.6	73.7	57.9	39.8	10.3

It is evident that a proportion of An. stephensi are able to survive contact with malathion on the common sprayed surfaces. The survival rate increases as the residue ages. It may, therefore, be assumed that mosquitoes surviving the diagnostic dose of 5% malathion in the WHO susceptibility test are also able to survive exposure to malathion residues of 2 gm/m^2 on wall surfaces. Thus, the results of WHO susceptibility tests with malathion constitute a useful indicator of the presence and frequency of effective resistance in the mosquito population.

3.5.5 Status of Insecticide Resistance

The following discussion is based on susceptibility records provided by the provinces concerning the two major anopheline species in Pakistan, An. stephensi and An. culicifacies, and the insecticides DDT, dieldrin, malathion and fenitrothion. Although emphasis has been placed on the results of tests conducted during 1984 and 1985, all data available since 1981 have been collated and examined in order to discern possible trends in susceptibility. As recommended by the ERT in 1983, susceptibility testing with DDT and dieldrin was reduced considerably during 1984 and 1985, whereas testing with malathion and fenitrothion was increased. The analysis of data suffers from the randomness of the collection sites and from shifts in the areas treated from year to year. Hence the data from all localities of a district were pooled and are examined with the district as the smallest unit. Using a still smaller unit of measurement might have been unrealistic in view of mosquito population mobility and natural dispersal.

3.5.5.1 DDT

A limited number of susceptibility tests which were conducted with DDT in the Punjab, NWF and Sind provinces in 1984-85 indicate that both species continue to be highly resistant to this insecticide. Furthermore, examination of the average mortality values

obtained in yearly tests since 1980 on An. stephensi in NWFP, reveals only a slight increase in mortality, at the diagnostic dose of DDT, i.e. from 42.6% in 1980 to 60% in 1985 Table 5.1 (Annex 6.5.1). Therefore, there is no prospect in sight that DDT will be of use in anopheline mosquito control in Pakistan in the foreseeable future.

3.5.5.2 Dieldrin - BHC

As with DDT, tests with dieldrin in the Punjab and NWFP show no definite trend toward reduced resistance in either of the anopheline species. The results of 21 tests with An. culicifacies and 52 tests with An. stephensi in the Punjab were classified as "resistant" by WHO criteria (i.e. showing less than 80% mortality), in 90% and 98% of the cases, respectively. In NWFP, the average mortality caused in An. stephensi by the diagnostic dose of dieldrin was 55.8% in 1980 and 52.5% in 1985 Table 5.2 (Annex 6.5.2).

3.5.5.3 Malathion

The results obtained with malathion are presented separately for the various districts of Punjab Table 5.3 (Annex 6.5.3), NWFP Table 5.4 (Annex 6.5.7), Sind Table 5.5 (Annex 6.5.8) and Baluchistan Table 5.6 (Annex 6.5.9). The NWFP data have also been consolidated in Tables 5.7 (Annex 6.5.10) and 5.8 (Annex 6.5.11) for An. stephensi and An. culicifacies, respectively. The data from each district have been calculated to show the range and average mortality obtained in the various tests, instead of the general category (Resistant, Tolerant or Susceptible) in which the results of each test fall. The data as presented show more clearly the changes that have occurred from one year to the next in each district.

(a) Anopheles stephensi

There is clear evidence of resistance to malathion in An. stephensi in several districts of the Punjab, Sind and NWF provinces. If an average mortality of less than 80% during the years 1984 and 1985 is used as a working basis for operationally significant resistance, the following districts in descending order may be considered as confronted with a malathion resistance problem. Districts with inadequate data have not been included, although in some of them resistance is evidently present.

District and Province		Avg. % mortality in 1984-85
Sahiwal,	Punjab	67.2
Okara,	"	67.2
Bahawalpur,	"	70.4
Faisalabad,	"	71.5
D.G. Khan,	"	72.5
Bahawalnagar,	"	73.2
Gujranwala,	"	76.0

Sanghar,	Sind	34.5
Shikarpur	"	35.5
Sukkur	"	43.5
Nawab Shah	"	51.8
Khairpur	"	59.2

The very low mortalities reported in 5 districts of Sind may have ominous implications in the future performance of malathion. However, these results represent only one year's tests (1985) and relatively small numbers of insects Table 5.5 (Annex 6.5.8). There is an obvious need for closer monitoring of resistance in these districts in 1986.

The data for the Punjab districts Table 5.3 (Annex 6.5.3 - 6.5.6) are amenable to closer scrutiny since in many instances they are derived from large numbers of insects and often represent several consecutive years of testing. In a number of districts, a progressive increase in resistance to malathion during 1981-85 is clearly evident (see especially Faisalabad, Sahiwal, Bahawalpur and Bahawalnagar). The rate of such increase appears to be very gradual, probably due to the fact that only a small proportion of resting sites (11-21%) were treated with malathion during 1981-85.

This is also reflected in the relatively small quantities of malathion used in the malaria control program in the Punjab in 1980-85 as compared to the 1976-78 period:

	Amounts of Insecticide used (m.tons)	
Year	Malathion 50%	Fenitrothion 40%
1976	3349.0	27.5
1977	4050.0	91.0
1978	4419.0	58.7
1979	1742.8	2.8
1980	1062.9	391.5
1981	156.9	391.5
1982	106.9	429.3
1983	1222.0	346.4
1984	1430.4	40.0
1985	2730.0 (est.)	0

(b) Anopheles culicifacies

Field populations of An. culicifacies continue to demonstrate susceptibility to malathion throughout the country, but in a small number of instances, less than complete kill has been obtained with the WHO resistance test (see Sargodha, Bahawalnagar, R.Y. Khan, etc.) Table 5.3 (Annex 6.5.3 - 6.5.6). As has been observed in earlier years with DDT and BHC, An. culicifacies demonstrates a lower propensity for development of resistance to malathion than An. stephensi. However, it must be noted that a malathion-resistant strain of An. culicifacies has been selected in the

laboratory at NIMRT (I. Rathor, personal comm.). The MCP Entomologist in Punjab also noted that unlike in past years, knockdown of An. culicifacies in the WHO test now occurs more slowly. Resistance to malathion in field populations of An. culicifacies has been reported from India (Gujrat, Sambalpur Andhra Predesh and Maharashtra) and from Sri Lanka (WHO data 1980) Material from Maharashtra that was studied in the laboratory, was found to display a wider spectrum of organophosphate resistance which, in addition to malathion, included fenitrothion, chlorophoxin, iodophenphos and pirimiphos-methyl. Therefore, the species must be monitored for resistance regularly, especially in view of its role as an effective malaria vector

3.5.5.4 Fenitrothion

To-date, all susceptibility tests with fenitrothion against both anopheline species have been negative, cases of survival to the diagnostic dose of 1% fenitrothion having been extremely low. Among several hundred specimens tested in Punjab during 1985, only one individual An. culicifacies (Multan District) survived the test. In Faisalabad, 4 specimens of An. stephensi among 300 tested in May 1984, survived; however, follow-up tests which were conducted at the same site in September failed to detect any resistant individual. In Bannu, NWFP, individual An. stephensi were found to have survived the diagnostic dose of fenitrothion in two of the tests conducted in 1984. Interestingly, these mosquitoes were obtained from localities which had been treated with fenitrothion during 1981-83.

3.5.6 Role of agricultural insecticides in resistance

There is clear evidence from different countries that insecticide resistance in mosquitoes is most serious in agricultural areas that receive heavy and frequent applications of insecticides. The crop most frequently implicated is cotton, but rice, sugar cane, and corn are also often suggested. The most serious cases of such resistance are those of An. albimanus in Central America and An. sacharovi in Turkey.

The data on the geographic distribution of malathion resistance in An. stephensi in Pakistan, although still rudimentary, show a general correlation with the distribution of cotton cultivation Fig. 1 (Annex 6.5.12). Some 9,189 metric ton of formulated insecticides have been imported in Pakistan in 1984, and 57.1% of these were organophosphates Table 5.9 (Annex 6.5.13). It is understood that cotton crops receive the largest share of these insecticides, and that the amounts used have increased substantially during the last 2 to 3 years. The potentially unfavorable effects of such heavy use of insecticides on the suceptibility of mosquitoes must be borne in mind in the planning of mosquito resistance surveillance in the future.

3.5.7 The question of replacement of malathion

In view of the evidence for the presence of resistance to malathion in An. stephensi in certain districts of the country, the

question is raised whether malathion is still the most desirable chemical for use in the malaria control program.

Among the very few presently available chemicals that are suitable for indoor residual application, malathion has traditionally been considered the chemical of choice due to its low mammalian toxicity, relatively low cost vis-a-vis other, non-chlorinated, insecticides and most importantly, due to the unique mechanism of resistance by which insects may eventually become resistant to it. This mechanism, based on the enzyme carboxylesterase, is specific for malathion, thus insects becoming resistant to malathion by this means are not cross-resistant to other insecticides. Most other organophosphate insecticides (fenitrothion, temephos, chlorpyrifos, fenthion, etc.,) are resisted by insects primarily through more broadly acting enzymes, referred to as phosphotriesterases, which impart cross-resistance to several organophosphate insecticides. These considerations have not changed in recent years; in fact, they have been strengthened for the case at hand, by the finding that the enzyme carboxylesterase is indeed the mechanism of malathion resistance in both An. stephensi and An. culicifacies.

It must be pointed out, however, that when anopheline mosquitoes are exposed to multiple types of insecticides, broadly acting resistance mechanisms such as phosphotriesterases and insensitive acetylcholinesterases may be selected, thus conferring a broad spectrum of resistance involving several types of classes of insecticides. This is an insidious risk which may eventually be expressed in heavily sprayed agricultural areas.

Has malathion resistance in An. stephensi reached a level at which its use is no longer cost-effective? While the resistance tests do indicate significant presence of malathion-resistant individuals in certain areas (section 3.5.5.3), population density determinations continue to show drastic reductions following the spray application. Whether the observed increases in malaria incidence during the past few years are the consequence, at least in part, of more rapid re-attainment of critical densities by the vector populations in sprayed areas, this cannot be answered at present due to lack of comparative epidemiological data from sprayed and non-sprayed areas on which correlations with resistance and vector density can be sought.

The question of introducing another insecticide in the malaria control program must be answered by taking into consideration all factors involved. These include the continuing susceptibility of the principal vector An. culicifacies, the toxicological advantages of the insecticide, the lack of cross-resistance to other organophosphates, the experience of the present organization in its use, the economics of its procurement, and the short and long-term disadvantages of changing to a broadly acting chemical. When all these factors are weighed, it becomes apparent that a change would be justified only when supported by strong evidence that use of that insecticide no longer accomplishes the desired objectives.

As stressed elsewhere in this report, it is essential that comparative data be obtained from sprayed and non-sprayed indicator villages concerning (1) resistance (2) vector density (3) epidemiology and (4) history of chemical control.

In anticipating the eventual need for substitution of malathion in certain areas, field trials must be initiated with new chemicals and tactics of use, so that these may be introduced when judged desirable. Fenitrothion has been used operationally in Pakistan in past years. Bendiocarb, a carbamate, has been examined on a small scale and requires further testing. There is some concern that carbamates may be more prone than organophosphates to select for "insensitive acetylcholinesterase" type of resistance; therefore their wider use must await the results of research on this issue. Pyrethroids (cypermethrin, deltamethrin, permethrin etc.,) are highly active against adult mosquitoes but have been shown to be affected by existing DDT resistance. Thus, their use may be limited to selective applications, as for example on mosquito netting.

Tactics of insecticide use that hold promise for delaying the onset of resistance include the "mosaic" use of two chemicals. These may be applied in the same house by spraying opposite walls with each, or spraying the ceiling with one and the walls with the other. A carbamate, in view of its fumigant action, may be a member of the pair. Alternatively, the carbamate may be sprayed in the living quarters where the use of malathion is meeting objections, while the latter is sprayed in the animal quarters and storage rooms.

3.6 Parasite Resistance

Chloroquine became the standard antimalarial world-wide in the early 1950s. For the following 10 years, it was used with success against the acute infections of all the human malarias. In South East Asia, chloroquine resistant falciparum malaria was first detected in Thailand in the early 1960s. From this original focus, the resistant parasites have spread westerly, reaching India by 1973.

Realizing the grave implication to the malaria control effort should chloroquine resistant falciparum malaria become established in Pakistan, the Directorate of Malaria Control (DOMC) launched an extensive program beginning in 1974 to evaluate the response of local falciparum strains to chloroquine by the use of the WHO extended (28 days) in-vivo field test. In addition, in collaboration with WHO, 50 macro in-vitro tests were also carried out in 1976. The results of these early evaluations showed that the falciparum strains assessed were fully sensitive to chloroquine.

Beginning in 1981, field monitoring for chloroquine resistant falciparum malaria was intensified. Initially, the National Malaria Training Center (NMTC), of the DOMC performed all of the assessments. In an attempt to widen the scope of field monitoring, personnel from the Punjab MCP, were given training by the NMTC on both in-vivo and in-vitro (WHO micro test) methods of field studies. The results of field studies in recent years are summarized in the following table:

The Evaluation of the Susceptibility of falciparum strains of Pakistan to chloroquine by in-vivo tests

NMTC conducted studies:

Date of Study	Province/District	No. Subjects	Results* S	R I	R II	R III
12/77 - 01/78	Punjab/D.I. Khan	58	58	0	0	0
10/80 - 11/80	Punjab/Gujrat	60	60	0	0	0
01/81 - 02/81	Sind/Sukkur	27	27	0	0	0
10/81 - 11/81	Punjab/Sheikhupura	60	58	2	0	0
02/83 - 03/83	Punjab/Sheikhupura	39	39	0	0	0
11/83	Punjab/Jhang	60	56	4	0	0
01/84	Punjab/Bahawalnagar	33	17	15	1	0
10/84	Punjab/Lahore	16**	6	10	0	0
11/84	Punjab/Kasur	43	16	24	2	1
12/84	Sind/Karachi	2**	2	0	0	0

** WHO Micro-in-vitro test

MCP, Punjab conducted studies:

Date of Study	Province/District	No. Subjects	Results* S	R I	R II	R III
01/85 - 02/85	Punjab/Lahore	57	1	34	22	0
02/85 - 03/85	Punjab/Kasur	44	1	11	32	0
02/85 - 03/85	Punjab/Sheikhupura	31	15	16	0	0
02/85 - 03/85	Punjab/Muzaffargarh	34	0	4	30	0

* The *in vivo* response of the falciparum infections studied was graded according to the following WHO criteria:

S = Clearance of patent parasitaemia by day 7 with no recrudescence

RI = Clearance of patent parasitaemia by day 7 with recrudescence by day 28 or earlier.

RII = No clearance of patent parasitaemia by day 7 but parasitaemia lower on day 7 than day 0.

RIII = No clearance of patent parasitaemia by day 7; parasitaemia higher on day 7 than day 0.

Beginning in January 1985, personnel of the NMTC began a modest trial of alternative antimalarials against chloroquine resistant falciparum malaria in Okara district of the Punjab. The results are as follows:

Drug	No. of Cases	Results S	RI	RII	RIII
1. Chloroquine	15	6	9	0	0
2. Amodiaquine	14	3	8	3	0
3. Fansidar	14	13	0	1	0

In addition, provincial MCP personnel also studied the efficacy of amodiaquine against falciparum strains with known chloroquine resistance at RI level. Sixteen such cases were treated with amodiaquine at 25 mg base/kg and followed for 3 weeks. The results showed:

1 case each recrudesced at 1st and 2nd week and
3 cases recrudesced at 3rd week

The NMTC plans to continue the monitoring activities beginning in November 1985, using the WHO micro-in-vitro test as a screening device to identify foci with possible chloroquine resistant strains. Once such areas have been identified, the presence of the resistant strains will be confirmed by in-vivo testing.

Results to date indicate clearly that chloroquine resistant falciparum strains are present in Pakistan. The foci of resistant parasites are indicated in map shown as Annex 6.8. Of interest is the disparity in result between the NMTC and Punjab provincial MCP studies. The NMTC findings indicate that up to 1983, the vast majority of the falciparum strains were still sensitive to chloroquine. Since 1983, there appears to be a significant increase in prevalence of resistant parasites mostly at the RI level. In contrast, the Punjab provincial studies not only showed high prevalence rates but also a concomitant increase in level of resistance to the RII level. It is difficult to explain the differences in the 2 sets of studies. Note worthy is the fact that the NMTC personnel have had considerably more experience in field monitoring of resistant parasites than the provincial personnel. Another factor to consider is that the provincial studies were performed in Jan., to March, months during which there would no longer be falciparum transmission. Thus, it is possible that the cases studied represented strains which were transmitted during the transmission season, September-November the previous year and which remained positive after heavy selection pressure from chloroquine treatment.

The number of falciparum infections treated with alternative antimalarials were few but the fact that in one trial, 13 of 14 infections treated were susceptible to Fansidar is encouraging.

To date, field monitoring for chloroquine resistant falciparum malaria has been confined essentially to the Punjab. According to NMTC personnel, MCP personnel from the Sind and NWFP will be provided practical training on the use of both in-vivo and in-vitro monitoring methods as part of the planned NMTC monitoring activities, for these provinces. Discussions with MCP personnel from the Sind, NWFP and Baluchistan indicate that they did not believe chloroquine resistant falciparum malaria to be a problem in their respective provinces.

The threat posed by the spread of resistant strains should not be minimized. The only method to curtail its spread is to control falciparum malaria transmission. Thus, steps must be taken to vastly improve surveillance and spray operations. In addition, effort must be made to educate the medical profession in Pakistan not to abuse the use of alternative antimalarials such as Fansidar. It is clear from information provided to the team that Fansidar is being prescribed widely by private practitioners for clinically diagnosed malaria cases. Unless such a practice is modified, its unjustified use may bring about a premature development of resistance by falciparum parasites, which would negate the usefulness of this most important alternative antimalarial.

3.7 Urban Malaria

The problem of malaria control in urban areas was not visualized at the time of preparation of the original 14 year plan for malaria eradication. Due to major malaria outbreaks in Karachi in the late 1960s (1967) and early 1970s, the DOMC included urban malaria control in the Five Year Extension Plan starting in 1975-76. The work of initiating and improving urban malaria control continues as a major activity in the 1982-87 planned program.

The major emphasis in the present plan for the control of urban malaria is described as being placed on construction of permanent engineering works for improvement of drainage of waste water and environmental sanitation. As the DOMC or the PMCP do not have personnel or authority to carry out such work in urban areas their role is confined to encouraging local bodies to do such work and providing technical assistance, limited commodities, evaluation and training services when requested. It is a policy of the DOMC that the ultimate responsibility for control of urban malaria rests with the local bodies. There is also special emphasis on the development of an effective passive surveillance system to assist in pin-pointing focal malaria areas. During the Extension Plan, urban malaria control was initiated and limited transport, spray equipment and larvicides were supplied to local authorities. Under the present plan it is proposed to include malaria control activities to all cities/towns having more than 20,000 population. The plan qualifies DOMC assistance to such urban areas by requesting that a functional system for monitoring vector density and malaria incidence be established and operational. All supplies from the DOMC for urban malaria activities are routed through the provincial health departments according to stated policy. However, it appears that this policy is not followed in all cases (Sind) and supplies often go directly from DOMC to the local bodies.

The DOMC, in an effort to strengthen its program of urban malaria control, organized and held a workshop on urban malaria and other vector control programs on September 24-25, 1984 in Rawalpindi. The workshop was aimed at activating urban malaria control and vector control programs in 13 major cities of Pakistan. The need to (1) establish passive case detection posts and (2) establish an entomological monitoring capability was stressed at the workshop. The participants were asked to formulate plans for their own areas and provide support requirements to the DOMC for their proposed

activity. It was understood by the team that not all the plans have been received by the DOMC as expected and detailed planning is being delayed.

Karachi

The largest major urban malaria control program in Pakistan is Karachi. Greater Karachi City covers an area of approximately 250 square miles. The Lyari River, Malir River, numerous storm water drains, nullas (canals), seepage water from housing areas, blocked drainage areas all contribute to major mosquito breeding situations. There are at least eleven different major civic agencies in Karachi such as KDA, KMC, Cantonment Boards, Pakistan Railway and the Port Authority that have responsibility over portions of the Karachi area and contribute to a complex situation regarding jurisdiction for mosquito/malaria control. The team visited the Karachi Municipal Corporation (KMC) as well as the urban and rural zones of Karachi during their evaluation in Sind Province. The KMC has seven administrative districts - Khori Garden Zone, Saddar Zone, Nazimabad-Liaquatabad Zone and Orangi Township, Lyari Zone, Societies Zone, Landhi-Korangi Zone and North Karachi. Each Health District is divided into 5-15 sectors with a malaria supervisor and from 5-10 malaria coolies. Each sector has six daily working beats. There are malaria inspectors at each district. The entire operation is coordinated at the KMC by an experience vector control officer.

The epidemiological data for Karachi is organized by the Karachi Urban Zone. A summary of the 1981-84 data provided by the Karachi Urban Zone is presented below with detailed information in Annex 6.7.

Year	Total Slides Collected*	Total p.v.	Total p.f.	Mixed	Total Positives
1981	71,650	434	20	1	453
1982	65,773	201	27	-	228
1983	50,465	189	51	2	238
1984	51,950	221	43	-	264

* 29 institutions under Urban Karachi Zone.

It appears from the reported data that malaria is being basically controlled in Karachi even with the limited information available. However, there are several points which need to be stressed in reviewing this data. First, the blood slides are collected by MCP personnel assigned to the 29 institutions and it was reported that the institutions themselves do not actively take part. Second, the information is incomplete and does not include many private or military clinical cases. More important, information on malaria was not available with the KMC Vector Control Officer at the time of the team's visit for his use in program planning and in directing operations.

The team learned that mapping of breeding sites was last carried out in 1978 and it is upon this basis that the present program plans its activity. A new mapping (GR) effort is being proposed for 1986-87 and the team certainly supports this plan. There is no sanitary engineer assigned to

the KCM for vector control activities in the Health Department and permanent control methodology is dependent on the cooperation and involvement of other KMC departments. Major operational activities implemented by the Vector Control Officer consist of degrassing, channelisation, reduction and elimination of breeding sources, cleaning drains, increasing water flow, larvicide treatment, ULV and backpack spraying applications for adulticiding. The team visited two working sites and observed the KMC operations. There is a total of 836 employees assigned to the KMC for vector control of which 709 are coolies, 47 are malaria supervisors (acting), 12 malaria supervisors, 7 malaria inspectors, 3 insect collectors, laboratory personnel, and 60 incharge of work. There is one entomologist, one malaria superintendent and one malaria assistant who are the major technical and supervisory officers. The basic urban malaria entomological information is included in the section on Operational Entomology in this report.

As can be seen, the Karachi urban vector control operation is a complex, expensive, labor intensive activity which requires a variety of high quality skill levels. The insecticides being used are costly and require careful handling and application for environmental and health reasons. The team is very appreciative of the difficulties of the task and the hard work of the limited senior staff and field personnel. In discussions it came out time after time that the KMC personnel required basic training, refresher training, specialized training, supervisory training and the obvious gaps in knowledge on modern control methodology are substantial.

It appeared to the team that training and technical assistance are major areas where the Province, the DOMC and assisting agencies can up-grade the existing system. It is true that additional ULV and transport are required for field service, but it is more important to have a well developed work plan, mapped areas, trained personnel and epidemiological data to justify insecticide, labor and equipment expenditures. The DOMC emphasis on permanent control methods and environmental sanitation is correct but needs more interagency coordination and implementation as it appears the present method is not as effective as it might be.

Quetta

The team held discussions with the Quetta Municipal Corporation (QMC) as well as the Provincial Offices on the question of urban malaria control in Baluchistan. The team reviewed a draft plan of action prepared by the Province in December 1984 for urban malaria control in Quetta which included a staffing pattern, budget, equipment, coordination and availability of technical guidance. The plan is sound in its approach, but has not been accepted by the QMC. It was not clear whether the QMC had participated in the planning or not. The Province does provide limited equipment and larvicides such as Abate to the QMC. The Province also supplied synthetic ULV Pyrethroid to the QMC in 1984, but not in 1985. The Municipal Corporation Health Officer was visited and it was learned that his staff includes 2 chief sanitary inspectors, 13 anti-malaria workers and 13 anti-fly workers which carry out a scheduled work program. The Health Officer did not have malaria epidemiological data and it appears that the five health dispensaries which come under his supervision do not collect slides. The 1985 malaria data for

Quetta town which was available from the province indicates that the PCD institutions listed as activated had not been very productive through the January - June period. The malaria control office in Quetta collected 199 slides with 31 positives during this period. It was explained that many of the positive slides detected by the PMCP are from Afghan refugees and are not indigenous to the town area. No urban entomological data were presented. The QMC vector control insecticidal operations are carried out with Diptex, Abate, Actellic and malathion and are not guided by field entomological evaluations. Field personnel are not trained in health education and working experience appears to be the primary source of operational and safety skills. The PMCP stated that in 1984 they had received 20 MTs of Abate from the DOMC. This material was divided by issuing 10 MTs to the QMC and 10 MTs issued to the 17 district offices in the province. The team was unable to find a plan upon which this allotment was provided or any report of the results obtained by its use. Abate granules cost approximately $1700/MT plus shipping from U.S. port to Karachi plus shipping to Quetta. A 10 MTs allotment may cost between $25,000-$30,000 for district delivery and use. This level of investment can not be justified if evaluation of its action on mosquito larvae is not determined and there is no epidemiological evidence that malaria or any other disease is affected. Chemical control can not be substituted for basic sanitation and is to be primarily reserved for control in areas where no other method is suitable.

The team stresses that a basic work plan should be developed in every municipality engaged in vector mosquito or fly control. Training of its district and sector staff in basic control methodology, health education and safety is essential. For QMC and the Province as a whole, a massive and intensive training program is suggested. The period of March-April in 1986 appears a suitable period. The province should provide the QMC with malaria data and encourage them to engage in PCD activities on a planned basis. If possible, QMC laboratory facilities should be developed. The use of available technical assistance for anti-malaria and anti-mosquito/fly control work including planning, operations and evaluation needs to be encouraged. The continued provision of materials to districts for anti-malaria or anti-mosquito activities without a planned program or trained personnel is not cost effective and may lead to future technical and management problems.

Lahore

Information in the Punjab Province was provided to the team on the epidemiological and entomological activities in Model Town, Lahore in September 1985 by the NMTC. Out of 344 slides, a total of 40 *P. vivax* and 10 *P. falciparum* were detected. Only a low density of *An. stephensi* and *An. pulcherrimus* were captured in the area. None of the mosquitoes dissected were positive for sporozoites, but two *An. stephensi* were found with oocysts. It appears from case investigation that malaria transmission is occurring in Model Town. This recent investigation points out the importance of urban malaria control and the urgency of maintaining technical surveillance backed by operational resources.

In summary, a start has been made on organizing and implementing an urban malaria control program in Pakistan. There are existing offices with fiscal and human resources engaged in this effort at some operational level.

The concerned offices should now strengthen and expand their programs through training, use of appropriate and cost effective technology and work against a planned program stressing environmental measures and reducing chemical control where possible. As a point of interest, a brief summary prepared by Dr. William Chin on the risk of malaria infection in urban centers of Pakistan is enclosed in Annex 6.9.

3.8 Operational Research

3.8.1 Background

Much of the hope to meet operational research needs of the MCP, as delineated in the Malaria Control II Project Paper was dependent on the creation of an operational research unit (ORU). It was planned for the ORU to be part of the NMTC and by the recruitment of 23 staff member, would augment the NMTC personnel to undertake the dual responsibility for research and training to meet MCP needs. The ORU, after a number of delays, was sanctioned by the Ministry of Health but the recruitment of personnel was not initiated. The possible cause for this situation appears to be the GOP's reliance on the possibility that a field unit of the University of Maryland, the International Center for Medical Research and Training (ICMRT) in Lahore would fill interim needs until such time as the ORU becomes fully operational. Thus, significant funding, amounting to U.S. $3.6 million from the USAID Malaria Control II Project funds, and considerable effort of the technical resources available to the MCP, were provided at GOP request to assist the ICMRT. After one year of operation, the technical performance of the ICMRT was evaluated by a team constituted by the USAID. A major conclusion of this team was that of the ICMRT activities, no more than one third was relevant to assist the MCP in resolving difficult technical problems. Based on the results of this evaluation, the USAID decided to cease its funding to the ICMRT effective May 15, 1985. It was also decided by the Ministry of Health, GOP that in the place of the ICMRT, a new GOP institution would be organized beginning on May 16, 1985, which would incorporate those former Pakistani ICMRT staff who were willing to transfer to GOP service.

At the initiative of the Ministry of Health, the National Institute of Malaria Research and Training (NIMRT) was created. Because of the need to maintain continuity of employment for former Pakistani ICMRT staff, the NIMRT was established by the Ministry of Health prior to its sanctioning by the Ministry of Finance. Currently, the Ministry of Health is making intensive efforts to seek sanctioning of the NIMRT by the Ministry of Finance. The present plan is to organize the NIMRT as a part of the Ministry of Health and not as part of the NMTC or DOMC.

The Malaria Control II Project also contains a provision whereby the USAID would purchase and renovate a building in Lahore which would become the permanent facility for the NMTC and its ORU component. Such a building was identified and negotiations to finalize the sale was nearing completion in February 1985 when the Ministry of Health requested the USAID to explore other options. Currently, the unsanctioned NIMRT is still based at the former ICMRT facility and the NMTC has relocated to the same facility. The team understood that there is a likelihood that the Punjab provincial authorities may request the return of this provincial property to the Punjab.

3.8.2 Summary of Research Projects carried out by the National Malaria Training Center

3.8.2.1 A large scale field trial of bendiocarb, malathion and fenitrothion w.d.p as indoor residual spray was carried out in Sheikhupura, in which a population of approximatey 40,000 living in 8,100 houses were covered. The results indicated that bendiocarb compares more than favourably with the two organophosphorus compounds.

3.8.2.2 A trial was carried out to incriminate insectary reared An. stephensi. In a few mosquitoes fed on malaria carriers, sporogonic cycle was completed in 13 days for P. falciparum in one female and in 10/11 days for P. vivax in two females.

3.8.2.3 A field trial to compare the effect of malathion versus fenitrothion on malaria transmission was carried out in two separate districts in 1983-1984. Results showed that fenitrothion has a longer residual effect than malathion especially in connection with An. stephensi which showed some degree of resistance to malathion. Of considerable significance was the finding that 35 of 46 (76%) of the spraymen who applied fenitrothion manifested toxic symptoms as compared to 1 of 42 (2%) of the spraymen who sprayed malathion.

3.8.2.4 A field trial with Bacillus thuringiensis H-14 (Teknar) was carried out in Lahore city in 1983-84, against culicine and anopheline larvae, using three concentrations of the bacterium, 0.05, 0.1 and 0.2 ml/m^2 dose. The concentration of 0.1 ml/m^2 was found appropriate to effectively kill anopheline larvae at weekly interval. Culex kill by all the dosages was almost the same. The authors concluded that if Teknar is to be used in rural/semi-urban areas 0.1 ml/m^2 could be used. However, in urban conditions even 0.05 ml/m^2 dose will be sufficient to kill culicine larvae at weekly intervals.

3.8.2.5 Diffubenzuron (Dimilin), an insect growth regulator was tested in Lahore against mosquitoes breeding in polluted water and sewerage. Results were not conclusive and further observations were recommended.

3.8.2.6 Monitoring studies to detect chloroquine resistant falciparum malaria and evaluations of alternative treatments for the drug resistant strains are described under section 3.6, Parasitic Resistance.

3.9 Training

3.9.1 The National Malaria Training Center in Lahore is and has been doing a most commendable job. Several thousand participants have taken part in training and/or orientation at the Center over the years. Courses conducted followed more or less the classical training pattern for this type of center, and have trained competent staff and personnel for the country's anti-malaria effort. Courses in the past have included general courses in malariology for professional and senior technical staff, and special courses in the major desciplines of the program, as entomology, parasitology, etc.

In recent years, emphasis has been shifted towards malaria training and orientation for general health services staff, and the introduction of special subjects and new techniques in malaria. Besides refresher courses for staff of the anti-malaria program, courses were organized on malaria epidemiology for (Assistant) District Health Officers; on malaria microscopy for general laboratory technicians; on passive case detection for personnel of rural health institutions; on urban malaria; on space spraying techniques; on the safe use of insecticides; on in-vitro and in-vivo testing for chloroquine sensitivity; etc.

During the period 1981-1985 (up to August) the total number of courses given is as follows:

1981 - 6 courses, with 68 successful participants
1982 - 5 courses, with 96 successful participants
1983 - 5 courses, with 68 successful participants
1984 - 11 courses, with 227 successful participants
1985 - 7 courses, with 177 successful participants

Courses are being assessed through pre- and post-course tests, showing not only the progress of participants, but reflecting at the same time the quality of the teaching (see Annex 6.10).

3.9.2 The present staff comprises three competent professionals, and about 25 supporting and ancillary personnel. Despite limitations of time and staff, the NMTC has been able to carry out a number of applied field research activities during this period, including:

- Field tests for determining the sensitivity of P. falciparum to chloroquine in-vivo and in-vitro, in various localities.

- Field trials with various larvicides, including temephos, chlorphynifos, pirimiphos, Bacillus thuringiensis, diflubenzuron (a chitin synthesis inhibitor) and methoprene.

- Malaria survey in northern areas.

- Trial with malathion and fenitrothion.

- Large scale field trial with bendiocarb, malathion and fenitrothion.

In view of technical and operational difficulties facing the anti-malaria program at this very moment, in particular in relation to resistance of vectors to malathion, resistance of P. falciparum to 4-amino-quinolines, and the need for re-adjustments in the organization of especially the surveillance operations under the integrated set-up, there is an urgent need for a whole series of applied field research studies. These studies could most conveniently be carried out under the auspices and/or in cooperation with the staff of the NMTC through the creation of an operational

research unit, to be added to the present Training Center. Such an addition would require some additional professional and supporting staff. The temporay physical facilities of the NMTC, adequate for the present limited activities, would need an expansion as well. More important is its need to relocate to adequate permanent facilities.

3.9.3 From discussions and a review of data available at the provinces, the team feels that training does not receive the attention it deserves. It is suggested that each plan of action include a realistic and detailed plan for training including training and retraining to be conducted within the province for lower echelons of workers, like malaria supervisors and spray squads, as well as training that would need to be undertaken at the NMTC. It is essential that for all training activities the necessary budgetary provisions for travel as well as for board and lodging of trainees be made when indicated. DOMC may consider a short-term consultant on training for reviewing in depth the provincial plans, personnel needs and facilities for training. In the meantime, each province should assign a senior officer with the task of specifically looking into training needs and develop in coordination with other provincial officers a schedule for implementing the planned training program.

The budgetary difficulties experienced by provinces in sending participants to NMTC courses could be overcomed at least in part if in the expansion suggested above for NMTC, a dormitory facility would be included.

3.9.4 It is only a few decades ago that there appeared to be a considerable number of expert malariologists throughout the world who could fill the key positions in their national anti-malaria programs. Today, one is faced with a global shortage of qualified and experienced malariologists; the situation in Pakistan is no exception.

Identifying some promising medical officers/science graduates, who could, after appropriate training and exposure here and abroad, take up malariology and make it their career, deserves highest priority.

3.10 Integration of the Malaria Control Program into the Primary Health Care System

The delivery of health services and the implementation of the malaria control program (MCP) are responsibilities of the provincial government. The MCP is now under various stages of integration with the general health services. The present status is as follows:

3.10.1 Province of Sind

In Sind, the MCP has been integrated with the general health services since 1974 but only at the district/zonal level where the zonal MCP has been brought under administrative control of the District Health Officer (DHO) who acts as zonal malaria control officer with all administrative and financial power for salary sanctions, distribution and disbursement of operational funds allocated by the provincial malaria office.

At the top level, MCP still maintains the office of Provincial Chief (MCP), independent of the office of the Director Health Services which is responsible for general health services operations in the province. Both offices, although independent are under the administrative, supervisory and policy control of the Office of the Secretary of Health, Provincial Government.

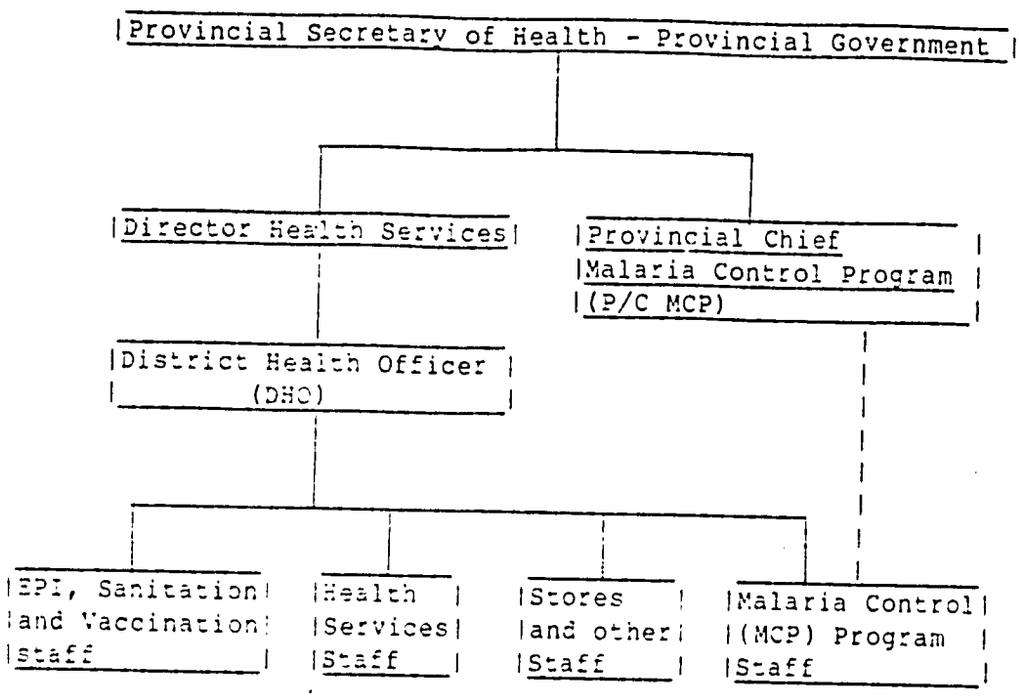
The office of Provincial Chief (MCP) is responsible for preparing and obtaining sanctions of the provincial budget for MCP operations excluding the salaries of district malaria control staff which are budgeted, drawn and disbursed by DHOs. This office also assists the DHOs in preparing district/zonal malaria control operational plans in the distribution of allocated funds to the district offices for MCP operations in accordance with the requirements of respective districts as per its MCP operational plans duly approved by the provincial MCP office. This office is also responsible for the retrival and consolidation of insecticides left surplus in one locality/ subsector/sector to another. Other commodities like spray equipment, anti-malaria drugs, research equipment and vehicles purchased or provided by the DOMC, Ministry of Health and donor agencies are also distributed to the zones or districts by the provincial MCP office. This office also provides the technical and operational guidelines to the district health offices in carrying out malaria control activities. Thus the provincial MCP exercises powers of functional monitoring of malaria control activities in the district health offices but do not have administrative control of the DHOs who are accountable and answerable only to the Provincial Director of Health Services.

Therefore, in the present set up of integration of the MCP with the general health services in Sind, the Provincial Chief of the MCP has functional control but almost no administrative control, to ensure efficiency and effectiveness, in the implementation of the MCP in districts/zones. This dual control for administration and functioning of the integrated MCP by two different supervisory agencies (Chief, Provincial MCP and Director Health Services) presents uncertainty in achieving targeted/desired results and affects satisfactory operational implementation of MCP activities in the districts/zones.

It is therefore recommended that to achieve the desired results from the integration of the MCP, the provincial MCP office be integrated with the Directorate of Health Services in such a manner that the provincial malaria Chief Officer exercises functional, as well as administrative control over the District Health Offices so that smooth and effective implementation of the MCP is ensured.

SIND MALARIA CONTROL PROGRAM

Present Status - (partially integrated)



LEGEND: _____ (indicate) = Administrative and Functional Control

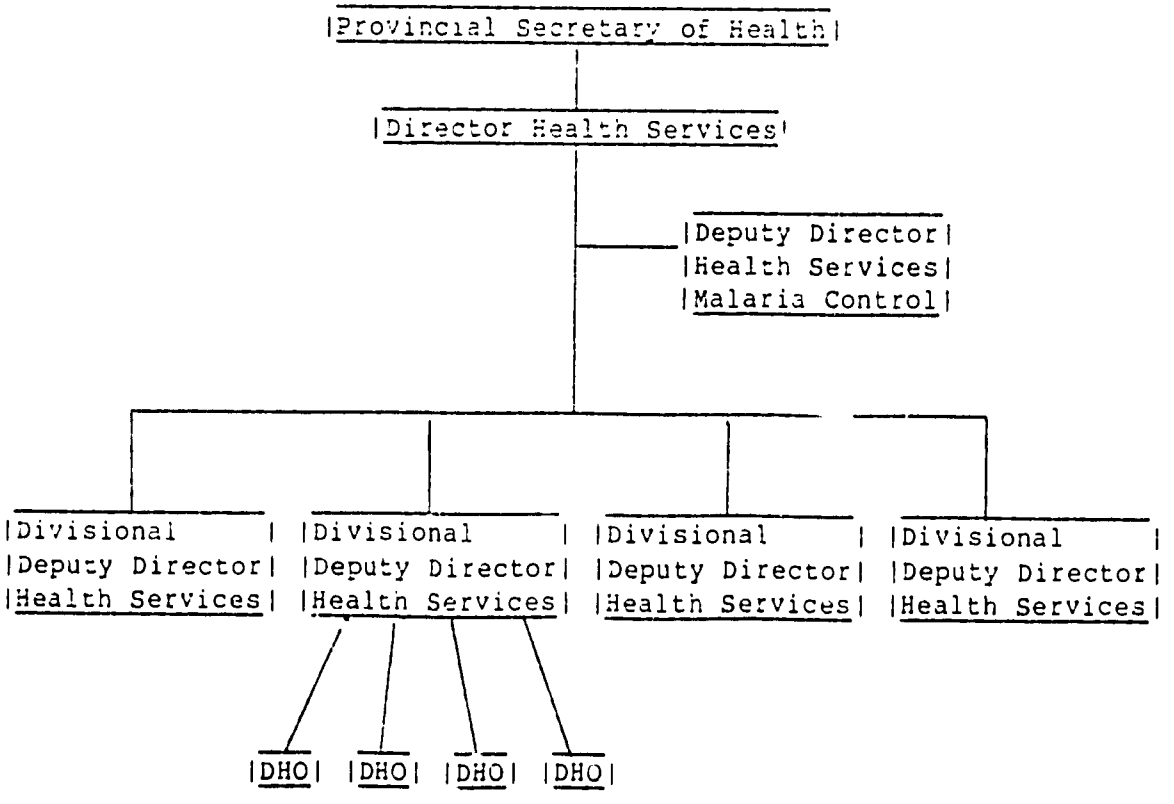
------- (indicate) = Functional Control only

3.10.2 Province of Baluchistan

In Baluchistan, the MCP was a vertical program till June 30, 1985 when it was integrated with the General Health Services both at provincial as well as at district/zone level. Rather, the zones of the malaria control program which were formerly only two have now been made seventeen i.e. the same number as there are districts in the province. The provincial chief of the malaria control program has been designated as the Deputy Director, Health Services (Malaria) at the provincial headquarters and the Divisional Deputy Director, Health Services has been made responsible for administrative and functional control of MCP staff distributed in the seventeen districts/zones and placed under the administrative control of the District Health Officer (DHO). In this way MCP activities have been integrated functionally and administratively with the general health services and have been placed under administrative and functional control of the Director Health Services who exercises that control through his Deputy Director Health (Malaria) who was formerly the Provincial Chief, Provincial Malaria Control Program. The program has thus maintained its previous potential of effective MCP activities at the same time increasing the number of administrators and functional supervisors.

BALUCHISTAN MALARIA CONTROL PROGRAM

Present Set up - (fully integrated)



3.10.3 North-West Frontier Province

The MCP in this province has been integrated with the general health services since July 1, 1985, in a way similar to the integration in Baluchistan.

The required reorganization is underway, but still very much at a stage of transition during which several difficulties related to the integration process need yet to be resolved. Present plan proposes the abolition of the post of malaria superintendent by redesignating such personnel as administrative officers. The previous post of malaria superintendent would be filled by newly recruited medical graduates as CDC officers.

Of utmost importance is training of staff who will assume new responsibilities in the implementation of the MCP. Under the integrated set-up this task at the district level will be in the hands of CDC officers who frequently have had no training in malariology. This training is presently being planned. True integration of various anti-malaria activities, in particular PCD, will hopefully follow thereafter, after proper orientation and training of staff and personnel involved in this activity.

A problem peculiar to this province is that in converting the old malaria zones into health districts and agencies, the latter category will be without any malaria staff. Each of the seven agencies of the province would require at least two malaria officers and a laboratory for keeping the current MCP operations going in these areas.

3.10.4 Province of Punjab

The MCP was provincialized and integrated with the General Health Services, along with other vertical programs on July 1, 1977. It may be of interest to put on record that the integration was, during several years by and large an administrative integration only, whereas genuine functional integration of malaria field activities is rather a very recent development, and even to date in some respects not yet fully operational.

Great efforts have been made to attain functional integration through proper direction and intensive training of staff and personnel of the general health services in relevant fields of malariology.

In retrospect it would appear that beside the Director of Health Services, District Health Officers have played a deciding role in getting functional integration off the ground. This province has thereby shown that it can be done in Pakistan.

3.10.5 Since the title of this section refers to the Primary Health Care system, it may be appropriate to point out that one is still referring to the integration into the basic rural health services, and not to the present concept of Primary Health Care (PHC) which should bring health for all, down to the village level. The most peripheral unit of the rural health services in Pakistan is the Basic Health Unit covering on the average a population of 15,000. Through its mobile component, this unit may bring

health to the village level, but then only intermittently. For the treatment of an acute disease like malaria, the ultimate solution would require a static health facility at village level, which could provide adequate treatment.

In this connection, the present efforts being made towards the development of true PHC at the village level through voluntary village health workers should be noted. At this stage, these volunteers are found in only a very limited number of villages, and their tasks have remained so far restricted to providing advice and education in so far as malaria is concerned related to acceptance of indoor spraying and reporting of fever. The present target of the program is to provide one male and one female voluntary worker to every 1000 inhabitants. Apart from supervision provided by the PHC program itself, it is envisaged that mobile teams should provide additional stimulation to these volunteers. Although currently still in a rudimentary stage of development, it is felt that this program, which is receiving substantial external support would be an important extension of the basic health services, which in relation to the MCP would gain in importance, once some minor additions like the collection of blood smears and the administration of anti-malarials would be included in their routine tasks.

3.11 Health Education

No one can deny the role of health education in increasing the acceptability of insecticide spray by the homeowners in the rural areas. There are many excuses forwarded by the inhabitants of the villages in their effort not to have their house sprayed or to avoid having to prepare the house for spray. If it were not for the health education campaign provided by the malaria/CDC supervisor or his inspector/assistant malaria superintendent, there could not be satisfactory achievement of the target of house actually sprayed viz-a-viz houses planned for spray. Each malaria/CDC supervisor in each of four provinces of Pakistan has been carrying out this activity in his own capacity. In order to support this effort during the 1984 and 1985 spray operations, DOMC with the financial assistance of USAID, organized and presented a health education campaign through Radio Pakistan in all regional languages and dialects spoken and understood in various parts of Pakistan. Field visits of federal, provincial and USAID officials confirmed the improved response of the public to the spray operations program. This improvement was made as a result of this health education campaign carried out through radio and other media techniques to support spray operations. The slogans of the radio health education campaign were prepared jointly by Health Education Officers of all the provinces who met in the DOMC prior to the 1984 and 1985 spray operations. In addition, to increase public knowledge of spray operations and surveillance, 1,625,000 (17" x 25") color posters were printed by DOMC, with the financial assistance of USAID, and distributed to Provincial MCP. The provincial offices had the posters displayed in their localities under spray operations and in other suitable places. It can be judged that this program has improved the awareness of the public regarding spray operations and case detection as well as the treatment of malaria.

The individual provincial activities in health education are as follows:

Punjab:

This province has sufficient staff, equipment, mobile units, transport and budget at provincial as well as divisional level to design, prepare and institute health education campaigns on mass scale as well as at local level for their periodic fairs and community gatherings. In addition to the radio time purchased by DOMC and USAID during spray operations, this province purchased time on the radio as well as on TV from its own budget (broadcasting and telecasting) for a health education campaign for malaria control. The overall provincial activity for health education for malaria control is considered satisfactory.

N.W.F.P:

This province has a health education officer, health education vehicle and support staff. The evaluation report provided to the team indicated presentations by health education officer of film on malaria control that have been presented in schools and union councils as well as public discussions on spraying and surveillance. No other health education activities through use of media etc., are evident in the report. Budget status of health education activities in the province was not clear in the presentation. However, the health education campaigns launched by DOMC through radio in regional languages and local dialects to support spray operations, did have a positive effect and did increase the awareness of the public on how to avoid toxicity of insecticide. The health education effort was shown to improve the acceptability of spray operations by the householders. The display of posters provided by DOMC also assisted the province in its anti-malaria efforts.

Sind:

This province has one health education officer and a health education van with equipment and display unit. The health education officer has been carrying out activities to increase awareness of the general public to malaria, ways to prevent the infection, encouraging the use of the nearest health post or malaria supervisor to obtain blood examinations in case of fever. Local fairs and other congregations of people are used to promote provincial health education activities. The provincial chief has expressed satisfaction in regards to amount of health education activities of the province considering the available budget.

The health education campaign launched in 1984-85 to support spray operations has had an appreciable effect and a number of letters to editor appearing in local newspapers indicated an increase in public awareness on the importance of spray operations.

Baluchistan:

The team was impressed with the activities of provincial health education officer and the successful inputs into provincial training through his leadership. Although no other supporting staff such as projectionist, clerks and assistants are available to the health educator, it appeared that

provincial health educationist was capable of preparing training schedules and implementing them if the required support is provided by the Department. With the newly approved divisional basis for operating the provincial malaria effort, it appears that the time is appropriate for applying basic information on malaria control to the Health Department and malaria control staff. Training of the divisional groups on malaria could be done at short in-service courses combined with training on other diseases or public health activities. On provincial basis, health education activities have been carried out through establishment/erecting of health and malaria stalls at public fairs and congregations at rural sites. These stalls display charts and posters and provide health information to the public attending these gatherings. The health education van provided to the health education officer is used for carrying out health education activities in rural areas. These activities have increased the public acceptance of insecticide spray in their houses during spray operations. Provincial efforts have been supported by a health education campaign launched through radio broadcasts during the 1984 and 1985 spray operations.

Overall, the health education activities in the country are considered marginally satisfactory. Many activities need to be improved and expanded especially in regards to surveillance. The evaluation team appreciates malaria control program's future plans to continue a health education campaign through radio, TV and newspapers for improved surveillance and spray operations.

3.12 Evaluation of Achievements Against Planned Program Targets for the 1982-84 Period

3.12.1 Directorate of Malaria Control

The overall objectives of the GOP Malaria Control Program as stated in the PC-1 document under review and consideration by the Government for the 1982/83 - 1986/87 period are stated as follows:

General Objectives	Accomplishments in the 1982/83 - 1983/84 period
A. To keep malaria at its present low level in both rural and urban areas of Pakistan.	A.1 Malaria is on the increase: 1982 - 56,360 reported cases 1983 - 51,596 reported cases 1984 - 73,996 reported cases A.2 The *P. falciparum* per cent is rising: 1981 - 13.32% 1983 - 30.42% 1982 - 17.47% 1984 - 33.39%
B. To delineate more precisely areas with high, moderate, low and no malaria transmission.	B.1 Available data indicates that while GR is updated, the epidemiological stratification requires more precise delineation.

C. To Pakistanize the ICMRT to form a National Institute of Malaria Research and Training to undertake the research problems confronting malaria control.

C.1 Accomplished. The NIMRT, however, remains separate from the DOMC as a special department of the Ministry of Health, Social Welfare and Special Education.

D. Full functioning integration of the malaria control program with the General Health Services.

D.1 The process of integration has actively been implemented in all four provinces, but full integration may not be achieved by 1987.

E. The ultimate objective remains the total eradication of this disease from Pakistan.

E.1 Long term and adequately supported control efforts will be required for many years.

The Government of Pakistan/DOMC has quantified the following program targets:

Targets

A. Annual Parasite Rate should be kept at or below 0.5 cases/1,000 population.

A.1 The population-at-risk of malaria is given at 62,133,283. API of 0.5 for this population would allow 500 cases per million or 31,000 cases/population at risk. The reported case rate in 1984 was 73,996.

B. P. falciparum should not represent more than 10% of all cases of malaria.

B.1

Year	Total cases	Total p.f. cases	% of p.f.
1981	37,923	5,053	13.3
1982	56,360	9,845	17.4
1983	51,596	15,696	30.4
1984	73,996	24,703	33.3

The available data indicate more than 10% p.f. in all cases.

C. The contribution of passive case detection(PCD) slides by General Health Services to total slides collected through surveillance should not be less than 25%.

C.1 Province-wise ACD and PCD slides by year were provided as follows:

Year	No. of ACD Slides	No. of PCD Slides	Approx. %
1981	2,413,989	245,372	(9.2)
1982	2,555,122	341,219	(11.8)
1983	1,969,688	347,050	(15.0)
1984	2,747,350	373,988	(12.0)

The presented data indicate that the 25% rate has not yet been achieved as these two sources (ACD, PCD) are the

			major slide collection areas. There are other slides sources, but their contribution would not change the general picture. Many of the PCD slides are collected by malaria control personnel and not by PCD staff at institutions. Punjab province has had a beginning success in having true PCD slide collection.
D.	The indoor residual spraying of houses should not exceed 25% of all existing houses.	D.1	The number of houses in the 1984 GR is given as 12,073,219. The number of houses sprayed in the 1984 spraying report is given as 2,241,147 totally sprayed and 293,411 houses partially sprayed or 2,534,558 houses. This represent approximately 21% of the existing houses.
E.	The establishment of a functional Malaria Institute for Research and Training.	E.1	A Malaria Institute for Research and Training has been established by the MOH.

3.12.2 A.I.D. Project - Malaria Control II - #391-0472

This project is designed to assist the Government of Pakistan implement its malaria control program (MCP) under an approved PC-1 in the 1982-1987 period. The previous A.I.D. assisted malaria project, which ended in 1980 was successful in achieving an annual parasite incidence (API) of 0.5 cases per thousand or 500 cases per one million population. The Malaria Control II Project is designed to build upon the previous project and to contain or further reduce the incidence of malaria. This will be accomplished by: (1) expanding and increasing the capacity of the federal, provincial and municipal health services to effectively control malaria; and, (2) assisting the MCP move from a vertically organized program emphasizing total coverage house spraying and active case detection surveillance methods to an integrated program utilizing a selective mix of vector control measures and a better balance between active and passive case detection and treatment methods.

The Malaria Control II Project consists of four components - (1) Program Management: technical assistance to strengthen the MCP in evaluation, management, epidemiology, surveillance, urban malaria control and the safe handling of insecticide; (2) Training: to improve the National Malaria Training Center, support for a new facility, short term fellowship, in-service training for malaria and public health personnel; (3) Basic and Operational Research: technical assistance, supplies and equipment, budget to support field studies; and, (4) Commodity Support: insecticides, urban malaria control vehicles, ultra-low volume (ULV) spraying machines, and other necessary commodities.

The A.I.D. Project Paper developed a series of outputs which should be achieved to meet the project purposes. These outputs are as follows:

Project Outputs	Project Accomplishments 1982/84
A. Annual house-spraying programs are targeted specifically to moderate or highly endemic areas based on refined epidemiological analysis.	A.1 Procedure being followed.
B. Senior and mid-level health personnel trained in malaria control undertake surveillance as a regular part of their duties, including taking blood smears, administering appropriate drug treatment, and conducting periodic epidemiological analysis.	B.1 Training has been provided to staff and epidemiological analysis being done, but much more effort is required.
C. Criteria for selection of appropriate organophosphorus insecticides (malathion or fenitrothion) exist and are applied in the program.	C.1 Standard criteria is developed. Entomology is weak. Epidemiological data questionable in many cases.
D. Appropriate and effective biological control methods have been identified from field trials and are implemented.	D.1 None to date.
E. A new facility for the NMTC which is fully equipped and adequately staffed is established.	E.1 Under process. Good progress.
F. NMTC's research and training programs meet the priority needs of the GOP's Malaria Control Program.	F.1 Under process and developing well.
G. Urban malaria control programs are operating at an expanded level and have reliable and accurate epidemiological reporting systems for programing and policy decision-making.	G.1 Limited progress and training and supplies have been provided. Much more effort required. Workshops held in September, 1984 for 13 major urban malaria control operations.

H.	Health education activities have expanded and achieved positive results in obtaining social acceptance of house spraying and surveillance activities.	H.1	Efforts being made but results indicate more inputs required. Malaria control staff need health education training at all levels.
I.	An extended plan of operation for malaria control covering a period of at least three years following the completion of the A.I.D. project (Sept.30, 1987) is prepared and adopted by the GOP.	I.1	Extended planOps (PC-1) prepared but not approved as 10/85.
J.	Participation of females, as both recipients and providers of malaria control services, has increased in surveillance activities.	J.1	Not evident in data or program.

The project also quantified specific output indicators by year. These indicators are provided below for 1983 and 1984:

	Indicator	Year 1983	Year 1984		Accomplishments todate 1983	Accomplishments todate 1984
A.	Spray Operations Spray operations should cover at least 80% of the planned number of houses to be sprayed each year and should reach 95% by 1987.	80%	83%	A.1	82%	92%
B.	Surveillance					
i.	Passive Case Detection (PCD) PCD blood slide collection should reach 25% of the total number of slides collected.	8%	10%	B.1	16%+ -	13%+ -
ii.	Active Case Detection (ACD) The average time lag from ACD slide collection to treatment of a positive case should be 14 days or less.	28 days	25 days	B.2	Average time except in Baluchistan appears to meet standard according to provincial officers but there are exceptions. More specific data required for evaluation.	

	iii. Laboratory Services The error rate in laboratory examination should not exceed 1%.	10%	7%	B.3 All laboratories are below error rate. Many errors reported from hospital laboratories serving Afghan refugees in Baluchistan area which could be corrected by in-service training.
C.	Transport The percentage of the total vehicular fleet (excluding condemned, nonrepairable vehicles) which is off-the-road at any point in time should not exceed 10%.	10%	10%	C.1 - 1984 a. Baluchistan reported 35 vehicles of which 16 were off-road for major repairs. b. Sind reported 80 total vehicles with 21 off-road. c. NWFP/Punjab not provided, but in 1985 vehicles were merged with GHS in NWFP. d. General evaluation is that more than 10% are off-road.
D.	Staff vacancies in the total authorized regular budget staff should not exceed 5%.	5%	5%	D.1 Acceptable. Difficulties with temporary spray personnel due to low daily wage rate.
E.	Planning			
	i. Annual Plan of action prepared.	1	1	E.1 Included with PC-1.
	ii. Annual plan for insecticide safety outlining training and safety measures to be taken is prepared.	1	1	E.2 Not given in detail.
F.	Evaluation Annual program-wide evaluation is conducted with GOP/A.I.D./W.H.O. participation.	1	1	F.1 1983 done in part I, part II. 1984 not done. 1985 done.

The summary evaluation of the achievements of the program over the 1982-84 period indicates generally satisfactory progress in many areas. The lack of an approved PC-1, technical gaps in entomology and epidemiology, insufficient attention to safety measures in the spray program and the need for training of staff in the basics of malaria control including urban malaria control are all areas of concern. The rise of P. falciparum malaria indicates increasing transmission due to inadequate or insufficient control. The report offers recommendations and guidelines for correction of these areas in Section IV.

IV. RECOMMENDATIONS AND GUIDELINES FOR FURTHER IMPROVEMENT OF THE PROGRAM

4.1 Epidemiology

4.1.1 Reporting of Cases of Malaria

The reporting of the number of malaria cases detected in the district/province/country through the various mechanisms (ACD, PCD, MBS etc) would be considerably more meaningful if they are recorded for sprayed and unsprayed localities separately. As the malaria year in Pakistan starts around July 1, cases found during the first half of the year are largely if not exclusively due to the transmission which occurred in the previous year, and should therefore be listed as occurring in sprayed or unsprayed areas, dependent on whether the locality was sprayed or unsprayed during the preceeding year.

4.1.2 Active Case Detection (ACD)

The team endorses the plans of the DHS, Punjab to form mobile health teams consisting of the ACD worker, the EPI worker and a sanitary inspector which will provide limited treatment for common ailments as well as preventive services. Such an arrangement would add to the prestige of the ACD worker, would render house visits more productive and permit closer supervision. A similar re-organization deserves consideration in other provinces now that integration of health services has become country-wide.

4.1.3 Passive Case Detection (PCD)

Recent experience has shown that effective functional integration of PCD is largely a matter of briefing, orientation and training of all officers concerned on the purposes and techniques of this valuable tool.

Orientation and training exercises for DHO's and ADHO's, officers-in-charge of health institutions and technicians who will be involved in the actual collection of bloodsmears have been initiated by the NMTC. It is strongly recommended that this activity be vigorously pursued, and that provincial health authorities utilise the opportunity for the training offered.

4.1.4 Evaluation of Indoor Spraying Operations

In view of the many uncertainties of the case detection machinery in most areas, some doubts regarding the consequences of reduced sensitivity of vectors to the insecticide in use, and the duration of the effective residual life of the insecticide, it is suggested that serial parasite surveys in a number of selected, fixed indicator villages be conducted to monitor the malaria prevalence in a sample of the population.

Taking the epidemiology and the objectives of the evaluation into account, the first "pre-spray" survey should be conducted two weeks after the commencement of indoor spraying, and subsequent surveys after two months, three months and ideally again after four months. (See also 4.3.4 recommendation under Entomology.)

4.2 Laboratory Services

4.2.1 Decentralization of Laboratory Services

The team supports the decentralization of the laboratory services, but this should be accomplished through (re-) training of existing general laboratory technicians/assistants posted at hospitals and health centers in malaria microscopy and not through the reassignment of malaria microscopists to peripheral institutions. The malaria microscopists should be kept at the provincial and district levels, or other strategic locations where their expertise can be utilized for re-checking of bloodsmears, stimulation and on the job training of laboratory technicians in malaria microscopy, handling surplus bloodsmears to avoid backlogs, and for special surveys and emergencies.

4.3 Operational Entomology

Under the present situation where up-to-date entomological information is urgently needed for the guidance of spraying operations and evaluation of its impact, and also because of the need to detect, verify and monitor insecticide resistance in time and space, the team recommends:

4.3.1 To expedite filling the vacant posts of assistant entomologists, and the training of those who did not attend the entomology senior course.

4.3.2 To hold annually a meeting at the Malaria Headquarters for entomologists and assistant entomologists to discuss results of entomological activities carried out during the previous year, constraints, and the work plan for the coming year.

4.3.3 To prepare, shortly after finalization of the spraying program and in consultation with the malaria superintendent/CDC officer, annual detailed entomological work plan with the participation of the assistant entomologists and the entomologist in each province.

4.3.4 To determine the impact of insecticide spraying in index villages which are to be selected annually from within the areas planned for spraying and from areas which will be left unsprayed as control. Parallel entomological observations consisting of indoor resting collections, human bait collections indoors and outdoors and parous rate are to be carried out once before spraying, 15,30 and 60 days after spraying.

4.3.5 To obtain the approval and support of the Provincial Chief Medical Officers and District Health Officers to the entomological work plan in order to provide the transport, funds for petrol and travel allowance required for implementation of the work plan.

4.4 Insecticide Resistance

4.4.1 Enhancement of Resistance Surveillance Activities

The results of susceptibility tests should be monitored closely in all provinces so that deficiencies may be corrected within the

current season. Such deficiencies frequently consist of (a) inadequate testing or absence of testing in a number of districts, (b) lack of follow-up testing in special situations where unusually high survival rate of test mosquitoes, high vector density, or epidemiological data raise questions as to the efficacy of the control activities.

4.4.1.1 Tests for "verification" of resistance as prescribed by WHO are not being conducted in any of the provinces. Such tests involve obtaining offspring from the survivors of a susceptibility test, and subjecting them to the same test as their parents. Higher survival in the offspring constitutes confirmation of the presence of true (inheritable) resistance. Verification of resistance is especially desirable during the early stages of resistance detection, as is now being observed with malathion and Anopheles culicifacies.

4.4.1.2 In the selection of villages for the detection and monitoring of insecticide resistance, attention should be given to the malaria situation, results of previous susceptibility tests, and history and type of insecticides applied for public health and agricultural pest control.

4.4.1.3 Susceptibility testing in the NWFP, Sind and Baluchistan should be strengthened in terms of (a) numbers of tests performed, (b) geographic distribution of test sites, (c) increased emphasis on sites at which resistance is suspected.

4.4.2 Determination of the Operational Significance of Resistance

4.4.2.1 It is necessary to conduct bioassay tests on malathion-treated wall surfaces in order to determine whether the effective life of deposits has been reduced as a consequence of increased resistance.

4.4.2.2 In areas where results of susceptibility tests show an increasing trend in vector resistance to malathion with parallel increase in the number of malaria cases it is necessary to carry out further entomological and epidemiological observations including man-vector contact, indoors and outdoors, indoor resting collections, exit-window trap collections, parous rate and case detection and their classification to determine when and where it may be necessary to change the insecticide.

4.4.2.3 The absence of simple laboratory facilities in the provinces, including the capability for rearing small numbers of test insects, strongly limits the entomological activities of the MCP. Bioassay tests and resistance verification tests as described are hardly possible without facilities for the production and maintenance of essential insect material.

4.5 Spray Operations

4.5.1 Proper residual spray operation procedures are well known and have been repeated in previous reports. One of the major causes of lack of compliance of operational personnel to basic application procedures is

the lack of adequate training. The team suggests that an intensive effort be made to plan and carry out retraining in the basics of malaria control with all levels of staff in 1986 using the newly prepared manual for malaria/CDC supervisors as has been done in 1985.

4.5.2 Safety measures for the field programs should include adequate cholinesterase testing as well as proper protective equipment and supervision. The number of cholinesterase tests reported to the team are below the nationally set policy. The team suggests that planning begin now to ensure better monitoring and supervision of spray personnel including the evaluation of tintometric tests pperformance by the Assistant Entomologist.

4.5.3 The criteria used in the selection of spraying areas during the planning process should be modified to provide alternative operational activities for low, medium and high malariologenic areas. It is recognized that spray area selection criteria for the 1986 program may not be able to conform to this recommendation, but the criteria should be established by January, 1986 for use for 1987 planning and procurement. The occurrence of P. falciparum cases in known-hypo endemic areas must be investigated to determine that it is indigenous prior to the spray operations.

4.5.4. In the less malarious areas, a spray cycle beginning in July may be suitable. However, in many areas of the country as in the Punjab it is apparent that most of the reported cases of malaria occur before spraying where the spray operation starts only by late August. The team is recommending that spray operations be varied within the country so that timing can be adjusted to the epidemiological needs. If limited focal spray is epidemiologically required after the first spray cycle to maintain control, then provisions for this activity should be estimated in the yearly procurement schedules.

4.6 Parasite Chemotherapy

4.6.1. Chloroquine Resistant Falciparum Malaria

4.6.1.1 Monitoring studies using the WHO micro in-vitro test as a screening device are recommended to be initiated to assess the prevalence and distribution of chloroquine-resistant strains.

4.6.1.2 Alternative antimalarials to treat the chloroquine resistant strains must be evaluated. These would include at the least amodiaquine and Fansidar; Mefloquine may be included when it becomes available.

4.6.1.3 Evaluation on the use of primaquine on a wider scale to eliminate gametocytes of possible resistant parasites would be important.

4.6.1.4 The provision of effective vector control in the localities where resistant P falciparum cases have been found deserves highest priority.

4.6.2 Radical Treatment for Vivax Malaria

The MCP regimen for the radical treatment of vivax infections, consists of chloroquine, 25 mg (base)/kg plus primaquine .25 mg/kg daily for 5 days. While this treatment has been in use for at least 10 years, the efficacy against local strains is unknown. Thus, its evaluation as a radical treatment would be important.

4.7 Urban Malaria

4.7.1 Training of personnel concerned with urban malaria and vector control activities as a means of strengthening these activities is required for all phases of the work including planning, implementation and evaluation. It is recommended that a practical two year training plan by Province be prepared that will ensure at least basic training and/or refresher training of field staff concerned with urban malaria and/or vector control. All training should be in-country. The plan should be prepared by early 1986.

4.7.2 All supplies and commodities from the DOMC for local bodies should go through the Provincial Malaria Offices in order to ensure provincial involvement with the local bodies and to create a working relationship with the local authorities.

4.7.3 A working plan for urban malaria control should be required for any local body receiving DOMC assistance that gives details on the local work program. The mapping of breeding sites, organizational schedule of treatment, commodities, permanent control activities, personnel, training, evaluation and funding are to be included in such a plan. The plan must contain an outline of safety measures to be taken in handling the insecticides.

4.7.4 The need for technical assistance in this field was very evident in many of the sites visited for the establishment and use of an epidemiological system, proper control methodology, training, entomological studies, health education and management. Such assistance can be in-country or from external sources, but should be planned by the provinces by January 1986.

4.7.5 Provincial malaria control program personnel should assume the responsibility for periodic malariometric surveys in urban fringes at least on a once a year basis during the transmission season until municipality malaria surveillance system becomes functional.

4.8 Operational Research

In view of the increasing technical problems of vector resistance to insecticides and falciparum resistance to drugs, it is necessary to strengthen the provincial and federal capabilities in operational research and carry out field trials with the objectives of elucidating these problems and finding solutions or alternative methods of control. The team recommends:

4.8.1 To up-date knowledge on malaria vectors in terms of their biting, resting and breeding habits, host preference, man-vector contact, indoors and outdoors, seasonal prevalence and longevity under different ecological conditions.

4.8.2 The role of An. stephensi in malaria transmission should be further clarified in some detail including the determination of the area of its distribution and breeding preferences, in order to establish its role in relation to that of An. culicifacies in different ecological situations.

4.8.3 Studies are needed to evaluate the effect of selective spraying of preferred resting sites i.e. partial spraying of living quarters, spraying of animal sheds only, barrier spraying of villages, etc. on the transmission of malaria.

4.8.4 To study the role of suspected vectors with particular reference to those which are known as vectors in neighboring countries.

4.8.5 In order to decrease reliance on chemical insecticides, trials should be carried out to study the effectiveness and utilization of other methods of vector control i.e. larvivorous fish (in cooperation with the Fisheries authority) and other biological agents, sanitary measures, and personal protection with community involvement.

4.8.6 Studies to be initiated in actual coverage of population by ACD and PCD by age and sex, with the purpose of finding ways to improve on and achieve optimal coverage in space, time and efficiency of the entire population-at-risk.

4.9 Training

4.9.1 It is suggested that plans of action include a realistic and detailed plans for (re-)training to be conducted within the province as well as training and orientation for general health services staff who are insufficiently familiar with the objectives and practices of the MCP at the NMTC in Lahore and/or suitable provincial locations.

It is essential in this respect that the necessary provincial budgetary provisions for travel and board and lodging of trainees be made.

4.9.2 In addition to training mentioned in the various sections, the over-all need to understand the basics of malaria control is very apparent. The team is suggesting that 1986 be a "Back to Basics" year for the program and all concerned offices stress proper spraying techniques, the proper collection and staining of a blood film, correct GR mapping to guide larviciding or spraying, collection of comparable data in entomology, epidemiological review of the on-going activities in order to ensure that these activities are done correctly throughout the country.

4.9.3 The shortage of qualified and experienced malariologists and medical entomologists in the MCP is a matter of great concern. It is recommended that highest priority be given to a search for promising medical officers and science graduates, who could, after appropriate training and experience within the country and abroad, give direction and guidance to the antimalaria program in future.

4.9.4 As an initial step in developing suitable alternative malaria control methodology, the team suggests that a national workshop on alternative control be held during 1986.

4.10 Integration and Community Involvement

4.10.1 The creation of Community Health Workers (CHW) under the PHC program is a valuable extension of the rural health services down to the village level. Until this system of CHW becomes fully functional a program of using properly trained and supervised village volunteers specifically for malaria case detection and administration of presumptive treatment should be developed.

V. Acknowledgements

The Team wishes to express its sincere appreciation to the many federal, provincial, district and municipal malaria vector control and health personnel who took time from their busy schedules to assist the team in its review. Our special thanks to the DOMC senior officers Mr. A.A. Mujahid, Acting Director, Dr. I. Shah and Dr. Hashim who gave us every support and assistance in our endeavors. Without the able assistance of these people the work would not have been possible. The many acts of hospitality to the team will be remembered fondly and we are very grateful for these expressions of friendship.

The team would also like to express thanks to the WHO/WPC, Dr. N. Al-Tawil, and his associates as well as Ray Martin, Chief, Health, Population and Nutrition, Dr. Rifaq Ismail and Dr. William Chin of USAID/Pakistan for their informative briefings and helpfulness during our brief stay in Pakistan. We would also like to thank Mr. Yawar Jan and Mr. Altaf Ahmad of USAID who typed the report and put in long hours of extra effort on our behalf.

PAKISTAN
ADMINISTRATIVE
DIVISIONS & DISTRICTS
U.S.S.R.
CHINA
AFGHANISTAN
IRAN
INDIA
ARABIAN SEA
KASHMIR
&
JAMMU
Bargai
Haripur
PESHAWAR DIVISION
RAWALPINDI
DIVISION
DERA ISMAIL KHAN
DIVISION
BAHGODHA DIVISION
LAHORE DIVISION
QUETTA DIVISION
MULTAN DIVISION
BAHAWALPUR DIVISION
KALAT DIVISION
KHAIRPUR DIVISION
KARACHI
DIVISION
HYDERABAD DIVISION
Shahdadpur
Mirpurkhas

SCHEDULE OF TRAVEL OF EXTERNAL REVIEW TEAM - 1985

04-10-1985 and 05-10-1985	Arrival of Team members
06-10-1985	Briefing at USAID, W.H.O. and Directorate of Malaria Control

TEAM - A

07-10-1985	Dep. Islamabad - (BY ROAD) Arr. Peshawar
08-10-1985 to 10-10-1985	Stay in NWFP Evaluation of the Program 08-10-1985 - Kohat District 09-10-1985 - Bannu District
10-10-1985	Dep. Peshawar - (BY ROAD/AIR) Arr. Lahore
11-10-1985 to 15-10-1985	Stay in Punjab Province Evaluation of the Program Lahore Municipal Corporation Gujranwala District Kasur and Lahore Districts
15-10-1985	Dep. Lahore - (BY AIR) Arr. Islamabad

TEAM - B

07-10-1985	Dep. Islamabad at 10.05 AM BY AIR Arr. Karachi at 12.00 PM (PK-301)
08-10-1985 to 10-10-1985	Stay in Sind Evaluation of the Program Thatta District KMC
11-10-1985	Dep. Karachi at 0915 AM BY AIR Arr. Quetta at 10.40 AM (PK-320)
12-10-1985 to 14-10-1985	Stay in Baluchistan Evaluation of the Program
15-10-1985	Dep. Quetta at 10.40 A.M. BY AIR Arr. Islamabad at 12.45 PM (PK-324)
16-10-1985 to 18-10-1985	Report Writing
19-10-85 to 20-10-1985	Workshop to exchange the views between Malaria Control Personnal Pakistan and External Review Team regarding Malaria situation in country.

21-10-1985 to 23-10-1985	Finalization of the Report Presentation of the report to Government of Pakistan,
24-10-1985	Ministry of Health, Special Education and Social Welfare, Islamabad
25-10-1985	Dispersal of the team

List of Contacts made by the Evaluation Team during the field visits from October 7-15, 1985

OFFICE OF PROVINCIAL CHIEF, MCP, NWFP
(October 7, 1985)

1. Dr. Mohammad Iqbal, Assistant Director, Malaria
2. Mr. Fazal-e-Razaq, Entomologist
3. Mr. Shoukat Pervez, Assistant Entomologist
4. Mr. Aziz Khan, Senior Malaria Superintendent
5. Mr. Murtaza Khan, Malaria Superintendent
6. Mr. Hashim Khan, Malaria Superintendent
7. Mr. Shoukat Bacha, Sanitarian, Urban Malaria Cell
8. Mr. K. A. Nasir, Assistant Entomologist, Urban Malaria Cell.

DISTRICT HEALTH OFFICE, KOHAT
(October 8, 1985)

1. Dr. Abdul Razzaque, Medical Officer
2. Mr. Mohammad Hasham, Malaria Supervisor
3. Mr. Taj Gul, Malaria Supervisor
4. Mr. Mohammad Bashir, Malaria Supervisor

DISTRICT HEALTH OFFICE, BANNU
(October 8, 1985)

1. Mr. Mirzali Khan, Asst. Medical Superintendent
2. Mr. Bakhmal, Malaria Supervisor

DIRECTORATE OF HEALTH SERVICES, PUNJAB, LAHORE
(October 12, 1985)

1. Dr. Elahi Bukhsh Somroo, Director Health, Punjab
2. Dr. Mohammad Khurshid Anwar, Deputy Director, CDC
3. Dr. S. M. Nasir, Assistant Director, CDC (Malaria)
4. Mr. Ismat Ullah Chaudhry, W.H.O. Tech. Assistant (EPI)
5. Mr. Sana A. K. Mahmood, CDC Officer
6. Mr. M. A. Ashraf, CDC Officer
7. Mr. Matin-ul-Haque Khan, CDC Officer
8. Mr. Mohammad Afzal, Supply Officer
9. Mr. Mohammad Ihsan Sheikh, Supply Officer (AUTO)
10. Mrs. Tayyaba Nasreen, Parasitologist
11. Mr. Javed Iqbal Malik, A/Entomologist

MUNICIPAL CORPORATION, LAHORE
(October 12, 1985)

1. Dr. Asad-ur-Rehman, Epidemic Control Officer
2. Syed Shaukat Ali Shah, Chief Officer
3. Dr. Mohammad Hanif, Chief Medical Officer
4. Dr. Asad-ur-Rehman, Epidemic Control Officer

DISTRICT HEALTH OFFICE, GUJRANWALA
(October 13, 1985)

1. Dr. Aftab Ahmad, Assistant Director, Gujranwala Division
2. Mr. Habib Ahmad Mirza, Divisional CDC Officer
3. Dr. Abdul Rashid Khan, District Health Officer
4. Mr. Mohammad Saleem, A/Entomologist
5. Mr. Mohammad Ashraf, CDC Officer

DISTRICT HEALTH OFFICE, KASUR
(October 14, 1985)

1. Dr. Mohammad Rafiq, District Health Officer
2. Mr. Zafar Ahmad, Divisional CDC Officer
3. Mr. Iftikhar Hussain Shah, A/Entomologist
4. Mr. Mushtaq Ahmad, Administrative Officer

PCD POST, LULIANI C-1 - (RURAL HEALTH CENTER)
(October 14, 1985)

1. Dr. Zafar Ullah Sial, Medical Officer
2. Mr. Rana Manzoor Ahmad, Laboratory Technician
3. Mr. Mahmood Ahmad, Rural Health Inspector
4. Dr. Mughees Anjam, Student of Research, M.Phil (Hookworms)

DISTRICT HEALTH OFFICE, LAHORE
(October 14, 1985)

1. Dr. Sher Mohammad Sadozai, Deputy Director, Lahore Division
2. Dr. Abdul Ghafoor Ahmed, District Health Officer
3. Mr. Sardar Ahmad Sheikh, A/Entomologist
4. Mr. Ihsan-ul-Haq Sheikh, CDC Officer
5. Dr. Fakhar-ul-Islam, A.D.H.O.
6. Mr. Abid Ali Zaidi, Admn. Officer

LAHORE DISTRICT - LOCALITY KEET b-2-01

1. Mr. Jan Mohammad, CDC Supervisor

PCD POST - KANA NAU a-16-01 - FRP 41

1. Dr. Shabir Ahmed, Medical Officer

NATIONAL MALARIA TRAINING CENTER, LAHORE

1. Dr. Imtiaz Hussain Shah, Senior Scientific Officer (Malariologist)
2. Mr. [illegible] Pervez, A/Entomologist
3. Rai Mushtaq Ahmad, Senior Scientific Officer (Operation)

DISTRICT HEALTH OFFICE, GUJRANWALA
(October 13, 1985)

1. Dr. Aftab Ahmad, Assistant Director, Gujranwala Division
2. Mr. Habib Ahmad Mirza, Divisional CDC Officer

3. Dr. Abdul Rashid Khan, District Health Officer
4. Mr. Mohammad Saleem, A/Entomologist
5. Mr. Mohammad Ashraf CDC Officer

OFFICE OF PROVINCIAL CHIEF, MCP, SIND
(October 8, 1985)

1. Dr. Mohammad Rafiq Chaudhry, Provincial Chief
2. Dr. Abdul Sattar, Epidemiologist
3. Mr. Ghias Haider, Entomologist
4. Mr. Abdul Majid, Senior Malaria Superintendent
5. Mr. I.A. Sarwar, Senior Malaria Superintendent
6. Mr. M.A. Memon, Senior Malaria Superintendent, Hyderabad Zone

OFFICE OF DISTRICT HEALTH OFFICER, THATTA
(October 9, 1985)

1. Dr. Ghulam Hassan, DHO
2. Mr. Ghulam Sarwar, Malaria Superintendent
3. Mr. Allah Dino, Malaria Superintendent

OFFICE OF DISTRICT HEALTH OFFICER, KARACHI
(October 10, 1985)

1. Dr. Mohammad Sharif Baluch, DHO
2. Dr. Nusrat Ali Khan, ADHO
3. Mr. Asmat Ullah, NME
4. Mr. Muhammad Haider, Assistant Entomologist
5. Mr. Mohammad Shamsher, Malaria Superintendent

KARACHI MUNICIPAL CORPORATION

1. Mr. Mohammad Naqvi, Senior Malaria Superintendent, KMC and Incharge Malaria Control Program in KMC

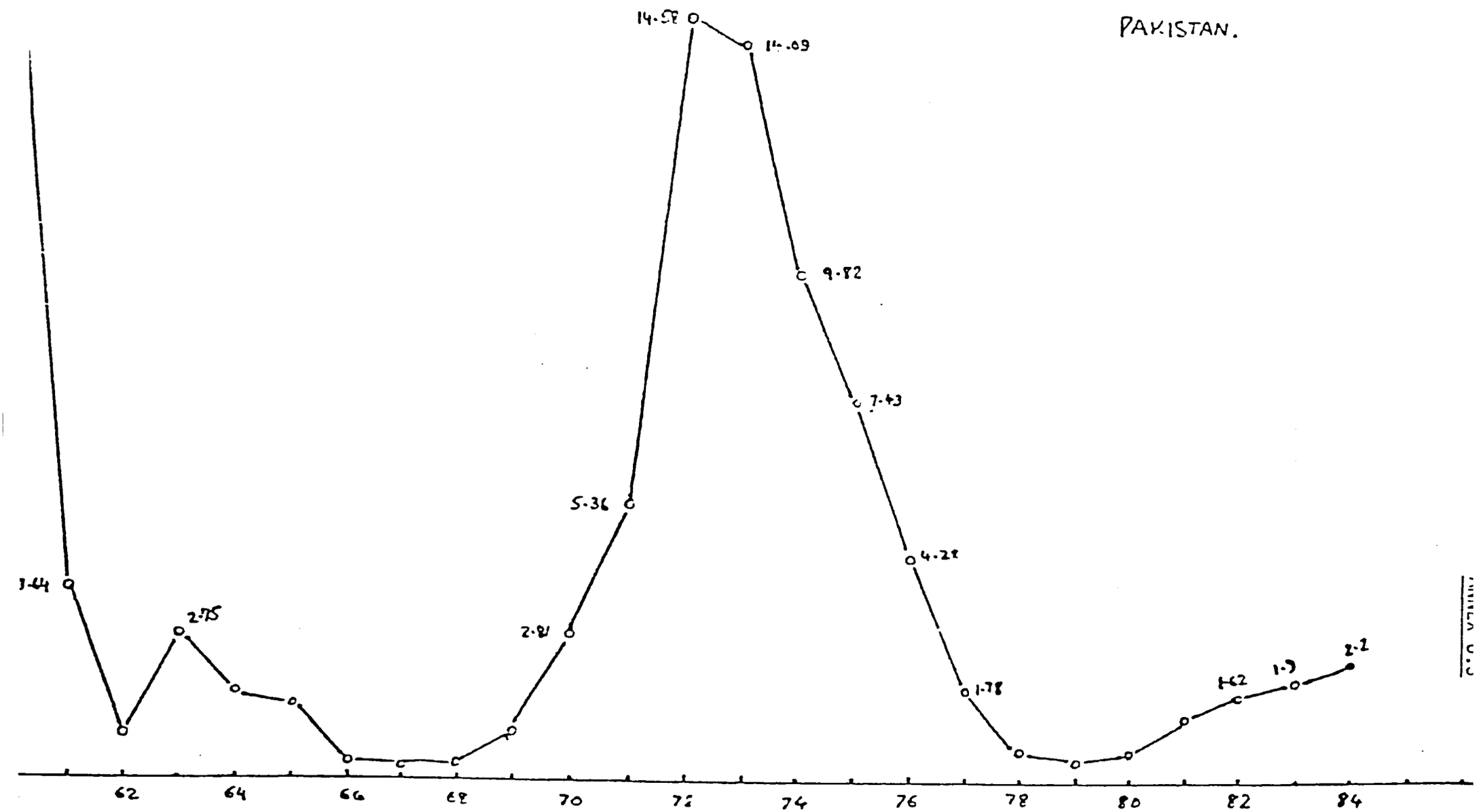
OFFICE OF DEPUTY DIRECTOR (MALARIA), BALUCHISTAN
(October 12-13)

1. Dr. Niamatullah Gichki, Deputy Director (Malaria)/Provincial Chief
2. Mr. Abdul Sattar, Senior Malaria Superintendent
3. Mr. Mohammad Sadiq, AMS
4. Mr. Noorullah, Health Educationist
5. Mr. Ali Ahmed, Entomologist

QUETTA MUNICIPAL CORPORATION
(October 14, 1985)

1. Dr. M. Abdul Qayyum, Municipal Health Officer
2. Mr. Mohammad Afzal, Sanitary Inspector

SLIDES POSITIVITY RATE %
1960 - 1984
PAKISTAN.



ANNEX 6.4

MALARIA ACTIVITIES FROM 1981 TO 1985

Year	Province	Total Slides	+ve.	V	F	M	Mix	SPR%	F.R.
1981	Punjab	1674102	17167	14863	2346	-	42	1.02	13.67
	Sind	509591	5052	3506	1587	-	41	0.99	31.41
	N.W.F.	780039	15238	14323	936	-	26	1.93	6.14
	Baluchistan	54736	466	291	164	2	11	0.85	39.48
	PAKISTAN	3018468	37923	32988	5053	2	120	1.25	13.32
1982	Punjab	1776737	24385	18164	6289	3	71	1.37	25.79
	Sind	520918	6951	4604	2389	-	42	1.33	34.37
	N.W.F.	108602	1704	22538	820	-	38	2.60	48.12
	Baluchistan	896810	23320	1380	347	-	23	1.56	1.49
	PAKISTAN	3303067	56360	46686	9845	3	174	1.70	17.47
1983	Punjab	1480486	29618	19773	9927	4	86	2.00	33.52
	Sind	446073	12465	8379	4154	-	68	2.79	33.33
	N.W.F.	611995	8155	7219	957	-	21	1.33	11.74
	Baluchistan	49366	1358	748	658	-	48	2.75	48.45
	PAKISTAN	2587920	51596	36119	15696	4	223	1.99	30.42
1984	Punjab	2084222	53823	34275	19648	-	100	2.58	36.50
	Sind	439706	9534	5996	3611	-	73	2.16	37.87
	N.W.F.	668892	9764	8748	1083	-	67	1.46	11.09
	Baluchistan	63033	875	530	366	-	11	1.38	41.83
	PAKISTAN	3255853	73996	49539	24708	-	251	2.27	33.39
1985*	Punjab	996454	15417	11053	4407	1	44	1.55	28.59
	Sind	229125	3710	2127	1609	-	26	1.62	43.37
	N.W.F.	234842	2805	2663	149	-	7	1.19	5.31
	§Baluchistan	3486	34	15	20	-	1	0.97	58.82
	PAKISTAN	1463907	21966	15858	6185	1	78	1.50	28.16

* Data upto June

§ - Data upto February of Quetta Zone

- Data upto January of Khuzdar Zone

Table 5.1

Results of susceptibility tests with DDT in NWFP during 1981-85 against *An. stephensi* and *An. culicifacies**

	An. stephensi				*An. culicifacies*			
	No.	Adults	% Mortality		No.	Adults	% Mortality	
Year	Tests	Tested	Range	Average	Tests	Tested	Range	Average
1980	64	2050	0-85	42.6	8	272	40-60	53.0
1981	50	1565	23-75	44.0	11	322	33-47	40.2
1982	50	1679	28-91	51.6	4	153	53-93	64.3
1983	19	679	43-100	57.4	2	72	44-56	50.0
1984	13	662	40-90	59.5	1	40	40-90	59.5
1985	4	193	54-76	60	0	-	-	-

* WHO test method: 4% DDT, 60 min. exposure.
Compiled from data provided by Directorate of Health Services, NWFP, Peshawar.

Table 5.2

Results of susceptibility tests with dieldrin in NWFP during 1980-85 against *An. stephensi**

Year	Tests	Adults Tested	Percent Mortality	
			Range	Average
1980	36	1000	9-95	55.8
1981	10	258	29-83	63.5
1982	12	395	30-70	50.8
1983	6	243	43-55	48.1
1984	1	40	-	52.5
1985	0	-	-	-

* WHO test method: 4% dieldrin, 60 min. exposure
Compiled from data provided by Directorate of Health Services, NWFP, Peshawar.

Table 5.3

Results of susceptibility tests with Malathion in the Punjab Province during 1981-85 against *An. stephensi* and *An. culicifacies**

District	Year	*An. stephensi* Adults Tested	*An. stephensi* % Mortality Range	*An. stephensi* % Mortality Average	*An. culicifacies* Adults Tested	*An. culicifacies* % Mortality Range	*An. culicifacies* % Mortality Average
1. Lahore	1981	-	-	-	157	-	100
	1982	446	72-88	80.5	1277	76-100	95.8
	1983	-	-	-	60	83-100	92.0
	1984	601	76-94	86.6	155	86-100	97.2
	1985	150	72-85	79.8	70	-	100
2. Kasur	1981	-	-	-	40	-	100
	1982	90	-	100	-	-	-
	1983	20	-	100	105	-	100
	1984	-	-	-	-	-	-
	1985	117	76-84	81.1	287	-	100
3. Sheikhupura	1981	-	-	-	-	-	-
	1982	-	-	-	404	-	100
	1983	-	-	-	127	-	100
	1984	74	?	84	319	-	100
	1985	-	-	-	414	-	100
4. Okara	1983	-	-	-	148	-	100
	1984	190	59-76	72.5	762	-	100
	1985	1160	47-100	61.9	-	-	-
5. Gujranwala	1981	-	-	-	70	80-88	84
	1982	85	71-89	86.6	676	-	100
	1983	390	96-100	99.0	-	-	-
	1984	100	?	95.0	400	-	100
	1985	49	?	57.0	643	-	100
6. Gujrat	1981	20	-	-	50	-	-
	1982	-	-	-	23	-	-
	1983	-	-	-	-	-	-
	1984	-	-	-	147	-	-
7. Sialkot	1981	-	-	-	25	-	100
	1982	-	-	-	50	-	100
	1983	-	-	-	388	96-100	99
	1984	-	-	-	945	-	100
	1985	-	-	-	151	96-100	100

Table 5.3 continued

District	Year	An. stephensi Adults Tested	% Mortality Range	% Mortality Average	An. culicifacies Adults Tested	% Mortality Range	% Mortality Average
8. Rawalpindi	1981	155	92-100	99.2	110	90-100	97
	1982	85	-	100	55	-	100
	1983	385	90-100	96.3	15		100
	1984	245	-	100	270	96-100	99.7
	1985	-	-	-	140	90-100	99.6
9. Attock	1981	140	83-100	96.6	227	85-100	98.6
	1982	143	-	100	174	-	100
	1983	60	-	100	45	-	100
	1984	60	-	100	135	-	100
	1985	40	-	100	95	-	100
10. Jehlum	1983	225	96-100	99.4	250	96-100	99.1
	1984	185	-	100	60	-	100
	1985	75	-	100	120	-	100
11. Sargodha	1981	160	83-93	88.9	-	-	-
	1982	397	83-100	98.6	45	-	100
	1983	356	83-100	94.9	50	-	100
	1984	804	65-98	81.5	498	89-100	96.2
	1985	226	72-100	82.5	226	90-100	96.5
12. Khushab	1983	50	-	100	-	-	-
	1984	-	-	-	-	-	-
	1985	126	86-100	95.3	51	-	100
13. Mianwali	1981	50	93-100	97.7	30	-	100
	1982	75	92-100	97.3	48	95-100	97.5
	1983	-	-	-	-	-	-
	1984	-	-	-	-	-	-
	1985	-	-	-	52	-	100
14. Faisalabad	1981	149	72-93	84.2	51	-	100
	1982	1920	31-100	80.0	377	79-100	95.9
	1983	314	80-100	90.2	281	88-100	96.0
	1984	4021	58-94	72.3	1247	66-100	96.8
	1985	1094	50-100	70.7	651	99-100	100
15. Jhang	1981	84	-	100	446	96-100	99.8
	1982	44	-	100	241	93-100	98
	1983	81	-	100	220	-	100
	1984	710	83-95	86.6	811	83-100	99.6
	1985	130	-	100	237	-	100

Table 5.3 continued

District	Year	An. stephensi Adults Tested	% Mortality Range	% Mortality Average	An. culicifacies Adults Tested	% Mortality Range	% Mortality Average
16. Multan	1981	60	98-100	99.0	85	-	100
	1982	25	-	96.0	466	86-100	96.4
	1983	-	-	-	192	-	100
	1984	117	86-100	94.5	304	95-100	98.6
	1985	75	90-100	96.3	501	85-100	95.6
17. Vehari	1981	-	-	-	353	-	100
	1982	46	-	100	803	-	100
	1983	-	-	-	413	-	100
	1984	124	-	100	221	-	100
	1985	-	-	-	96	97-100	99.4
18. Sahiwal	1981	250	98-100	99.3	987	-	100
	1982	290	66-87	84.4	2087	-	100
	1983	80	?	90	260	-	100
	1984	1174	59-92	72.4	1679	-	100
	1985	2344	36-100	62.1	412	-	100
19. Bahawalpur	1982	-	-	-	193	-	100
	1983	-	-	-	66	-	100
	1984	453	76-85	80.2	1233	-	100
	1985	410	20-100	60.6	200	-	100
20. Bahawalnagar	1982	341	74-90	81.9	65	88-98	92.8
	1983	625	80-100	91.7	451	75-98	89.3
	1984	827	66-95	80.8	426	92-100	97.3
	1985	229	60-76	65.5	251	-	100
21. R.Y. Khan	1982	385	96-100	98.4	571	98-100	99.8
	1983	158	94-100	96.1	515	91-100	96.3
	1984	1495	60-94	82.4	361	96-100	98.0
	1985	392	82-94	89.1	205	92-96	94.2
22. D.G. Khan	1981	158	57-93	74.9	108	-	100
	1982	249	64-87	77.7	452	-	100
	1983	72	51-84	72.5	496	-	100
	1984	1395	60-93	80.7	722	-	100
	1985	226	54-73	64.2	218	92-100	99.1

Table 5.3 continued

District	Year	An. stephensi			An. culicifacies		
		Adults Tested	% Mortality Range	% Mortality Average	Adults Tested	% Mortality Range	% Mortality Average
23.Muzaffargarh	1981	558	86-100	98	760	95-100	99.5
	1982	115	90-100	93.8	241	90-100	97.1
	1983	165	96-100	97.7	105	95-100	99.0
	1984	825	80-100	90.7	100	96-100	98.0
	1985	700	88-100	94.7	50	-	100
24. Layyah	1985	50	?	96	50	?	100

* Compiled from data provided by the Directorate of Health Services, Punjab, Lahore.

Table 5.4

Results of susceptibility tests with Malathion in Selected Districts of NWFP against *An. stephensi* and *An. culicifacies**

District	Year	No. Tests	Percentage Mortality Range	Percentage Mortality Average
Kohat	1960	21	-	100
	1961	3	-	100
	1962	4	-	100
	1963	3	85-93	89.7
	1964	3	77-100	89.0
	1965	3	81-84	82.3
Bannu	1960	6	-	100
	1961	0	-	-
	1962	6	80-90	85.0
	1963	6	92-100	95.0
	1964	15	88-100	95.0
	1965	6	92-100	96.0
D.I. Khan	1960	0	-	100
	1961	1	-	100
	1962	1	-	87.0
	1963	3	-	100
	1964	12	78-89	83.5
	1965	5	83-92	87.4

* Compiled from data provided by Directorate of Health Services, NWFP, Peshawar.

Best Available Document

Table 5.5

Results of susceptibility tests with Malathion in the Sind Province during 1984-85 against *An. stephensi* and *An. culicifacies*

District	Year	*An. stephensi* Adults Tested	*An. stephensi* % Mortality Range	*An. stephensi* % Mortality Average	*An. culicifacies* Adults Tested	*An. culicifacies* % Mortality Range	*An. culicifacies* % Mortality Average
Sukkur	1984	40	?	90.0	40	?	100
	1985	151	41.1-50	43.5	25	?	100
Nawab Shah	1984	25	?	100	20	?	100
	1985	135	33.3-80	51.8	155	-	100
Mirpurkhas	1984	419	?	97.6	524	?	97.5
	1985	145	95-100	97.2	264	96-100	97.1
Larkana	1985	115	95-100	99.0	25	?	100
Shikarpur	1985	65	30-45	35.5	61	-	100
Hyderabad	1985	40	-	100	65	-	100
Badin	1985	-	-	-	75	-	100
Thatta	1985	195	52-71	59.2	47	-	100
Sanghar	1985	170	25.7-40	34.5	-	-	-
Dadu	1985	-	-	-	25	?	96
Jacobabad	1985	-	-	-	50	?	100

* Compiled from data provided by Directorate of Health Services, Hyderabad.

Table 5.6

Results of susceptibility tests with Malathion in the Baluchistan Province during 1984-1985 against *An. stephensi* and *An. culicifacies*

District	Year	*An. stephensi*			*An. culicifacies*		
		Adults Tested	% Mortality Range	% Mortality Average	Adults Tested	% Mortality Range	% Mortality Average
Loralai	1984	-	-	-	22	?	100
Sibi	1984	46	65-84.6	74.6	141	85.5-100	92.9
	1985	51	92	92	51	-	100
Nasseerabad	1985	75	96-96.9	95	53	96-100	98
Pishin	1985	50	?	60	104	96-100	98

* Compiled from data provided by Directorate of Health Services, Baluchistan, Quetta.

Table 5.7

Susceptibility tests with Malathion against *An. stephensi* in NWFP during 1960-85. Consolidated data*

Year	No. of Test.**				Adults Tested	% Mortality	
	R	T	S	Total		Range	Average
1960	0	0	74	74	2200	-	100
1961	0	0	13	13	296	-	100
1962	1	9	14	24	944	75-100	91.6
1963	0	8	11	19	652	85-100	96.6
1964	2	29	23	54	2328	75-100	97.1
1965	0	10	5	15	701	81-100	91.5

* Compiled from data provided by Directorate of Health Services, NWFP, Peshawar.

** R = Less than 60% mortality
T = 60-90% mortality
S = Greater than 90% mortality

Table 5.6

Susceptibility tests with Malathion against *An. culicifacies* in NWFP during 1980-85. Consolidated data*

Year	No. of Tests**				Adults Tested	% Mortality	
	R	T	S	Total		Range	Average
1980	0	0	23	23	690	-	100
1981	0	0	3	3	145	-	100
1982	0	5	0	5	201	83-97	88.4
1983	0	0	6	6	148	-	100
1984	1	1	4	6	310	77-100	92.8
1985	-	-	-	-	0	-	-

* Compiled from data provided by Directorate of Health Services, NWFP, Peshawar.

** R = Less than 80% mortality
T = 80-98% mortality
S = Greater than 98% mortality

Fig. 1. Map indicating the distribution of cotton cultivation (●) and the occurrence of Malathion resistance in *Anopheles stephensi* in Pakistan. (Shaded districts are those in which WHO tests reveal less than 80% mortality in adult mosquitoes at the diagnostic dose of Malathion).

PAKISTAN

SCALE 1:5,000,000

COTTON

AREA UNDER CULTIVATION

Each ● represents ..... 1,000 hectares

" ● " ..... 10,000 "

Data for Jammu & Kashmir and Gilgit Agency not AVAILABLE.

Less than 80% kill in the stalkers during 1984-85.

TOTAL PRODUCTION

PROVINCE	Total Area Under Cultivation hectares	Total Production Metric Tons	Yield per hectare
PUNJAB	[illegible]	[illegible]	[illegible]
SIND	[illegible]	[illegible]	[illegible]
BALUCHISTAN	[illegible]	[illegible]	[illegible]
N.W.F. PROVINCE	[illegible]	[illegible]	[illegible]
TOTAL PAKISTAN	[illegible]	[illegible]	[illegible]

Tropic of Cancer

Table 5.9

Types and quantities of insecticides imported in Pakistan during 1984+

Type	Name	Quantity* (metric tons)	%
Organophosphates	Phorate	2,010.200	
	Disulfoton	515.400	
	Dimethoate	498.800	
	Triazophos	286.360	
	Monocrotophos	282.578	
	Fenitrothion	235.500	
	Diazinon	203.295	
	Parathion methyl	160.165	
	Azinphosmethyl	131.526	
	Malathion	123.500	
	Chloropyriphos	117.775	
	Other	679.653	
	Total	5,224.752	57.1%
Carbamates	Carbaryl	649.132	
	Cartap	596.612	
	Carbofuran	326.404	
	Other	20.960	
	Total	1,593.328	17.3%
Organochlorines	BHC	523.155	
	Endosulfan	256.710	
	Endrin	219.482	
	DDT	153.302	
	Dieldrin	36.521	
	Heptachlor	9.940	
	Total	1,200.110	13.1%
Pyrethroids	Cypermethrin**	627.594	
	Cypermethrin	107.452	
	Fenvalerate	269.515	
	Deltamethrin	71.980	
	Cyfluthrin	38.641	
	Permethrin	35.676	
	Total	1,150.858	12.5%
	GRAND TOTAL	9,189.047	

* Metric tons of formulated material
** Includes profenofos (organophosphate)
\+ Compiled from data provided by Dr. U.K. Baloch, Pakistan Agricultural Research Council, Islamabad.

SPRAY REPORT FOR THE YEAR 1984 ANNEX 6.6

MALARIA CONTROL PROGRAMME PAKISTAN

EXISTING	Sub Sector	3595
	Localities	48022
	Houses	12104374
	Rooms	39216995
	Population	62721597
PLANNED	Sub Sector	1891
	Localities	9215
	Houses	2797889
	Rooms	8829404
	Population	14252881
TOTALLY SPRAYED	Sub Sector	1853
	Localities	9070
	Houses	2241147
	Rooms	7002374
	Population	11253341
PARTIALLY SPRAYED	Houses	293411
	Rooms	863829
	Population	1687229
TOTAL	Population Protected	12940570
	Houses sprayed	2534558
	Insecticides used:-	
	1. Malathion	2138.428 M.Ton
	1. Sumithion	27.999 M.Ton
	% of population covered on:-	
	i. Existing	20 %
	ii. Planned	91 %
	% of Houses sprayed on:-	
	i. Existing	21 %
	ii. Planned	92 %

EPIDEMIOLOGICAL DATA PCD POST-WISE (PART I - 1981-82)
URBAN KARACHI

No. of PCD Posts	Name of PCD Posts area-wise	1981 Slides	1981 PV	1981 PF	1981 Mix	1981 Total	1982 Slides	1982 PV	1982 PF	1982 Mix	1982 Total
DISTT. SOUTH											
1	Jinnah Hospital	4,375	24	1	-	25	5,259	20	1	-	21
2	Jinnah Children	3,782	26	1	-	27	3,741	24	4	-	28
3	Abbasi Shaheed Hospital	2,525	9	-	-	9	2,325	2	2	-	4
4	S.G. Disp. Abesenia Line	575	3	-	-	3	1,020	1	1	-	2
5	S.G. Disp. Kiamari	620	2	-	-	2	1,535	2	-	-	2
6	Civil Hospital	5,722	40	3	-	43	5,340	10	1	-	11
7	Civil Hospital	6,919	39	5	-	44	4,250	6	-	-	6
8	Civil Hospital	4,071	30	7	-	37	2,176	4	-	-	4
	Sub-Total	28,589	173	17	-	190	25,646	69	9	-	78
DISTT. WEST											
9	S.G. Hosp. Liari	795	3	-	-	3	725	1	-	-	1
10	Sheikh Qatar H. Orangi	1,525	12	-	-	12	775	1	-	-	1
11	Sessi Disp. H. Bank Site	750	2	-	-	2	495	1	-	-	1
12	Baldia Disp. Sher Shah	775	2	-	-	2	505	-	-	-	-
13	S.G. Disp. Asif Colony	1,337	1	-	-	1	549	1	-	-	1
14	Sessi Hosp. Orangi-5	2,776	96	-	-	96	1,646	32	-	-	32
15	S.G. Disp. Orangi-1	1,038	4	1	-	5	1,316	2	-	-	2
16	Abbasi Shaheed Hosp.	4,732	6	-	-	6	6,232	4	5	-	9
17	S.G. Disp. Nazimabad	1,872	16	1	-	17	3,528	11	-	-	11
18	MCH Centre Nazimabad	2,592	6	-	-	6	2,004	3	2	-	5
19	S.G. Hosp. Liaqatabad	3,732	61	-	-	61	2,823	15	2	-	17
20	S.G. Disp. Ghareebabad	1,014	1	-	-	1	1,275	4	-	-	4
	Sub-Total	22,938	210	2	-	212	21,873	75	9	-	84
DISTT. EAST											
21	S.G. Disp. Drigh Colony	2,118	16	-	-	16	1,356	8	1	-	9
22	S.G. Disp. Malir	1,200	1	1	1	1	1,980	2	-	-	2
23	Sessi Disp. Saudabad	2,570	6	-	-	6	1,505	6	2	-	8
24	S.G. Hosp. Saudabad	2,350	8	-	-	8	2,043	5	-	-	5
25	S.G. Disp. Landhi-3	2,010	2	-	-	2	2,762	11	2	-	13
26	S.G. Hosp. Korangi-5	2,520	5	-	-	5	2,632	12	1	-	13
27	S.G. Disp. Ibrahim Hydri	2,050	6	-	-	6	1,472	11	1	-	12
28	R. Hosp. Karachi Cantt	1,862	3	-	-	3	2,228	1	-	-	1
29	Urban Disp. Sher Shah	1,423	4	-	-	4	1,674	2	2	-	4
	Sub-Total	18,103	51	1	1	51	17,854	58	8	-	67
	GRAND TOTAL	69,630	434	20	1	453	65,373	201	27	-	228

EPIDEMIOLOGICAL DATA PCD POST-WISE (PART II - 1983-84)

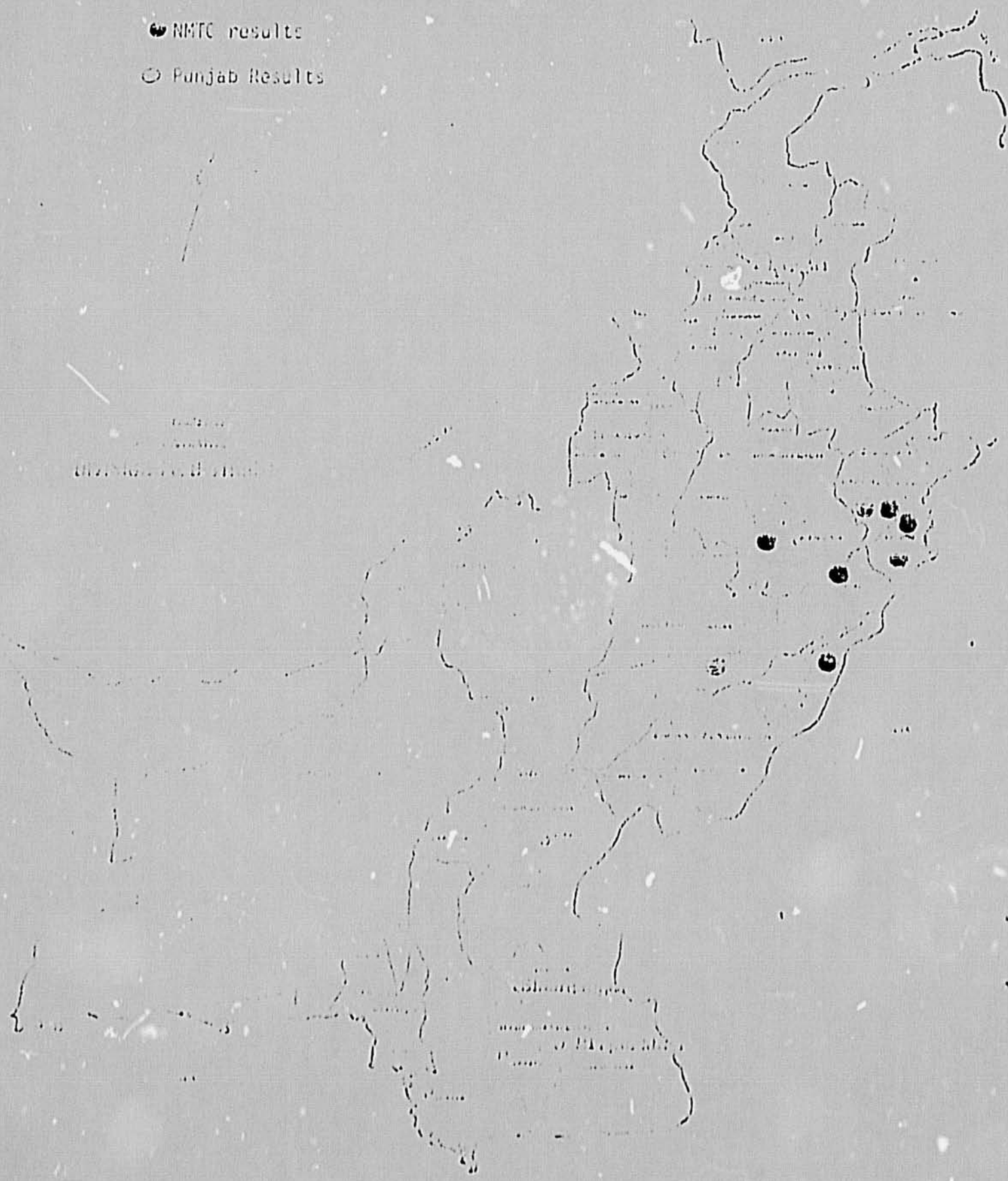
URBAN KARACHI

No. of PCD Posts	Name of PCD Posts area-wise	1983 Slides	1983 PV	1983 PF	1983 Mix	1983 Total	1984 Slides	1984 PV	1984 PF	1984 Mix	1984 Total
	DISTT. SOUTH										
1	Jinnah Hospital	2,010	2	10	-	12	2,760	24	14	-	38
2	Jinnah Children	2,200	3	2	-	5	3,254	10	1	-	11
3	Abbasi Shaheed Hospital	318	-	-	-	-	1,186	4	2	-	6
4	S.G. Disp. Abesenia Line	815	5	-	-	5	650	4	-	-	4
5	S.G. Disp. Kiamari	339	2	-	-	2	541	9	-	-	9
6	Civil Hospital	3,648	22	4	-	26	4,742	43	9	-	52
7	Civil Hospital	3,360	14	6	-	20	3,719	9	1	-	10
8	Civil Hospital	3,017	14	3	2	19	3,623	13	3	-	16
	Sub-Total	15,707	62	25	2	89	20,475	116	30	-	146
	DISTT. WEST										
9	S.G. Hosp. Liari	929	3	-	-	3	1,202	1	-	-	1
10	Sheikh Jatar H. Orangi	932	5	-	-	5	3,032	-	-	-	-
11	Sessi Disp. H. Bank Site	1,722	1	1	-	2	1,561	-	-	-	-
12	Baldia Disp. Sher Shah	1,274	-	-	-	-	779	-	-	-	-
13	S.G. Disp. Asif Colony	1,510	4	1	-	5	1,561	1	-	-	1
14	Sessi Hosp. Orangi-5	1,681	43	6	-	49	824	37	-	-	37
15	S.G. Disp. Orangi-1	845	3	-	-	3	639	-	-	-	-
16	Abbasi Shaheed Hosp.	3,052	3	-	-	3	2,247	4	-	-	4
17	S.G. Disp. Nazimabad	1,110	1	-	-	1	1,132	9	1	-	10
18	MCH Centre Nazimabad	3,712	-	-	-	-	2,458	-	-	-	-
19	S.G. Hosp. Liaqatabad	3,381	7	4	-	11	3,038	13	2	-	15
20	S.G. Disp. Ghareebabad	1,246	3	1	-	4	988	12	-	-	12
	Sub-Total	21,394	73	13	-	86	19,680	77	3	-	80
	DISTT. EAST										
21	S.G. Disp. Brigh Colony	1,281	5	2	-	7	1,683	4	1	-	5
22	S.G. Disp. Malir	1,679	1	1	-	2	1,490	2	2	-	4
23	Sessi Disp. Saudabad	1,001	-	-	-	-	620	2	-	-	2
24	S.G. Hosp. Saudabad	1,995	6	-	-	6	1,620	-	-	-	-
25	S.G. Disp. Landhi-3	1,637	2	1	-	3	1,364	2	-	-	2
26	S.G. Hosp. Korangi-5	1,812	22	-	-	22	1,684	10	3	-	13
27	S.G. Disp. Ibrahim Hydri	1,298	6	-	-	8	641	3	-	-	3
28	R. Hosp. Karachi Cantt	1,528	2	1	-	3	2,239	1	4	-	5
29	Urban Disp. Sher Shah	973	8	8	-	16	450	4	-	-	4
	Sub-Total	13,404	54	13	-	67	11,791	28	10	-	38
	GRAND TOTAL	50,505	189	51	2	242	51,946	221	43	-	264

Chloroquine Resistant falciparum malaria
detected by in-vivo assessments:

● NMTC results

○ Punjab Results



Best Available Document

What is the Risk of Malaria Infection to Someone Living in Urban Centers of Pakistan?

The risk is relatively low. Malaria in Pakistan, as well as in most endemic areas, is a rural disease. Recent surveys by WHO teams tend to support this judgement. These surveys were conducted by the examination of blood smears taken from school children residing in rural-urban fringes of various cities. The results are as follows:

	City	Time of Survey	No. of blood smears examined	No. (%) found positive
1.	Islamabad/ Rawalpindi	May 1984	2117	8 (0.37%)
2.	Islamabad/ Rawalpindi	Nov 1984	4032	22 (0.53%)
3.	Karachi	Apr 1985	5111	40 (0.78%)

In summary, the risk of acquiring malaria while living in urban centers of Pakistan is very low. That is not to say that it can not happen since an encounter with just one infected mosquito is sufficient to cause infection. While falciparum malaria may be potentially a very serious disease, all malarias including falciparum are easily treatable. The key to minimize serious complications including death, lies in its early detection and treatment. In this regard, the patient has the primary responsibility for thinking about malaria and to alert the attending physician to its possible exposure, when seeking medical attention for a febrile illness even for as long as 2 years after leaving Pakistan. (In one rare type, ovale malaria, found mostly in Africa, relapses may occur 4 years after leaving an anemic area.)

Finally, while "pest" mosquitoes may not be able to transmit malaria, they are capable of transmitting other serious diseases including dengue and encephalitis which may also be present in Pakistan. Thus avoidance of mosquito bites by wearing of protective clothing and by the use of insect repellants when venturing outdoors in the evening makes a great deal of sense from the esthetic as well as medical viewpoint.

PRE AND POST MALARIA MICROSCOPY TRAINING EVALUATION
OF LABORATORY TECHNICIAN/ASSISTANT
(FROM: 29-9-1985 to 17-10-1985)

Roll No.	Pre-test W	Pre-test P	Post-test W	Post-test PI	Post-test PII	Total Score	%	Grade	* P
1	54	50	74	70	115	259	74.0	C**	74
2	47	40	97	80	135	310	88.57	B	85
3	23	65	87	80	118	285	81.42	B	79
4	26	10	85	70	135	290	82.85	B	82
5	29	45	61	80	93	234	66.85	F	56
6	31	10	85	90	128	306	87.42	B	87
7	79	75	96	100	125	321	91.71	A	90
8	23	20	93	50	115	258	73.7	C**	66
9	37	45	93	100	113	306	87.42	B	85
10	23	50	91	90	125	306	87.42	B	86
11	47	20	84	80	113	257	73.42	C**	73
12	20	15	78	90	123	291	83.14	B	85
13	39	65	90	100	120	310	88.57	B	88
14	26	75	92	90	120	302	86.28	B	84
15	50	40	80	100	110	290	82.85	B	84
16	26	38	93	90	118	301	86.1	B	83
17	35	40	80*	90	118	268	76.57	C	83

W = 100 points
P = Practical
PI = Unknown Spot - 100 points
PII = Species Diagnosis - 150 points

C = Passing Grade
* = Weak in Theory
** = Need Supervision for Microscopy Work