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Tropical Disease Control for Development

The Malaria Information System in Pakistan: Past, Present, Future

Report of Final VBC Project Visit

September 3 - 30, 1993

by

James C. Sonnemann
Mary S. Church

VBC Report No. 82191

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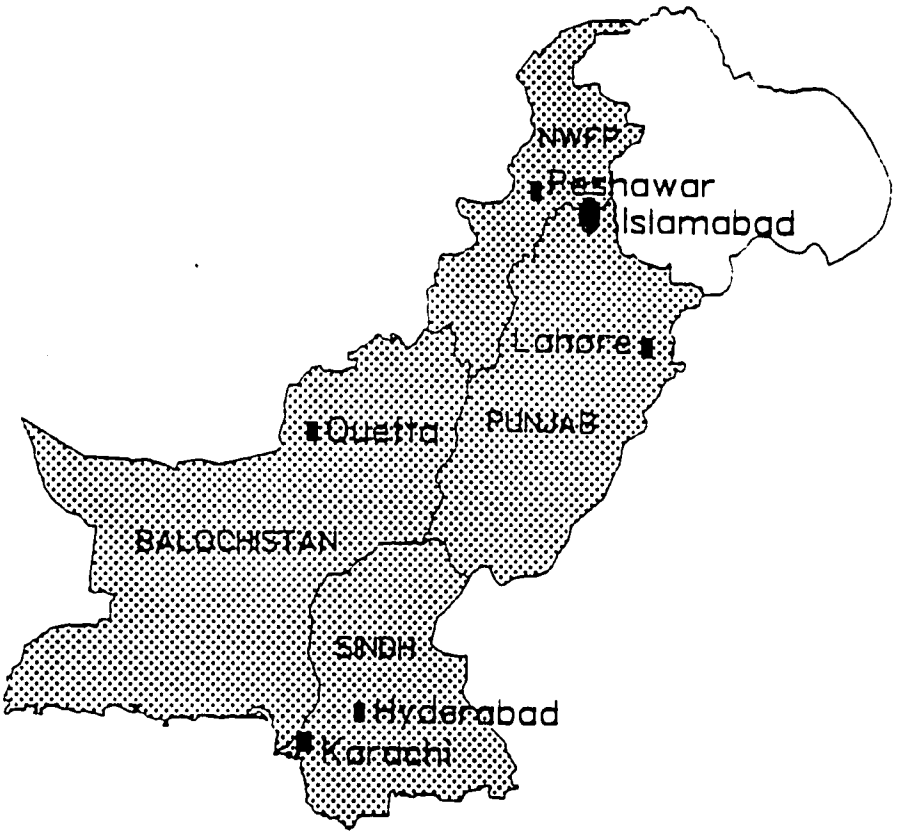
Pakistan Provinces and Cities Visited
September 1993



Acronyms and Abbreviations

ABER	Annual Blood Examination Rate
ACD	Active Case Detection
ADB	Asian Development Bank
An.	*Anopheles*
APCD	"Activated" Passive Case Detection
API	Annual Parasite Incidence
BHU	Basic Health Unit
CDC	Communicable Disease Control
DHO	District Health Officer
DOMC	Directorate of Malaria Control
EPI	Expanded Program on Immunization
GOP	Government of Pakistan
HIS	Health Information System
HMIS	Health Management Information System
ICON	Lambda Cyhalothrin (insecticide)
MCP	Malaria Control Programme
MSF	Médecins sans Frontières
NIMRT	National Institute of Malaria Research and Training
NWFP	North West Frontier Province
PCD	Passive Case Detection
P.f.	*Plasmodium falciparum*
PHC	Primary Health Care
PUO	Pyrexia (fever) of Unknown Origin
P.v.	*Plasmodium vivax*
RHC	Rural Health Centre
Rs.	Pakistani Rupees
SPR	Slide Positivity Rate
UNHCR	United Nations High Commission for Refugees
USAID	United States Agency for International Development
WHO	World Health Organization

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Executive Summary

At the request of USAID/Islamabad and the Directorate of Malaria Control of the Pakistan Ministry of Health, the VBC Project was asked to provide an information systems specialist and an epidemiologist to follow up on previous information systems assistance to the Malaria Control Programme (MCP). The authors visited Pakistan from September 3 - 30, 1993 and met with malaria control officials at the federal level, in the provinces of Punjab, Sindh, Balochistan, and the North West Frontier, and at district and provider level facilities in two districts. Current malaria information was examined for its usefulness in providing information to monitor malaria and facilitate better management of malaria control activities. The use of computers at federal and provincial levels was reviewed and a geographic mapping capability introduced and demonstrated.

The authors found the MCP and its information system to focus heavily on parasite transmission aspects of malaria control, largely ignoring disease management. It is impossible to know how much malaria mortality is occurring, how often chloroquine treatment fails, or to what extent adequate treatment and follow-up are provided. The primary health care information system currently under development may permit better monitoring of patient care—if integration can be achieved—but the malaria control information system needs thorough rethinking.

The authors found the program to be using indicators and sources of data from the eradication era that have little meaning today. The annual blood examination rate is no longer useful. Annual parasite incidence cannot be interpreted as currently calculated, and uncertainties of both numerator and denominator render it highly questionable. Active case detection has become less sensitive to malaria trends than passive case detection in Pakistan and can now be abandoned.

Despite integration efforts since the 1970s and the inclusion of peripheral malaria services under the administrative support of general health services for some 10 years, little true integration is apparent. There is remarkably little coordination even with other health structures providing malaria services. Many urban data never enter the system. Nor do the good quality data from health services for Afghan refugees,

many of whom have lived in Pakistan for 10 years or more. And suspected malaria for which no blood slide is prepared at various clinics and hospitals is essentially ignored by the MCP.

The principal activity of the MCP and the primary focus of its USAID support for many years has been residual spraying of houses with insecticide for mosquito control. Curiously, it is impossible to assess the impact of the focal spraying carried out because the epidemiologic data and the spraying reports cannot easily be brought together. Thus the impact of this massive and costly program cannot be demonstrated convincingly.

Efforts to computerize the existing malaria surveillance database at provincial and federal levels have been ineffective. All data currently used by the MCP continue to flow from the manual system. The only MCP computer that has proven its utility is that of the Directorate of Malaria Control secretariat which has been used for word processing. Limited computer literacy, combined with a difficult software package (PAKMAL) and no on-going technical support, has resulted in an inability to do much more than turn the machines on in some provinces. To date, the computers have been essentially irrelevant.

Opportunities to correct some of these problems are presented by the possibility of greater collaboration with general health services activities, particularly the new health management information system (HMIS) being introduced gradually within the national primary health care system by the Pakistan Child Survival Project. To be successful, collaboration will have to be supported with conviction from the top. Such support does not characterize current integration efforts. Malaria control remains isolated and something of an anachronism.

A variety of recommendations are provided in this report. Among the most significant are the following:

- Coordinate with the HMIS system, both for purposes of routine PCD monitoring of malaria trends in the country and for assistance in developing the capacity to computerize the MCP data.

- For routine surveillance purposes, rely on the slide positivity rate calculated from passive case detection reports. This should be supplemented with special studies when more information is needed.

- Abandon active case detection as no longer needed in the era of expanded health services across the country.

- Document the *P. falciparum* and *P. vivax* patterns separately since they may require differing approaches and do not necessarily coincide. Parasite trends should be followed using parasite specific SPR. Monthly figures should be used to reveal the differing seasonal patterns of falciparum and vivax malaria. Data currently collected can be used to calculate these indicators.

- Document the impact of spray activities on the epidemiologic indicators in those areas sprayed. Comparison with non-sprayed neighboring areas would be particularly useful.

- Expand the MCP information system — or the portions of the HMIS relating to malaria — to provide sufficient information to monitor the quality of the patient-related aspects of malaria diagnosis and treatment. This includes the taking of blood for malaria smears, treatment outcome, possible complications, trends in drug resistance, and presumptive malaria diagnoses without microscopic confirmation.

1. Introduction

The VBC Project has provided various types of technical assistance to the Pakistan Malaria Control Programme (MCP) in recent years. Among these were a determination of the feasibility and usefulness of computerizing the epidemiologic and entomologic databases of the Directorate of Malaria Control (DOMC), review of the information needs and flows of the MCP, development of data input formats, introduction of computer skills, and preparation and introduction of specialized MCP databases at federal and provincial levels.

The objective of this visit was to follow up on previous technical assistance for the development of malaria information systems. The authors, a health management information specialist and a medical epidemiologist, were asked to review the use and flow of computerized malaria data, upgrade the software available, investigate progress in promoting passive case detection, and report their findings. The official Scope of Work is attached as Annex A.

In addition, because USAID is withdrawing from Pakistan and this visit constituted the final technical assistance visit of its Pakistan Malaria Control Project, it was deemed useful to try to capture the lessons learned in the course of HIS interventions in the hope that they may guide future development of the Pakistan malaria information system and future USAID activities. What was particularly effective? If some interventions were less successful than anticipated, why was this? Could such problems have been avoided? What should be done differently next time? Also, it was considered essential to identify sources of local assistance in acquiring computer skills and for future malaria information system development.

The authors spent four weeks in Pakistan visiting the malaria control program at federal, provincial, district, and service provider levels (See itinerary and persons contacted, Annexes B and C). They discussed the information needs and practices of the program at different levels, investigated other health programs concerned with malaria, and provided assistance in computer use. Annex D is the briefing document presented to the authors by the MCP Directorate. It describes the current program from their perspective and illustrates the types of information and indicators they employ. Table 1 which concludes Annex D summarizes

those epidemiologic indicators by province and year since the inception of the malaria program in 1960. For readers not familiar with the history of malaria control in Pakistan, Annex E sketches some of the history of the MCP to show how the current malaria information system and its indicators evolved.

To an astonishing extent, the malaria eradication operation established in the 1960s exists in Pakistan today. Malaria still has its own identity, staff, and offices at federal, province, and district levels. It has its own information system and retains the original indicators. The malaria program still defines malaria in terms of slide-proven parasitemia instead of clinical disease, and staff worry more about transmission potential than case management. Malaria drugs are still found most commonly not in the pharmacies of health facilities, but in laboratories under the control of the malaria workers reading slides.

The persistence of many vestigial portions of the malaria eradication program of the 1960s is apparent in the information system reviewed by the authors. The eradication program provided the basic indicators included in the ill-fated PAKMAL surveillance package, and it is responsible for the great bulk of data collected and organized at all levels of the MCP today. To assess the appropriateness of those data and the ways in which they are handled, the authors considered the structures and functions of malaria control, its information needs, and the ability of the current system to satisfy those needs. Recommendations for improved use of existing information and suggestions for the evolution of the malaria information system were developed.

The following section focuses on the Pakistan malaria information system *per se* The computerization of malaria information is then addressed. Finally, since the four major provinces differ significantly in programs, problems, and potential, they are discussed separately in the final section of the report.

The final annexes, F and G, illustrate the malaria portions of the new HMIS system and of the current UNHCR reporting system, respectively.

2. The Malaria Control Program and Its Information Needs

With termination of USAID support of the MCP and the prospect of severely diminished resources for the purchase of insecticide, malaria control activities in the future will rely increasingly on disease control and case management techniques in Pakistan. Malaria control strategies will be revised and new information will be required. Given the evolution of malaria control and its information needs, this report includes both short-term and long-term recommendations. The short-term recommendations suggest mechanisms for using currently collected MCP data to identify priority areas and trends. The longer term recommendations apply to development of a more robust information system to support malaria control.

MCP Organization and Function

The Malaria Control Programme has evolved over the years from a self-contained vertical program to one that is variably integrated with other services at different levels of the health system. To simplify somewhat, the MCP can now be said to operate at federal, provincial, district, and local levels. The scope of its official functions is summarized in Figure 1, adapted from the MCP's annual calendar of activities.

Government health services and their support in Pakistan are organized at all governmental levels:

- Federal
  - Provincial
    - Divisional
      - District
        - Tehsil (or Taluka or Sector)
          - Union Council (or Sub-sector)
            - Community

Because each province is autonomous in the organization of its health services, there are organizational differences between the four provinces where the MCP operates. Nevertheless, malaria control can be differentiated into three principal levels by structure and function as seen in Figure 2.

FIGURE 1. **Functions of the Malaria Control Programme of Pakistan**

A calendar posted in the offices of the DOMC, Islamabad, outlines the activities of the MCP by function and by month. The chart below summarizes the activities of the calendar without specifying the month(s) for any given activity.

Annual Plan of Action for Malaria Control Activities in Pakistan

Mo.	Geographic Reconnaissance	Surveillance		Treatment	Laboratory	Epidemiologic Investigations	Entomologic Studies	Spray Operations	Special Activities
		ACD	PCD						
	House numbering; census; house cards; local maps.	*Monthly rounds of tracking fever cases, and fortnightly in sprayed areas July-November.*	*Health institutions* *Voluntary Collaborators*	*Presumptive chloroquine for fever.* *Radical primaquine treatment for confirmed cases.*	*Examine slides.* *Report pos. results to staff concerned.* *All positive slides and 30-40 neg. checked by supervisor & provincial laboratory.*	*Follow all P.f. areas for three months.* *Follow two sprayed villages in each Tehsil and one unsprayed village in each district or control area.* *Carry out malariometric surveys.*	*Vector density studies.* *Insecticide susceptibility tests.* *Study new positive localities.* *Follow highly positive localities.*	*Begin larviciding in March.* *Repair equipment.* *Train staff.* *Spray from July through October.*	*e.g. Special infant surveys.*

Figure 2: MCP Structures and Functions by Level

GOVERNMENT LEVEL	MCP STRUCTURES	FUNCTIONS
Federal	Directorate of Malaria Control	Establish policy Secure government and external resources Liaison with rest of government, donors, etc.
Province Division District Urban areas	Provincial malaria control office - - - - District malaria control office - - - -	Operations: Reconnaissance (population and geographical) Epidemiologic surveillance Special entomologic and epidemiologic studies Supervision Training Resource distribution Quality control (spray operations and microscopy)
Tehsil (Taluka, Sector) Union Council (Sub-sector) Community	(Rural Health Centre) Malaria supervisors Malaria microscopists (Basic Health Unit) Malaria supervisors (Microscopists in some areas) - - - -	Service delivery: Case detection Presumptive and radical treatment Case management, referral Intradomiciliary spraying Outreach (active case detection)

Review of the Current MCP Information System

The MCP uses two formal information systems. One summarizes the total numbers of cases detected annually by district, province, and nation. These epidemiologic data come from the monthly reports of malaria supervisors and laboratories throughout the country. They are used to follow trends in total numbers of slides examined, slide positivity rate, percentage falciparum, annual blood examination rate, and annual parasite incidence. The graph and two tables presented by the MCP in their briefing document (Annex D) illustrate the current indicators and their use. This section describes and critiques that system.

The second information system, although not always recognized as one, consists of numbers of confirmed cases by locality and by species. It is from these data, gathered once a year, not computerized and not examined in detail by the authors, that decisions concerning focal insecticide spraying are made annually. In recent years, for example, either five documented cases of *P. vivax* or one case of *P. falciparum* has been the minimum required to justify spraying in a given locality. This report does not cover that system.

Current Sources of Epidemiologic Information

The MCP detects malaria cases in three ways: active and passive case detection and special studies.

- *Passive Case Detection* (PCD) is defined as the detection of cases detected by microscopic examination of blood smears from patients who present with clinical signs and symptoms of malaria. These cases are not actively sought out, but simply identified when patients come to health facilities with fever. *Activated* PCD, where case detection is carried out by malaria supervisors working within health care facilities, is a variant of PCD.

- *Active Case Detection* (ACD) is the detection of cases during the regular community outreach visits of malaria supervisors from the blood smears of persons with fever (or having had otherwise unexpla[illegible] fever since the malaria supervisor's last visit). In principle, the supervisor goes from door to door actively seeking out fever cases. In practice, in areas such as those where the culture does not countenance a man visiting a home when only women may be present, the malaria

supervisor may simply inquire at local markets about fever cases and ask them to come forward. Schools may be visited as a quicker way to obtain the desired number of smears.

- *Special Studies.* A variety of special studies is sometimes carried out to supplement routine ACD and PCD information and to clarify problematic situations. These include malariometric surveys, entomologic surveys, and tests for resistance to insecticides and antimalarial drugs. When conditions warrant, such as when an outbreak is suspected or to check the effects of spray operations, blood smears may be taken from all symptomatic individuals or from a random sample of the population. The authors observed the MCP's skill with this technique in Kohat District, NWFP, where an outbreak had been reported, quickly confirmed with a special survey, and control measures rapidly put into operation.

Indicators Used

The MCP uses four main epidemiologic indicators: the Annual Parasite Incidence (API), the Annual Blood Examination Rate (ABER), the Slide Positivity Rate (SPR), and the relative proportion of confirmed cases attributed to *P. falciparum*. In addition, the proportion of total cases detected through PCD has been used to monitor the extension of the PCD system as more and more health facilities develop the laboratory capability to detect malaria.

- *API.* The annual parasite incidence is defined as the number of confirmed malaria cases per thousand population per year. Positive cases from all MCP sources are placed in the numerator; the denominator is a gross population figure that ignores differential access to MCP services. Before 1991, only the rural population was considered when calculating the API; since 1991 the urban population has also been included. Between 1991 and 1992, the denominator increased by more than 50% (from 72 to 112 million), and the API dropped by 47% (from 1.11 to 0.59). API has served as the MCP's major indicator of malaria trends in recent years.

- *ABER.* The annual blood examination rate is the proportion of the total population from whom malaria smears are obtained each year. It provides a rough gauge of the confidence interval that might be associated with the API. Conventional wisdom during the eradication

era was that the ABER should be about 10% for a reliable API. The national ABER in 1992, including slides from all sources, was 2.3%.

- *Slide positivity rate* (SPR) is the proportion of malaria blood smears examined microscopically that are found to have malaria parasites. When used to follow trends, the slide positivity rate can be expected to increase with higher infection rates. For the purposes of comparing large populations and trends over time, the SPR is likely to provide a fairly accurate indicator of malarial infection trends. It is also meaningful for smaller areas and time periods shorter than one year. In the 1970s, the MCP used the SPR as the primary indicator of malaria trends. Upon the advice of consultants, however, it was replaced by API as the primary indicator.

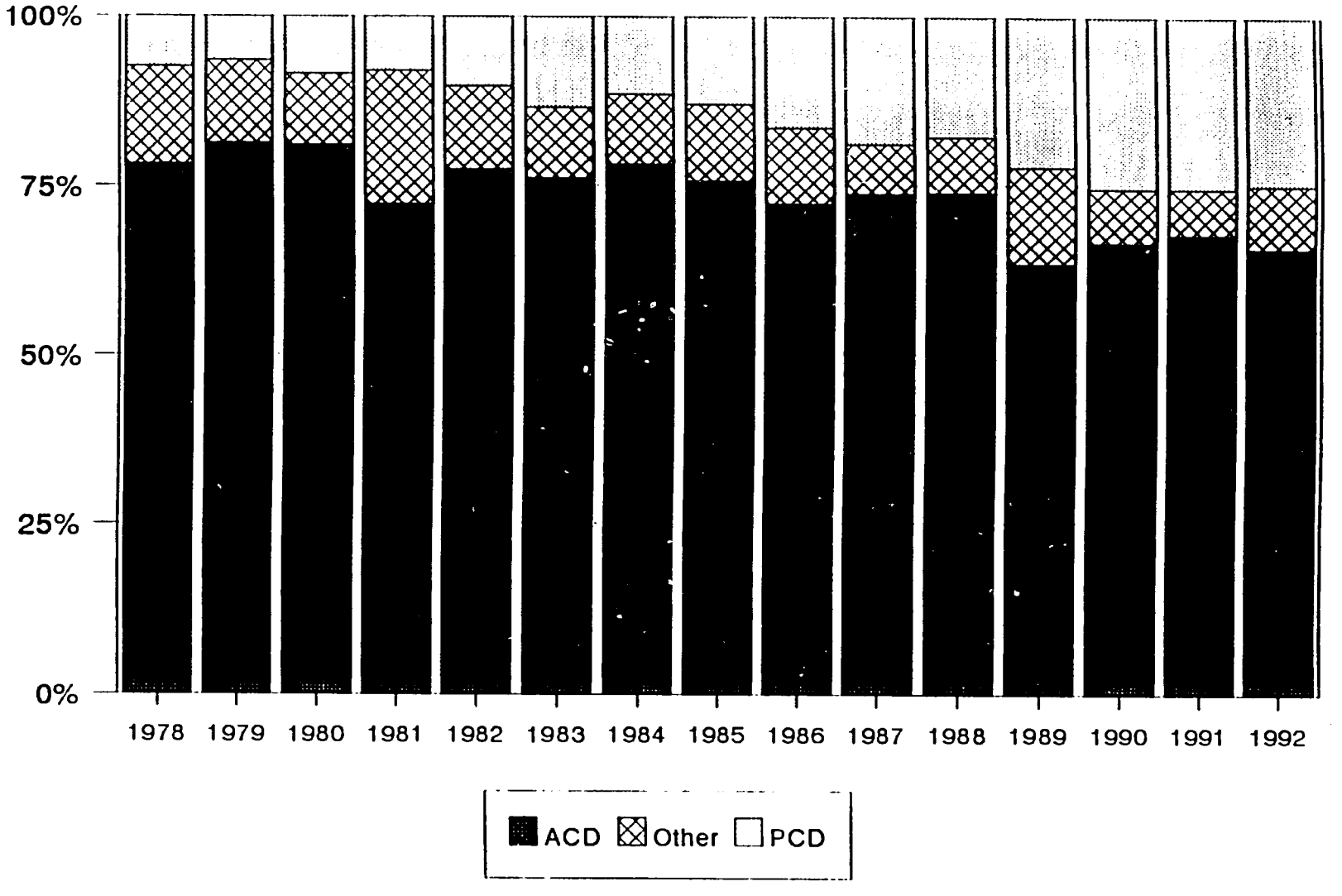
- *Proportion of total confirmed malaria due to P. falciparum.* Two parasites account for virtually all malaria in Pakistan — *P. falciparum* and *P. vivax*. Since *P. falciparum* is the more virulent, a higher proportion of cases associated with this parasite has been interpreted as pointing to a higher risk area. MCP has attempted to maintain the proportion of falciparum cases at less than 10% of the total.

- *Proportion of total confirmed malaria cases detected through PCD.* One objective of the 1987 extension to USAID support for MCP was to increase the proportion of slides obtained through PCD to 70% of the total. The consultants were asked to report on the results for 1992. Figure 3 shows the national trend for the past 15 years. In 1992, for the whole of Pakistan, 25% of all slides were obtained through PCD.

Provincial PCD trends can be calculated from Table 1, Annex D. Punjab, at 13%, and Balochistan, at 21%, showed the lowest PCD/total slides proportions, while NWFP and Sindh, both at 42%, showed the highest. All are well below the 70% target. Since 1987, both Sindh and NWFP have increased the proportion of slides from PCD by nearly 50%. Punjab's proportion, the lowest in 1987, remains essentially unchanged.

Table 1 is the authors' summary of Pakistan epidemiologic data, disaggregated by source of collection, parasite species, year, and province since the inception of the Pakistan malaria program in 1960. The authors' conclusions and recommendations concerning available data relate specifically to the collection and use of these numbers.

Figure 3. Collection Source of Blood Smears Examined for Malaria
Pakistan: 1978 - 1992



source of information:
Malaria Control Program

Discussion of Current Indicators and their Use

Currently, blood slide results from special studies, ACD, and PCD are combined to calculate epidemiologic indicators. The resulting numbers can be difficult to interpret.

The completeness of ACD data depends upon the diligence of malaria workers and the willingness of febrile individuals to submit to case detection. It does not, however, identify all malaria cases that PCD fails to detect. In fact, given how little is known about the reference population, ACD data cannot always be interpreted reliably. When asked whether ACD could be discontinued, MCP officials expressed reluctance to abandon malaria services to areas that may not be served by health facilities and PCD. It is not clear, however, that ACD penetrates underserved areas thoroughly. In Lahore and Kohat Districts, both ACD and PCD were found to have missed pockets of malaria.

PCD draws upon a fairly consistent population—people who choose to come to government health facilities for care. Because the reference population is consistent, even if different areas may vary in their use of government services, PCD data can be used to follow trends and for routine epidemiologic surveillance.

The percentage of total cases detected through PCD has been interpreted to reflect improvement in the PCD system as more and more health facilities carry out laboratory case detection of malaria. The percentage is also influenced, however, by changes in ACD. An increase in PCD percentage is not necessarily proof of improved PCD; it can simply reflect flagging ACD efforts. Conversely, the observed failure of the PCD percentage to increase appreciably in the Punjab may be due to the fact that ACD has been maintained with particular diligence there.

The ABER can be expected to decline as malaria incidence decreases since there will be fewer reasons to take blood smears, but it also reflects the level of outreach effort. The low ABER in recent years reinforces the authors' contention that API is unreliable as currently calculated in Pakistan and is not useful at this time.

The MCP recording system does not capture every case of malaria. When MCP data are used to calculate an indicator like API that is

intended to reflect an actual level of malaria in the reference population, the result is misleading. In such a situation only the direction of trends can be detected with confidence. Variations in case definition also limit the usefulness of API when comparing areas with different information systems. Finally, many fevers for which blood smears are never made are certainly due to malaria and should properly be part of the API numerator, but their number is unknown. In 1991 only 48% of rural fever patients had a blood slide taken.

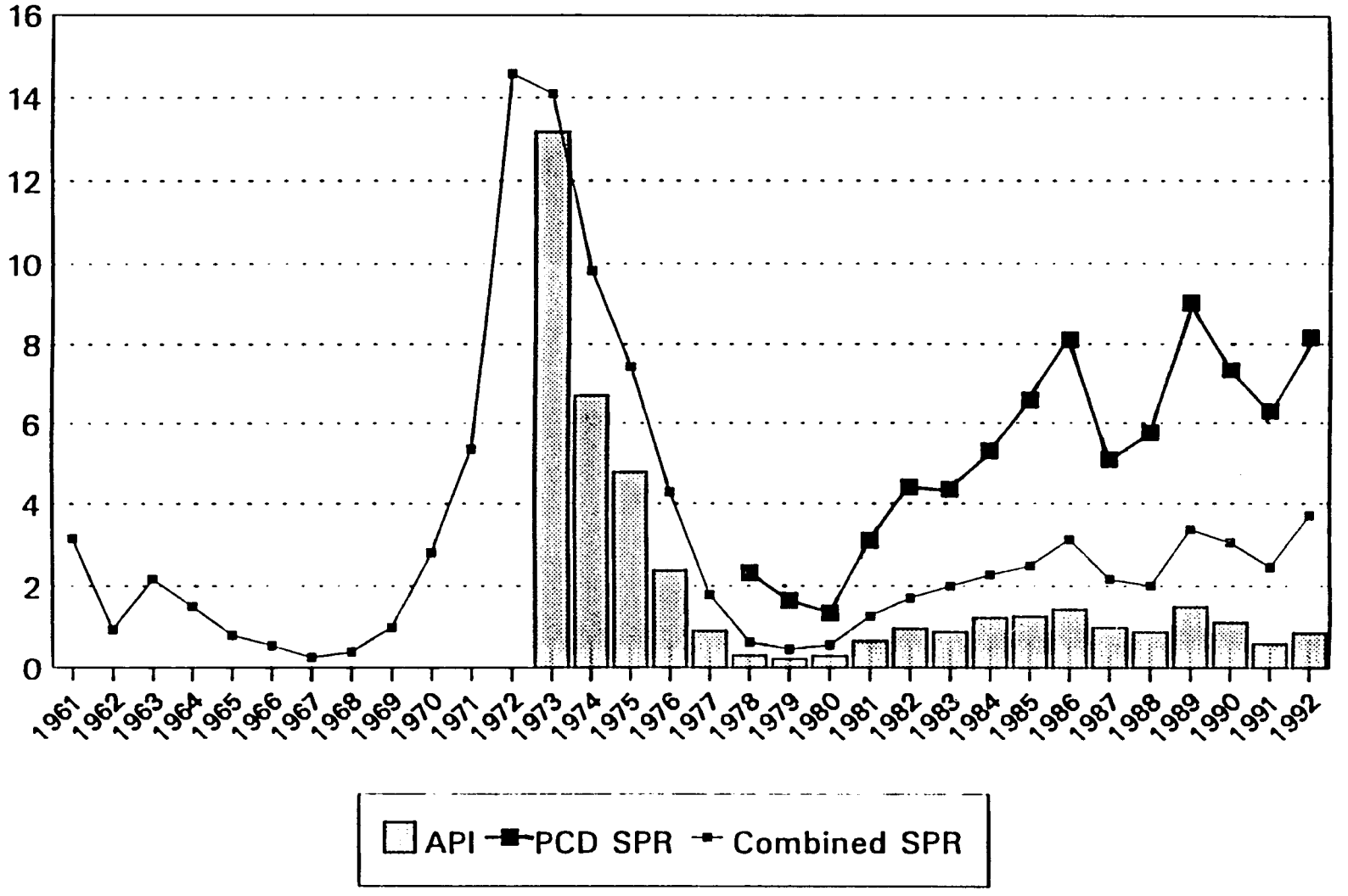
The API can be used to follow trends if cases are detected from a consistent population, so that one could have some confidence that the indicator reflects infection patterns and not population fluctuations or intensity of case detection effort. Unfortunately, the population used as the denominator for the API, the size of the pool from which slides are taken, admits no clear and unambiguous definition.

Urban data are not well reported to the current MCP information system. Without knowing more about the urban case reporting system, it is not clear whether the drop in API that was observed when the urban populations were added to the API denominator in 1992 reflects a true decrease in infection or simply a larger denominator.

In contrast to the API, the SPR has the advantage of a known denominator—the number of slides examined. The SPR presupposes, however, that the populations from which slides are taken have fairly homogeneous diseases patterns, and that the rate of malaria infection is the major factor that influences the SPR. It is not known how valid these assumptions are in Pakistan. A higher slide positivity rate for malaria could be caused by a decrease in fevers from other causes. Conversely, an increase in dengue fever, for example, would lower the SPR without any necessary change in malaria incidence.

Figure 4 compares the API, the SPR from all case detection systems combined, and the SPR from PCD alone as calculated from currently collected data. It appears that SPR is the most sensitive indicator of trends, especially when only PCD data are considered. SPR is even easier to interpret if calculated for *vivax* and *falciparum* cases separately. When the proportion of all malaria cases that is due to *falciparum* is used

Figure 4. Comparison of API, PCD SPR, and Combined SPR
Pakistan: 1961 - 1992



source of information:
Malaria Control Program, Pakistan

by itself, however, the result is difficult to interpret since an apparent increase in *P.f.* can be simply reflecting a decline in *P.v.* infections.

Future Information System Development

The limitations of the current MCP information system will require more than simply disaggregating data and presenting it in more useful fashion. Additional indicators are needed, and some will be suggested here. The information system of Pakistan's Primary Health Care system is in the process of being improved and expanded throughout the country. This system will address some of the needs of the MCP, and prospects for coordination—and even the eventual merger of the systems—are promising as well.

Mortality. The DOMC informed the authors that there is almost no mortality from malaria in Pakistan, but medical practitioners report that death from cerebral malaria is not uncommon. There is no reliable cause of death registry. Hospitals, particularly those equipped to provide accurate diagnostics, could provide information for specialized monitoring of mortality.

Morbidity. Given the limited case definition (positive blood smear), it is difficult to assess the extent of malaria disease in the overall population. Using MCP figures the amount of malaria is likely to be severely underestimated. The MCP receives data on numbers of fever cases seen and the numbers of fever cases from whom blood smears are taken. The program could use this information to estimate the numbers of cases in the government's catchment population.

The SPR's specificity as an indicator presumes a fairly constant background of general fever cases. Changes in the SPR reflect changes in relative malaria incidence. It would be useful to have a sense of the extent of malaria and other types of fever in the population at large. More information on fever patterns could be obtained through special studies.

Gender and age disease patterns. It is thought that malaria immunity is low in Pakistan, but that may not be true in all areas. Different patterns of malaria by age can reflect differences in relative exposure and immunity to malaria. There are indications that women in particular may have restricted access to services in some traditional

areas. If this is true, new approaches to the provision of services may be needed. The extent to which the different sectors of the population are served by the health system will be reflected by the pattern of age and sex of individuals examined. At present no assessment of disease patterns by age or gender is made, although this information is recorded for each smear. The BHUs supervised by UNHCR do aggregate this information (see Annex G). The MCP could also aggregate and analyze this information.

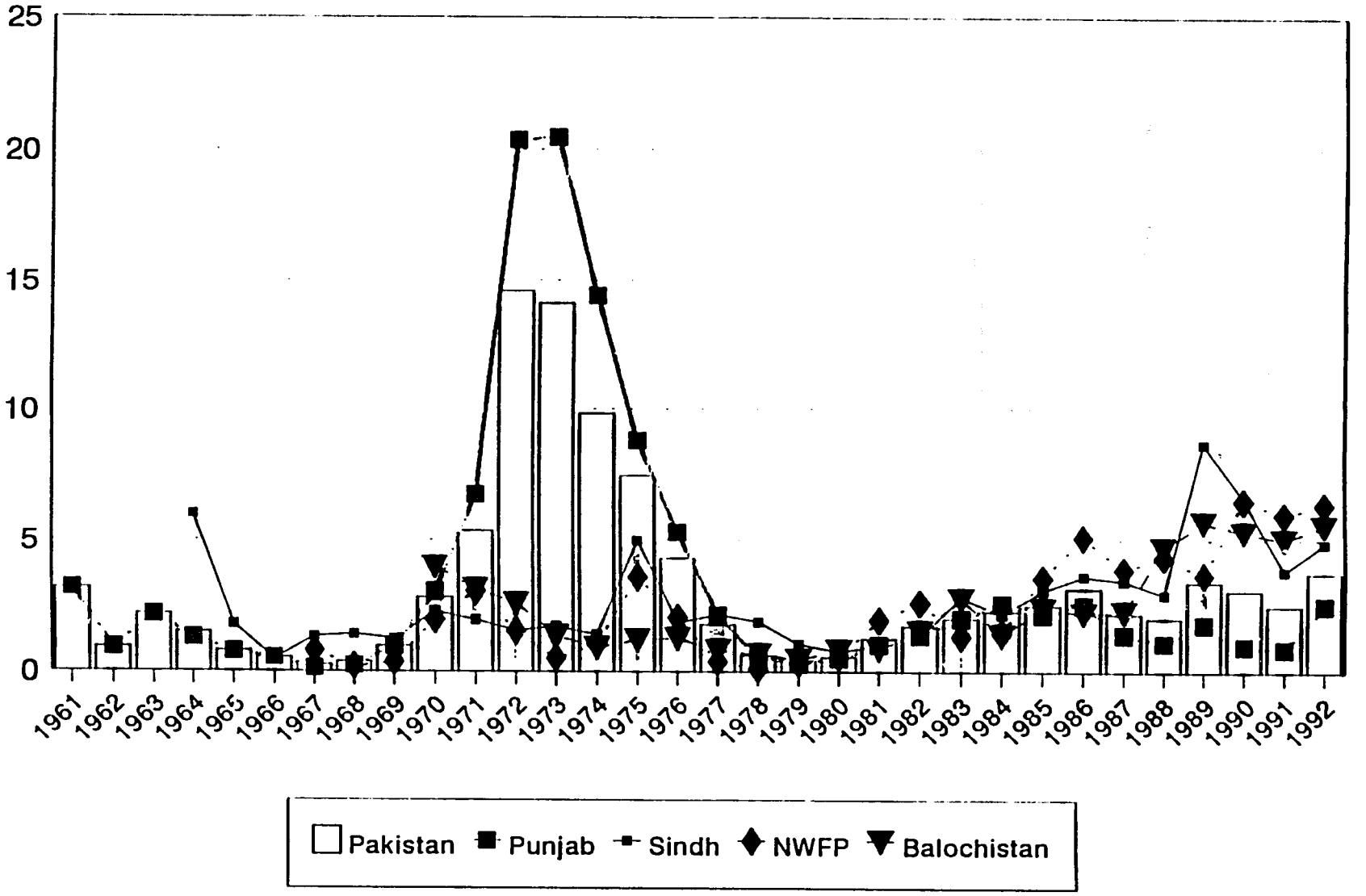
Local patterns of disease. Malaria is a focal disease in Pakistan, and the vector control actions of the MCP are locally applied. This necessitates information that shows the differing patterns in different locations. National data obscure local features. As seen in Figure 5, national SPR figures obscure the differences from province to province. Even more localized information can be aggregated from existing data by focusing on districts as in Figure 6.

Entomologic Indicators. The authors have no expertise in entomology and can offer few comments about specific types of information required. It was apparent, however, that the MCP has considerable entomologic expertise. The Punjab alone employs approximately 100 trained entomologists. While field workers appeared to have a good understanding of the entomologic characteristics of their own areas and special entomologic studies are carried out from time to time, there appears to be no systematic way to record this information and observe trends over time.

Even though funds had been allocated and a study design prepared to elucidate the role of *An. stephensi* in malaria transmission, the study has not been conducted. The question of the role of this mosquito is pertinent because it is generally resistant to the insecticides currently in use by the MCP. The DOMC expressed confidence in their existing knowledge of malaria vectors, however, and showed little interest in additional studies. In Kohat District the malaria chief reported that *An. stephensi* had been the vector in a recent *P.f.* outbreak since it was the only mosquito in evidence. Although this view was challenged by a central officer because no mosquitos had been dissected to prove incrimination, the possibility of new or changing vector patterns remains largely unexamined.

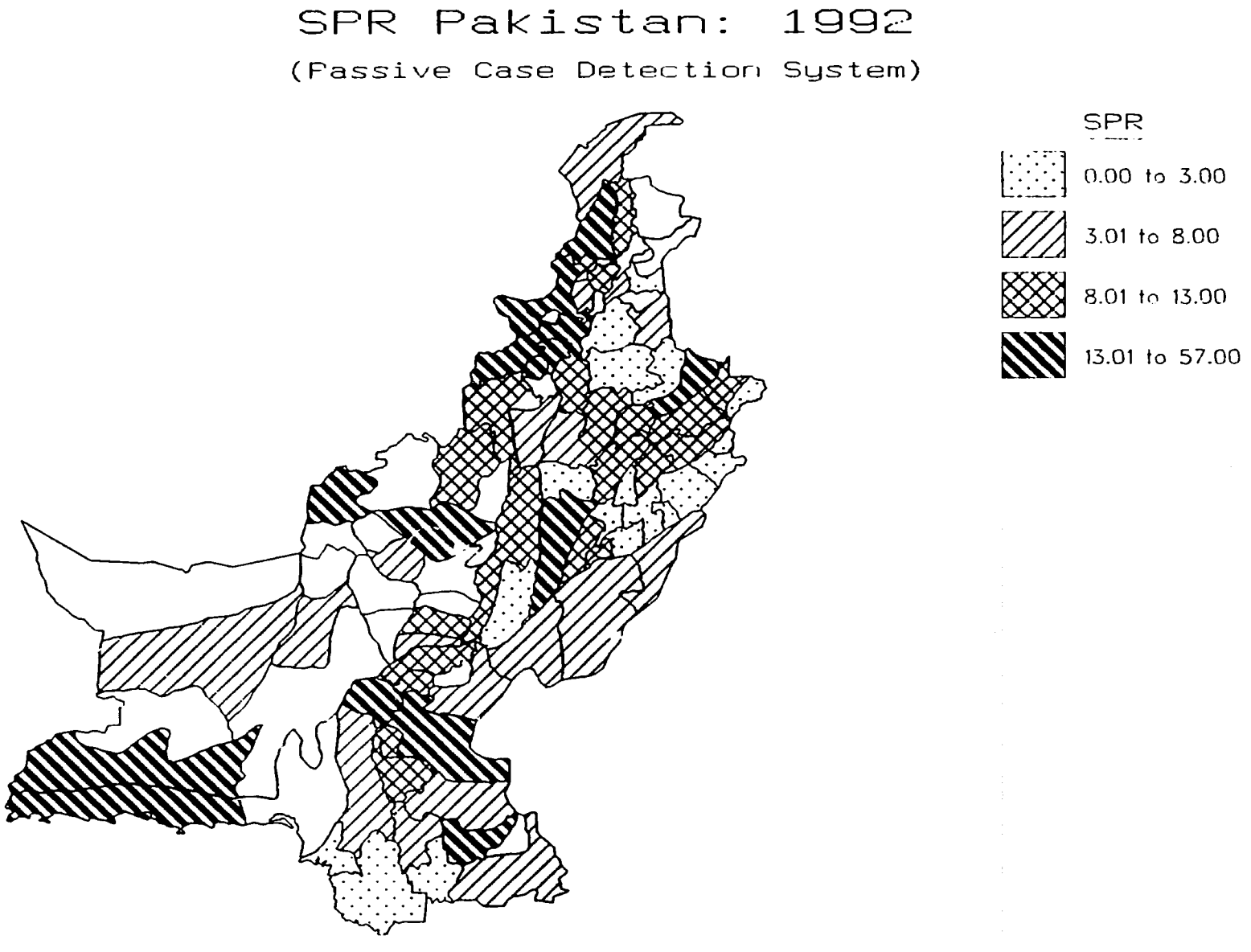
The 1992 evaluation team report includes detailed suggestions for

Figure 5. National and Provincial Combined SPR
Pakistan: 1961 - 1992



source of information:
Malaria Control Program, Pakistan

Figure 6


SPR Pakistan: 1992
(Passive Case Detection System)
SPR
0.00 to 3.00
3.01 to 8.00
8.01 to 13.00
13.01 to 57.00

collecting entomologic information to focus spray operations. There was no evidence that the MCP is trying to implement such a system.

Epidemiologic effects of spray operations. Because spray operations—the MCP's main intervention—are extremely localized, it is essential to assess their localized effects to substantiate their impact. Allen Lewis observed in 1990 that the data currently collected do not permit correlation between intervention and outcome (see bibliography). The situation has not changed since Dr. Lewis's visit. A record of localities sprayed during the previous three years is kept, however, and this information is available at the annual spray planning session. Some malariometric surveys are carried out after spraying, but these do not appear to be correlated systematically to assess impact. That correlation is needed.

Quality of care indicators. Malaria diagnosis and treatment is provided both by the workers who report directly to the MCP and by government care providers. The practices of both sets of workers need to be monitored to ensure quality of care. While concern for the health of spraymen has prompted attention to their observance of procedures, and microscopists' results are sometimes checked, other quality of care issues have largely been ignored.

The fact that sterile procedures are not always observed during ACD blood collection had been noticed by others before the authors questioned the practice. However, no attempt had been made to estimate the extent of the problem (by looking at the numbers of lancets distributed, for example) and no corrective action had been taken. No inventory records of blood-drawing supplies, laboratory equipment, or even antimalarial drugs were observed.

During field visits to two facilities, the authors were struck by the separation of the MCP services from the general health care system. Malaria was clearly viewed as the province of the "malaria man." Only the malaria worker takes blood smears from fever cases in one facility; when he is at another facility or in the field, diagnosis is made on the basis of clinical findings alone. The belief that taking blood smears for malaria confirmation is the task of malaria workers alone may also account for the fairly high proportion of PCD slides from Sindh and NWFP where malaria workers spend much of their time in facilities.

The discontinuities between MCP and general health care services were also apparent during interviews with practitioners. At both facilities visited, the doctor's treatment of clinical malaria did not conform to the recommendations of the MCP. The MCP apparently provides no training in malaria care to practitioners. Moreover, the drugs recommended by the MCP were not available in the facility dispensaries although they were available through the MCP worker in the same building. Because roughly half of the fever cases in 1992 had no blood smear taken and were presumably treated on the basis of clinical findings alone, the distance between MCP and general health services is disturbing.

Resistance to malaria drugs, a primary concern in establishing malaria treatment policy, is not monitored regularly or routinely. In the future it should be.

Fortunately, the Government of Pakistan has begun to implement an information system to support its primary health care programs, including malaria. That system should address those patient care aspects and contribute to epidemiologic surveillance.

The New Health Management Information System (HMIS)

In 1990, development of a coordinated Health Management Information System (HMIS) began with support from the USAID Pakistan Child Survival Project. The HMIS is focused on the first level care facility and the management decisions it requires. During the past year extensive training has been conducted, and some 40% of districts had begun using the HMIS monthly reporting forms by September 1993. Use of a computer-based information system had begun in all provinces, almost all divisions, and a few districts. The availability and use of reports from the computer-based system is expected to expand rapidly over the next few months.

While the HMIS was designed in a collaborative fashion involving representatives from all concerned horizontal and vertical programs, the MCP appears to have contributed relatively little to its design and implementation. Malaria control officers at the federal level have some familiarity with the system but find its coverage spotty and remain unconvinced that it will provide the information they require to manage their program. At peripheral levels, MCP awareness of the HMIS

system is extremely limited: malaria control personnel had not even seen the malaria portion of the new national reporting form. That portion of the HMIS format and the malaria indicators used by the PHC system are reproduced in Annex F.

The drug chain weaves through general health services and does not always seem to reach the goal of providing chemotherapy to patients who need it. MCP provides malarial drugs to the District Health Officer, who then distributes them to BHUs and MCP field workers. The HMIS will provide routine information that can be used to monitor quality of care, primarily in the form of drug and supply stock figures.

The HMIS project includes a supervisory module with a standard form that could be adapted for supervision of malaria diagnosis and treatment. The HMIS also provides modules to document training sessions and specific job responsibilities. These data can provide the basis for planning and organizing in-service training sessions as well as deployment plans for understaffed areas.

Even when the HMIS begins to provide information for malaria management, the responsibility for collecting and analyzing entomological and epidemiologic information on spray operations will remain with the MCP. Dwindling resources for insecticide-based interventions will require an increased emphasis on disease control through appropriate case management. As malaria control expands its use of disease control techniques, information on case diagnosis and treatment will be available through routine HMIS service delivery statistics and supervisory reports.

3. Computer Automation of the Information System

Review of Previous Activities

In 1989, a series of USAID-supported information systems activities was initiated, and this report concludes that series of activities. Data collected and reported by the MCP are often simply counts of slides with simple arithmetic done to calculate an indicator. Using a computer to store this type of information can dramatically increase the accuracy and ease of preparing reports. When a consultant was invited to assess the information needs of the MCP in 1989, the potential for automating data storage and analysis was recognized. USAID provided a computer and trained the chief epidemiologist and the biostatistician at the DOMC in basic computer literacy.

It was subsequently decided to introduce computers and printers at provincial offices and to develop a demonstration software program for the Pakistan MCP. In the spring of 1992, a course in basic computer literacy was held for provincial and federal MCP officers. Two consultants installed the program, PAKMAL, on provincial computers. Technical assistance visits to pursue this effort are described in the reports listed in the bibliography and will not be summarized here. The authors were asked to review the effects of earlier activities and to provide additional capacity in computer software.

The computerization results have been disappointing. Only the computer of the DOMC director has been used regularly. His secretariat uses it for word processing and preparing simple spreadsheets. The other central computer and the four provincial computers are in good working order but used irregularly.

The original objective was presumably to provide the tools and training so that MCP staff could take advantage of computer technology. This objective became obscured as time passed and the individuals trained did not succeed in using the technology. The trainees understood that they would be able to use PAKMAL and supplementary spreadsheets for their information system. This view seems to have been reinforced by USAID and its consultants who wanted then to ***improve*** this system. A demonstration had become the basic computerized system. When

problems appeared with PAKMAL, people simply stopped using the computers. No one took real advantage of the training in word processing and spreadsheets. Except in the director's office, no supervisor encouraged use of the machines. Supplies, even to the level of diskettes and paper, were provided only by USAID.

Computer Activities during the Current Visit

In providing technical assistance in the use of computers, the authors emphasized ways provincial MCP staff could apply computer technology easily and usefully. EpiMap, a desktop mapping program, was installed on each computer. A brief training was given in its use. When time permitted, the authors worked with MCP provincial staff to develop spreadsheets to be modified as needed. Wherever possible the authors worked with both MCP staff and provincial HMIS computer specialists to encourage collaboration between these groups. Spreadsheets, graphs, and maps were prepared using data from each province, providing examples of ways standard software can be used to present data. A copy of the data files used was left at each province, and a complete set was left for the MCP's chief epidemiologist when the authors departed.

In collaboration with MCP staff, maps and graphs were developed to compare overall and parasite-specific infection rates and seasonal trends in different areas. For Sindh Province, for example, one map and one figure display the SPR obtained from PCD data. Figure 7 shows the geographic distribution of malaria SPR by district. Figure 8 ranks districts by infection rates. Two maps side by side, Figure 9, compare the geographic distributions of *P. falciparum* and *P. vivax* in Sindh Province. Seasonal trends in overall infection rates can be shown in a graph plotted by month and compared with the average for the previous five years, as in Figure 10. Seasonal trends in falciparum and vivax malaria can be compared as in Figure 11.

The MCP Computers

DOMC (federal level). Two computers had been installed and staff trained. The computer in the director's office is used regularly for word processing and spreadsheets. The authors found it to be inoperative at the time of their visit, however, due to a hard disk malfunction. The other computer, in the chief epidemiologist's office, has had its hard disk replaced and has not been used since.

Figure 7

SPR

SINDH: 1992

(APCD/PCD Combined)

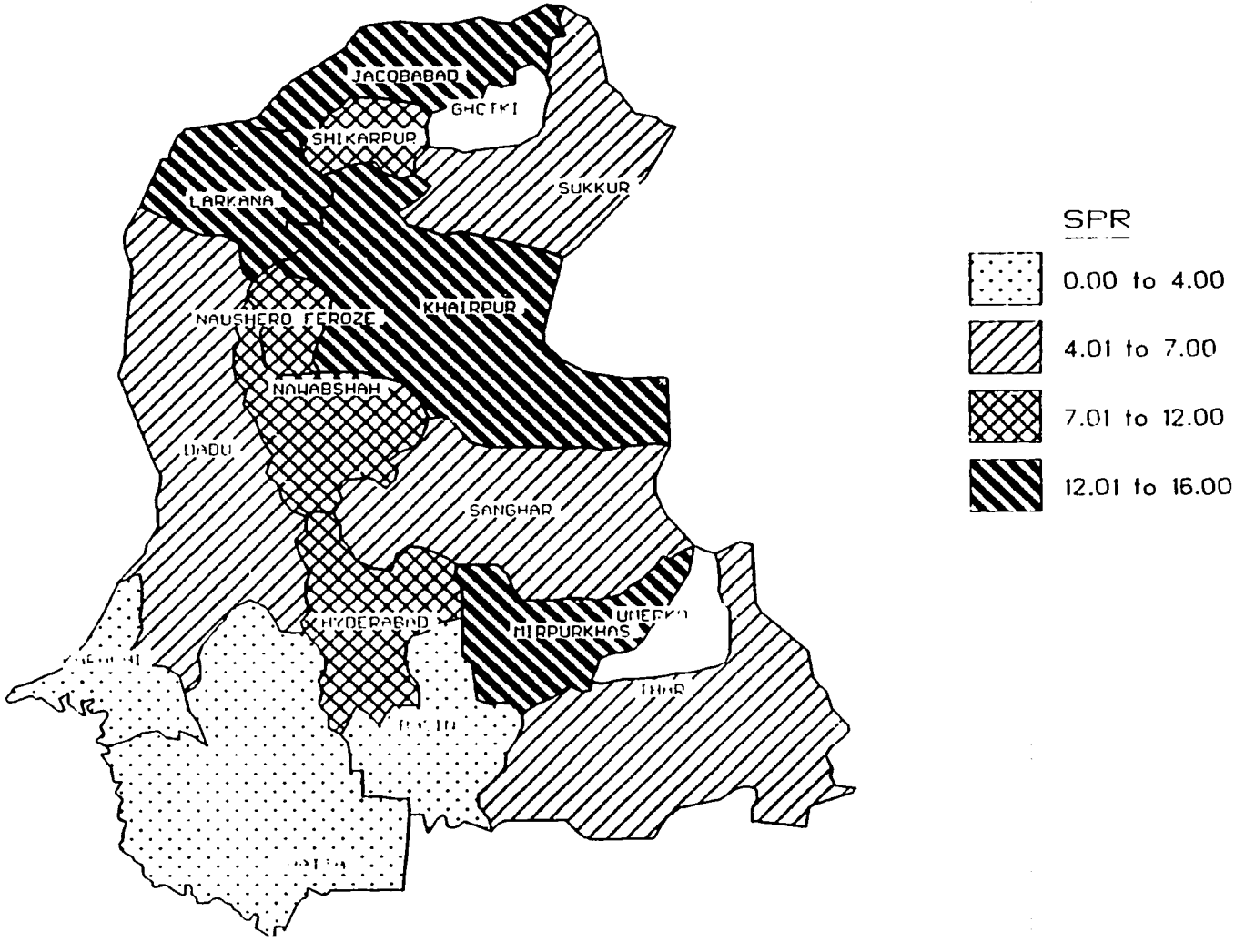
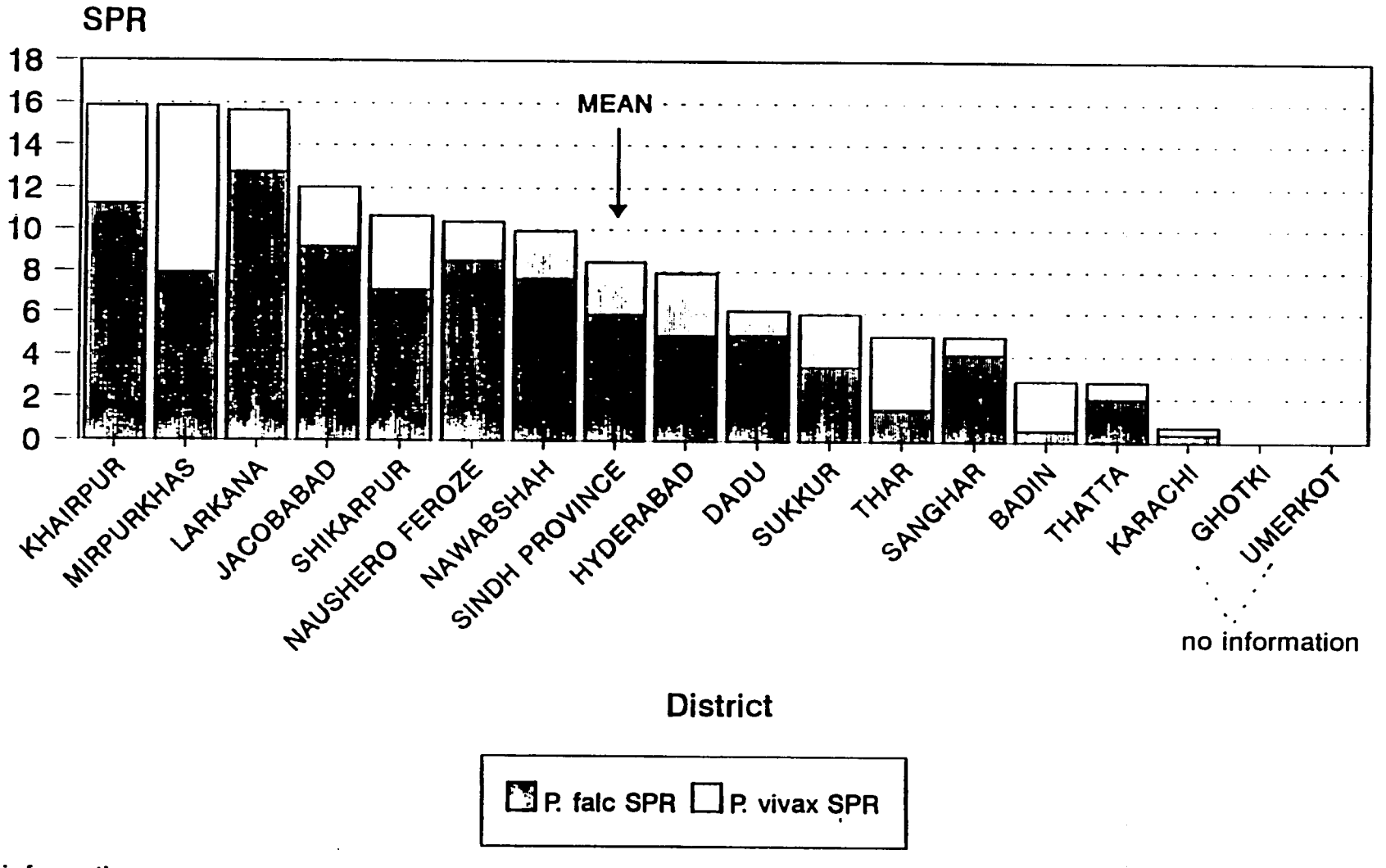


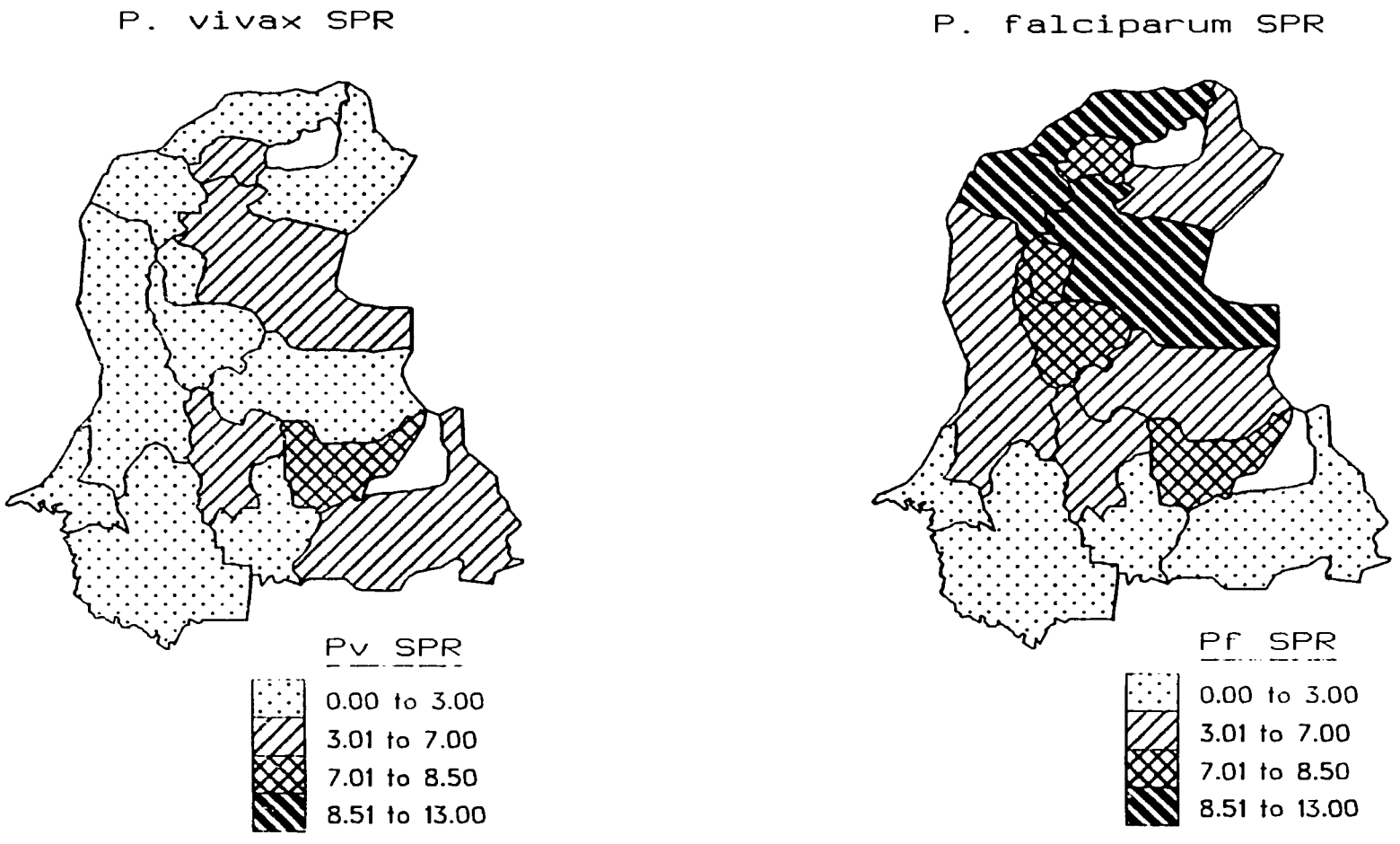
Figure 8. District SPR
SINDH: 1992
APCD and PCD Systems Combined



source of information:
Malaria Control Programme, Sindh

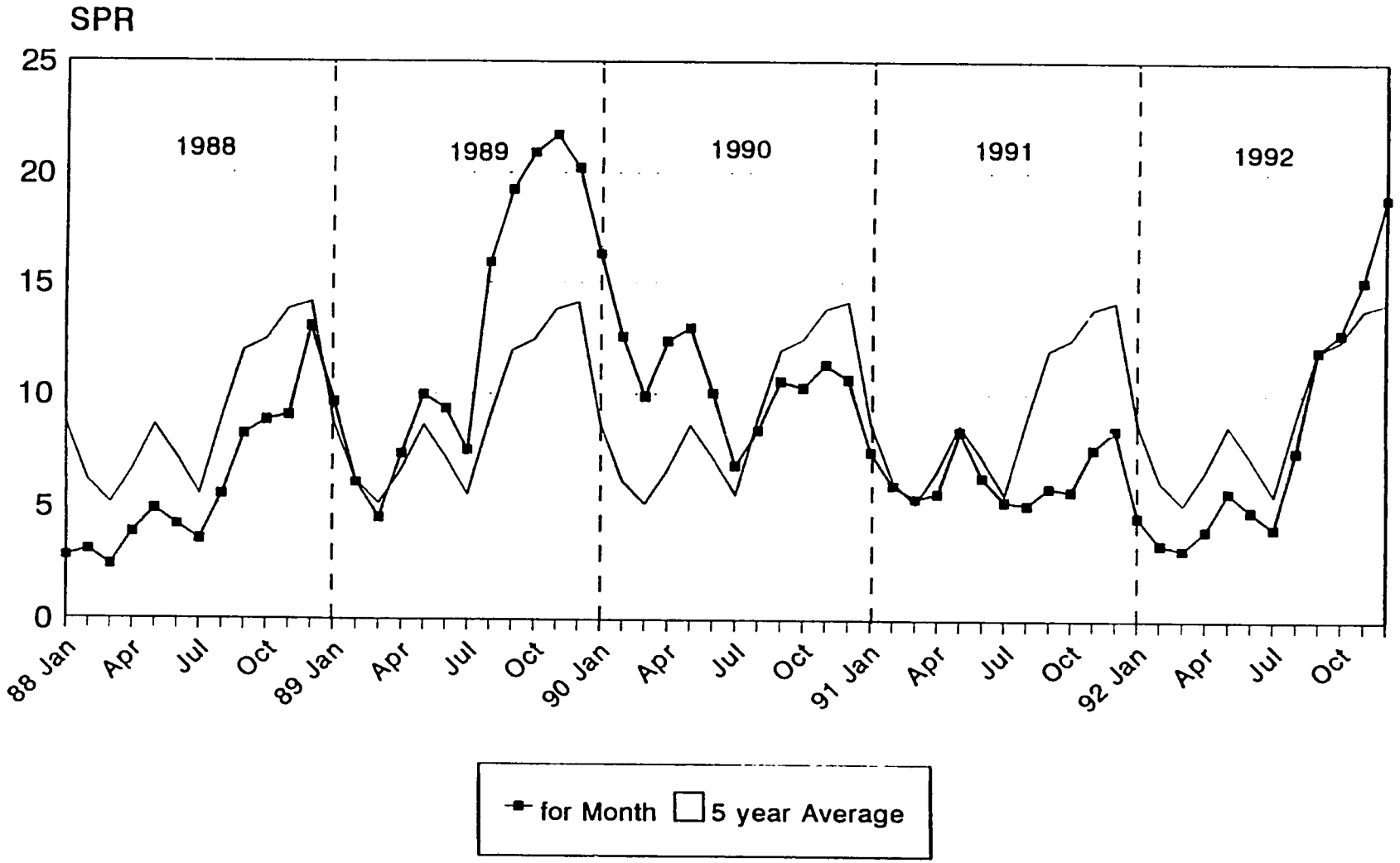
Figure 9

P. vivax and P. falciparum SPR
SINDH: 1992



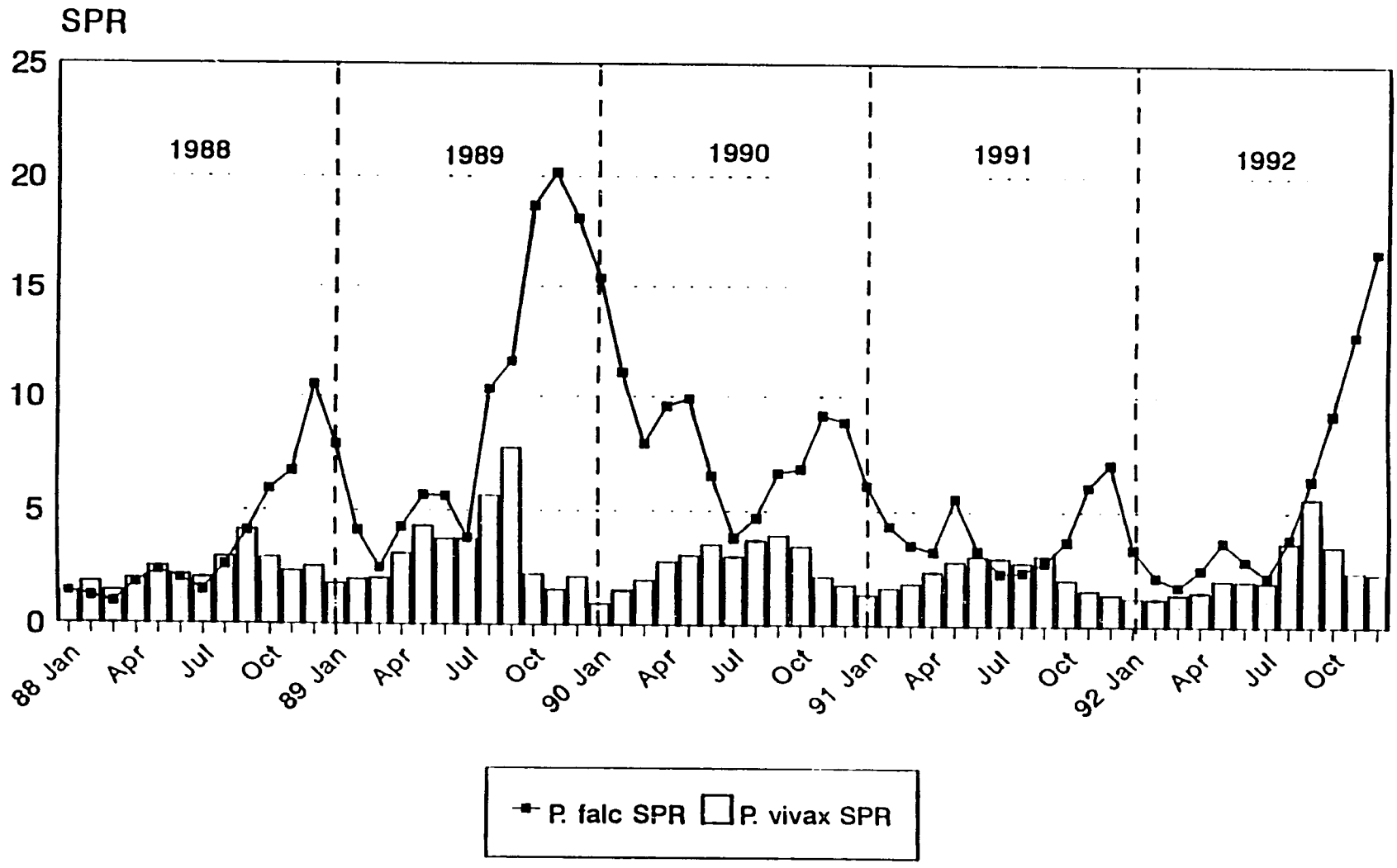
(APCD/PCD Combined)

Figure 10: SPR: Monthly and 5 Year Averages
Sindh: 1988 - 1992
APCD and PCD Systems Combined



source of information
Malaria Control Program, Sindh

Figure 11: P. falciparum and P. vivax SPR
Sindh: 1988 - 1992
APCD and PCD Systems Combined



source of information
Malaria Control Program, Sindh

Two individuals at the central level were to have taken the lead in encouraging the use of computers: the chief epidemiologist and USAID's resident malaria advisor. Neither assumed the responsibility. The chief epidemiologist believes it was a consultant responsibility to provide special purpose software for the MCP and has not used standard software packages to deal with MCP data.

Punjab Province. One computer had been installed and staff trained. The individuals trained are fairly senior and appear to be too busy with other responsibilities to practice using their computer. The Punjab MCP does not use its computer. At the request of the Director General of Health, Punjab, the computer was moved into the same air-conditioned room that houses the other provincial computers, and staff from other programs have been using it.

The Punjab computer cell has a dynamic leader and a trained computer expert. This unit is ready to provide support and training to MCP staff in the development of spreadsheets. Provincial commitment to computerization was evidenced by a Laserjet III printer that had been purchased locally. During the authors' visit, two statistical clerks from the MCP were designated to work with the computer cell to develop spreadsheets and other tools that could be used by the MCP.

Sindh Province. One computer had been installed and staff trained. The chief epidemiologist, in whose office the computer is placed, has demonstrated initiative in trying to use the computer, but has been hampered by a lack of colleagues with whom to trade ideas and problems. He abandoned the PAKMAL program and, after using the spreadsheets supplied for 1991, was unable to modify them for use in later years. He has experimented with putting other information into the computer, but has been deterred by inexperience in using standard software.

The epidemiologist has also been unable to print information for some time. The printers supplied, the HP Deskjet, produce a very high quality output, but the ink cartridge is expensive, fairly short-lived, and sometimes difficult to find. The MCP in Sindh has no budget for such supplies.

The authors' one day visit did not provide time to develop a provincial spreadsheet on premises. One was developed later and left with USAID to send to Hyderabad.

Balochistan Province. One computer had been installed and staff trained. The computer is in the office of the chief epidemiologist, who experienced problems similar to the Sindh in using PAKMAL and the spreadsheets supplied. He has not tried to use the software independently. Balochistan also suffers from a budget that does not include allocations for computer supplies. The MCP joined the other components of provincial health services in a new building this year. The HMIS computer cell is located just one floor away.

The authors worked with both the epidemiologist and the chief of the HMIS computer section to experiment with the EpiMap mapping facility and to develop a spreadsheet that can be used to record and analyze district monthly reports.

NWFP Province. One computer had been installed and staff trained. The computer is in a large, dimly-lit training room, accessible to all. It is used primarily by the chief entomologist and the chief statistical clerk. The provincial MCP staff had continued to try to use the PAKMAL system to check the indicators reported by sub-sectors. Like the other provinces, the MCP there has no budget for computer supplies. The acting chief of the provincial MCP appears willing to allocate funds for this purpose, however.

Provincial staff volunteered to work on their day off, and the authors worked with the acting chief, chief entomologist, and chief statistical clerk to develop formats for maps and spreadsheets that can be used by the province. The HMIS computer cell, located in a separate building, was not visited.

4. Provincial Findings and Recommendations

Punjab Province

With a population of some 70 million people and relative prosperity and stability, the Punjab is like a country in itself. Its malaria program appears dynamic and in the process of integrating with its health ministry more readily than in the other provinces visited.

The authors traveled to Lahore to visit the Punjab Communicable Disease Control (CDC) Programme that performs malaria control functions for Punjab Province. Two brief meetings with the Director General of Health Services, a former official of the malaria control system, revealed his continuing interest. He is also interested in the new HMIS and determined to integrate services within his province. He had directed that the MCP computer and printer be transferred to the "Monitoring and Evaluation Cell" with the other provincial computers over the objections of the DOMC, it appears. Computer expertise is being funded through an Asian Development Bank project.

The major activities in the Punjab included meetings with various CDC officials, work with the personnel of the computer cell, and visits to the Lahore District offices and Manga Rural Health Centre.

As mentioned earlier, the findings concerning computerization were that the principal official trained to use the computer, a senior parasitologist, appeared to be too busy to practice computer skills. He and his senior colleagues seemed to welcome the suggestion to ask the computer cell team to train two junior MCP statistical clerks. They identified two likely candidates immediately and began to arrange for their assignment to new responsibilities. EpiInfo and EpiMap were installed and demonstrated. The computer team was encouraged to help malaria officials capture the data they need on spreadsheet programs. Use of PAKMAL was discouraged as too inflexible and unnecessary.

Review of existing malaria records revealed a many-layered malaria control system with elaborate records manually maintained. The detailed records are so voluminous that they must be discarded after five years.

Relatively little is currently analyzed at district and provincial levels. Figure 12 reproduces the graph found on the walls of the CDC officials responsible for malaria control. A sample of existing records was reorganized into graphs and maps to demonstrate new ways of presenting available data.

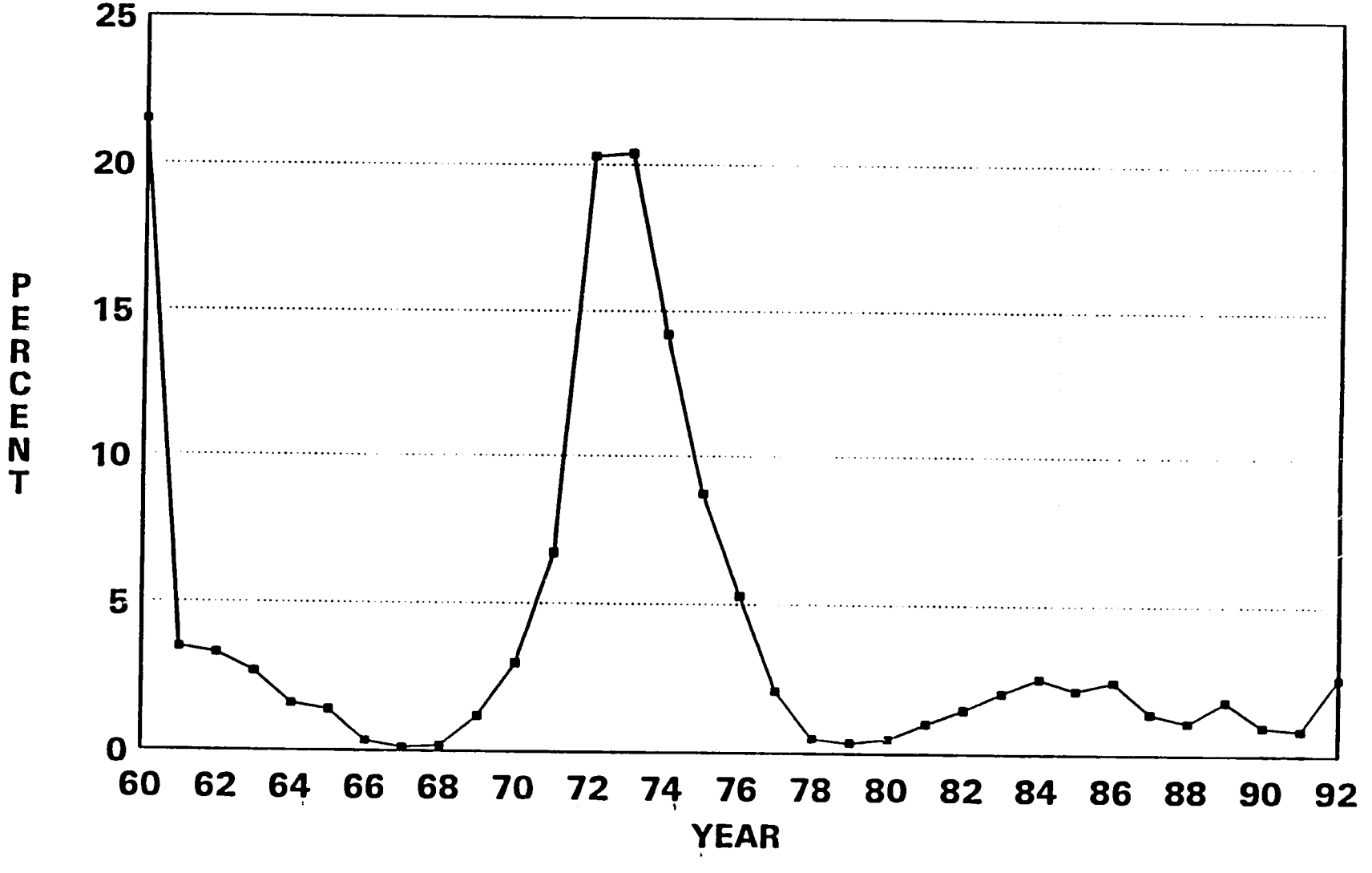
ACD is maintained with care. Schedules detail exactly which households (all carefully numbered through geographical reconnaissance by malaria personnel) in which community the malaria supervisor should visit on a given day. He is usually expected to accompany the EPI outreach person and send children due for vaccinations to his colleague as he identifies them while canvassing households for fever cases.

The malaria program is supervised by dozens of entomologists who function as part of the district health teams. They do occasional entomologic surveys. The National Institute for Malaria Research and Training is located in the Punjab and assists with special studies such as *in vivo* monitoring for chloroquine resistance. The province has an ambitious goal of training enough laboratory personnel to staff every RHC and BHU within the next few years.

Floods in 1992 prompted special concern for the possibility of malaria epidemics in certain districts. Insecticide and staff were diverted to those areas, and primaquine was added to the presumptive dose of chloroquine for suspected malaria to prevent further transmission. Provincial officials were pleased with their results and feel that they can rely on intensified case management as well as spraying. Entomologic studies demonstrated less *An. stephensi* than feared, suggesting that the immature stages had been partially washed away by the flood waters.

A visit to Manga Rural Health Centre provided an opportunity to observe a first line care physician and a laboratory examining blood smears for both ACD and PCD. The physician did not seem to be aware of the current treatment recommendations of the MCP. In fact, his list of essential drugs did not include either chloroquine or primaquine. They were found in the laboratory under the control of the microscopist who both diagnoses and treats malaria cases.

Figure 12. Slide Positivity Rate (%)
Punjab Province, 1960-1992



Malaria Control Programme, Lahore

Recommendations made during visit to Punjab Province

- Encourage PCD and phase out ACD, retaining expertise to mount special studies as required.

- Follow PCD rates for routine monitoring of malaria trends.

- Follow *P. vivax* and *P. falciparum* rates separately.

- Integrate with the HMIS data system as soon as it covers the areas now covered by the MCP.

- Train more junior MCP staff to use the MCP computer.

- Use spreadsheets rather than PAKMAL to collect malaria data.

Sindh Province

Because of security conditions that make it unwise for foreigners to travel in rural areas of Sindh Province, the visit to Sindh was limited to meeting with the Director General and malaria control program officials in Hyderabad. The current malaria program was described and the potential for greater coordination with general health services discussed. Current data collection and use was reviewed. Efforts to use the MCP computer were reviewed, and the EpiMap program installed and demonstrated. Suggestions for spreadsheet presentation of MCP data were made and later sent to Hyderabad for MCP use. Figures 7 through 11 illustrated suggested methods for handling existing data.

The practice of assigning malaria workers to health facilities to do passive case detections within those facilities has been encouraged in Sindh and is known as "activated passive case detection." Records are kept separately from those of ordinary PCD, but they are eventually combined into the complete PCD findings for the province.

Until 1991, Karachi was not considered to be part of the MCP, although the fringes of the city were variably included in spraying operations. Health care in the city was in the hands of municipal public health officials, hospitals, and private practitioners. In general, malaria cases were not reported to the MCP. It is curious that in 1967, the year of the great malaria epidemic in Karachi, official MCP figures show the

lowest API in the history of the program. Even now that Karachi is officially included, at least in the population denominator for Sindh, only four medical facilities in that city of five to seven million people report their case detection results.

The malaria program is housed in a building far from provincial health headquarters, and collaboration with other activities such as the HMIS is limited. The new provincial malaria chief is a clinician who had been a district health officer. He expressed interest in malaria case management and in greater cooperation with PHC services. A new building will bring them all together, and the director general has plans to combine MCP with other vertical programs for tuberculosis control, AIDS, diarrheal disease control, school health, vaccinations, blindness prevention, and perhaps others into a single communicable diseases program. For the moment, however, the MCP remains fairly independent.

The authors were introduced to the team of microscopists who routinely review all positive malaria slides and 10% of all negatives. The findings are recorded in a register which permits the assessment of the performance of individual microscopists. When numerous errors are noted, additional in-service training is arranged for the person in question. The same level of quality control did not extend to other malaria services.

The use of the MCP computer was described above. The epidemiologist, who is the only person who has been using it, appeared to be quite computer literate. He described how he gets technical computer advice from a friend at the airfield. He appeared to be totally dependent on USAID for computer supplies.

Recommendations made during visit to Sindh Province

- Collaborate with the HMIS when the two are moved to the new building.

- Provide greater access to the computer so other individuals can develop "computer literacy."

- Arrange for funding of routine computer support from the Sindh Health Directorate.

- Review the collection and use of Karachi data.

- Continue to strengthen passive case detection in health facilities throughout the province, moving from the "activated PCD" system to one where health facility staff take over the responsibility themselves or appropriate staff are assigned to do so.

- Disaggregate malaria data by parasite species and follow PCD for routine monitoring.

Balochistan Province

Balochistan was the last of the provinces to be included in the original malaria program, and it has lagged behind somewhat in establishing malaria services. The authors were told that it has only two entomologists at present. Until two or three years ago, it had only two laboratories for processing malaria slides. That has now expanded to some 18 health units, but there are still districts without malaria microscopy. The information system has been set up to record data for the sub-sector level, but there does not appear to be a use for malaria data at that level at present. The vast expanses and scattered population of Balochistan pose additional problems as do areas where traditional *Sardars* resist the introduction of modern health services. Malaria workers may be prevented from entering households for spraying or from even speaking with women.

The influx of Afghan refugees, concentrated around Quetta and some five other districts, and the malaria which they are thought to import from Afghanistan have required a good deal of MCP assistance. The MCP runs a laboratory on the ground floor of the Health Directorate building where hundreds of persons, nearly all Afghans according to the staff, present for malaria detection and treatment daily. Their slides are read within about 45 minutes, and treatment is given as appropriate. Because they are considered to be refugees, data from this operation are reported separately from the regular PCD figures, even if the Afghans have lived in Pakistan for years. Likewise, the excellent laboratory reports from the UNHCR health services across town are received by the MCP but not included. Annex G shows the reporting format used by UNHCR.

In fact, reporting irregularities are so common as to render the aggregated Balochistan data impossible to interpret. First, there is the exclusion of the large majority of malaria reports because they are considered refugees. Secondly, there are areas that send in no reports, and the MCP lacks sturdy vehicles to make visits to such areas. Third, areas without their own laboratory services are known to be under-represented in the data. Fourth, data are not collected from the numerous hospitals and clinics—there are more than a dozen in Quetta alone—that provide malaria services in addition to the MCP. The malaria data beginning to come in from the HMIS system do not find their way to the MCP. Finally, a local clinician described cases of cerebral malaria mortality seen in local hospitals, but the system has no mechanism for reporting such events when they occur.

The various reports from Balochistan show important foci of falciparum malaria. The Pakistan MCP goal of maintaining falciparum at less than 10% of the malaria total may not be realistic for Balochistan. Again, disaggregation by species would be helpful.

The MCP offices are now located in the new health directorate building, offering possibilities for greater collaboration. For the moment, however, it functions quite separately. And the persons in charge of spraying for vector control seemed to have little connection with the epidemiologic monitoring that the authors reviewed. The computer in the office of the epidemiologist was in operating order, but minimal computer literacy of staff meant that it has been little used. An attempt to move it to the directorate's computer cell had been resisted by the MCP and USAID, it was reported. Nevertheless, it is there that assistance in developing competence and confidence is available, and the HMIS staff are more than willing to help. They are particularly interested in the possibility of using the new EpiMap program.

The team spent considerable time assisting the MCP, with help from the HMIS team, to develop spreadsheets to process MCP data. Figures 13 and 14 use available data from Balochistan Province.

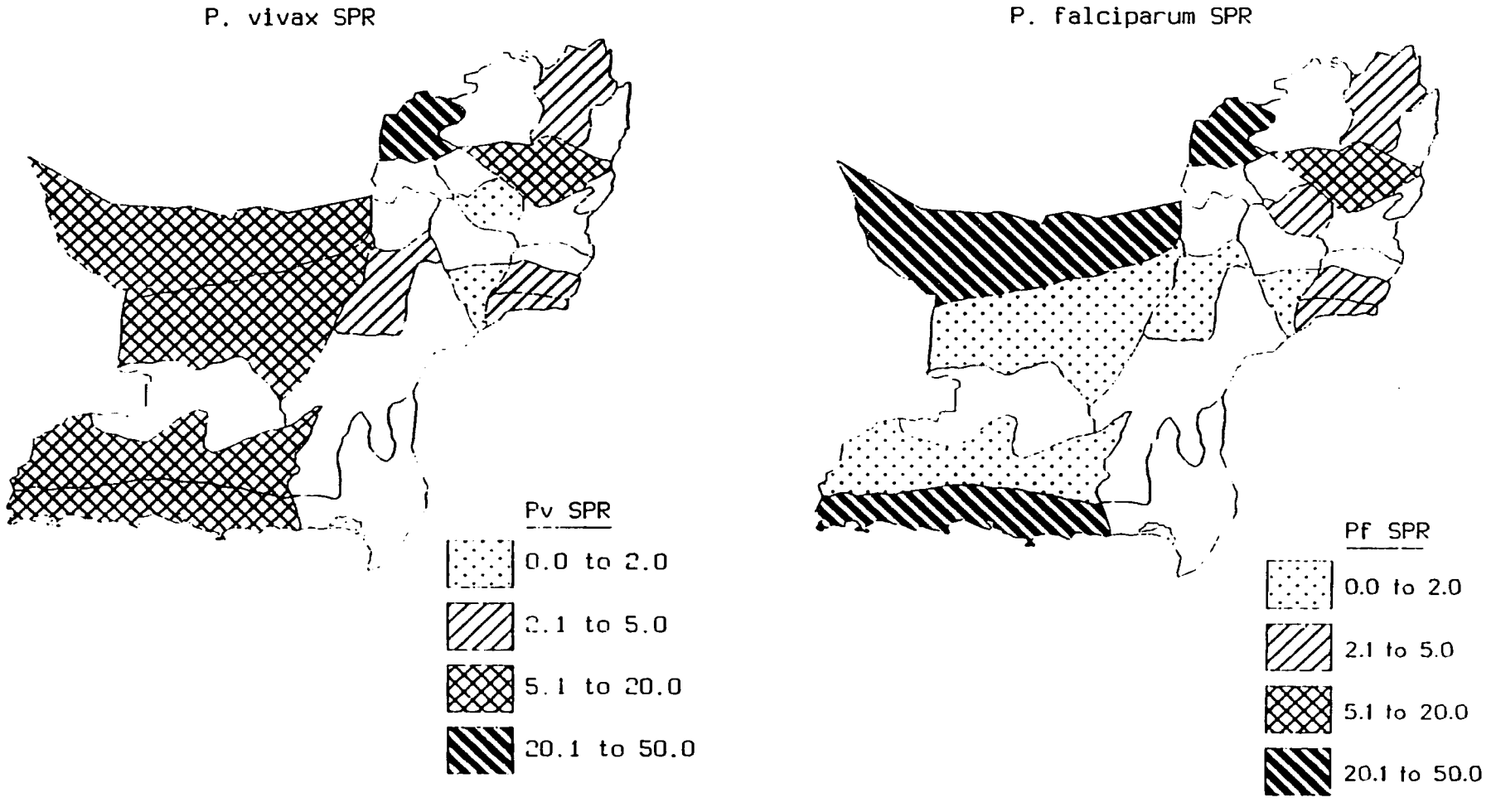
Recommendations made during visit to Balochistan Province

- Work toward coordination of MCP data system with HMIS.

- Move MCP computer to computer cell.

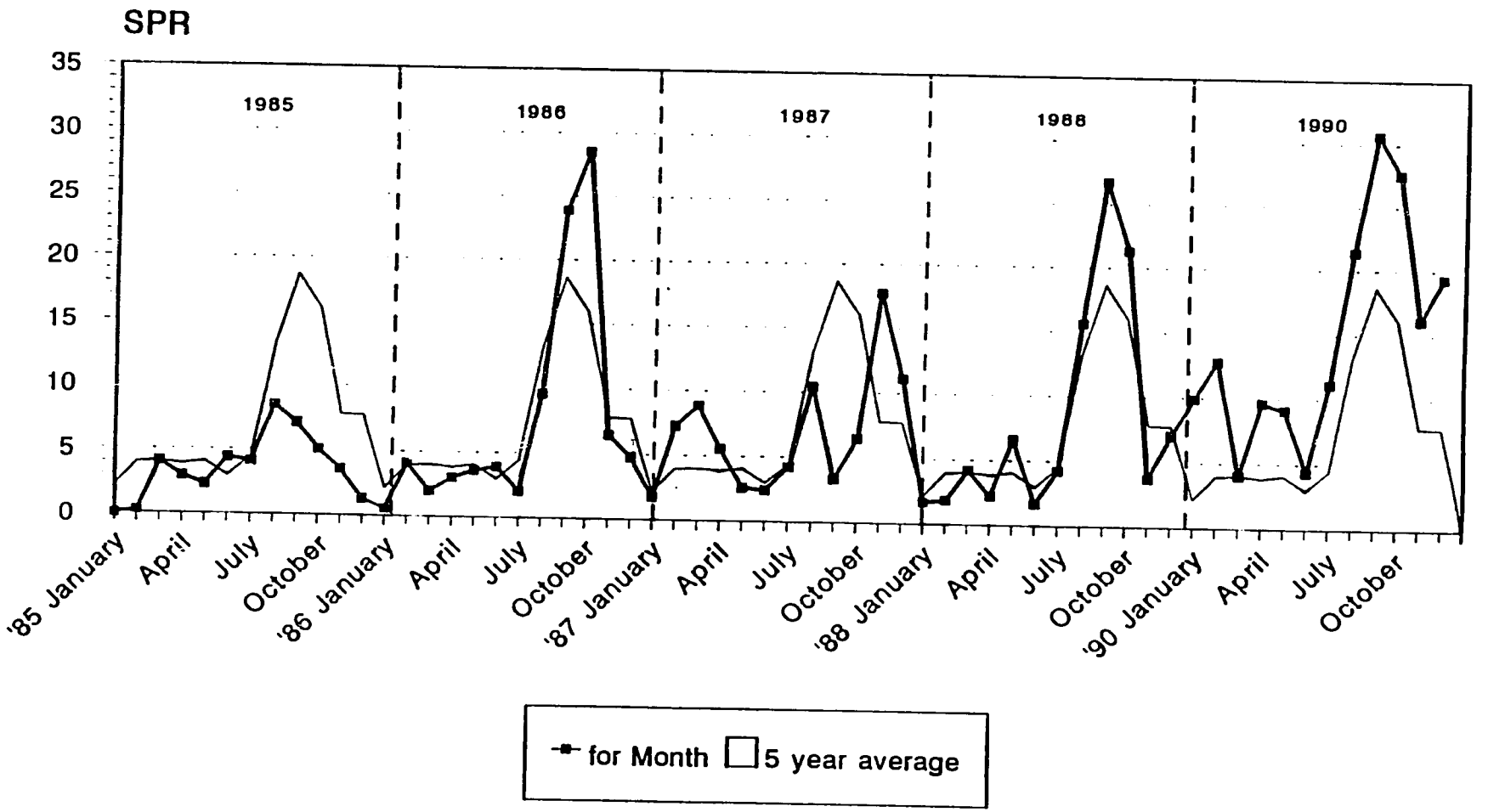
Figure 13

SPR
Balochistan: 1992



(Passive Case Detection)

Figure 14. Slide Positivity Rate
Monthly and 5 Year Averages
Balochistan, 1985 - 1990



Passive Case Detection System (data for 1989 not available)
source of information:
Malaria Control Programme, Balochistan

- Computer cell staff should develop computer skills of MCP staff.

- Provide support from the Directorate of Health for computers (paper, floppy disks, ink cartridges, etc.).

- Develop own reports and analyses as needed for particular locations.

- Separate data from special Quetta city programs such as MCP's walk-in malaria clinic from the rest of the Balochistan data.

- Prepare to field mobile teams to respond to possible malaria epidemics in particular rural areas.

- Find ways to use data from other sources such as the UNHCR.

North West Frontier Province

The visit to NWFP extended through a weekend. Senior MCP staff gave up their Friday off to meet with the authors to discuss their program and information system. Because it was not a working day, it was not possible to meet with the Director General or other government health officials in Peshawar. The authors did meet with the health coordinators of the UNHCR office, however. On Saturday a visit to a representative district level program in Kohat and a visit to a BHU at Togh Bala were made.

The Malaria Surveillance System of NWFP has an experienced and dedicated cadre of long-time malaria workers who supervise some 659 local malaria supervisors. Before 1970, district level supervision was provided by malaria control officers who could control their programs, hiring and firing as needed. Since then the DHO has that responsibility and everything depends on his interest. The general sense is that quality has suffered.

PCD is carried out almost exclusively by malaria workers, through an "activated" strategy by which malaria supervisors work four days a week in RHCs and BHUs and two days doing ACD. Decentralized services are available in 21 districts, ten of which have all-purpose laboratories. In the others, malaria supervisors provide APCD, as well as in five to seven health facilities per district. The seven "agencies" (federally-

administered tribal areas whose health services are supervised by agency surgeons) have no sanctioned posts for microscopists or services other than those provided by malaria supervisors. There are no services in Kohistan.

On the subject of integration with general health services, malaria control officials observed that "Integration is not real." They were unaware of the HMIS effort and its malaria section. Visiting a district health officer, it was apparent that his primary interest at this point is the EPI. If the posters and charts on the walls of DHO offices in NWFP and elsewhere are indicative, malaria is not a DHO concern. The offices visited by the authors always had posters and graphics relating to EPI, sometimes oral rehydration, perhaps an AIDS poster, but rarely anything concerning malaria.

At the district level malaria is separated from general health services, both physically and functionally. DHOs may have CDC officers assigned to them, individuals who could serve as a link with the malaria services, but the functions of the CDC officers were not clear. There is some resentment on the part of MCP officials of the assistance MCP has given EPI with EPI receiving all the credit—another sign of the lack of integration. Still, the only two services that operate at the periphery of the system and actually carry out field supervision are MCP and EPI. There are natural links between the two.

A voluntary collaborator program was started in the past. It failed when the volunteers were not paid as the EPI village workers were.

ACD is difficult to implement and what exists is unrepresentative. It includes blood from almost only males since approaching women at home is not permitted. Kohat District energizes its ACD when additional slides are needed to reach the 1% ABER target. Schools are a good source for slides, but the positivity rate is low. Malaria control personnel consider PCD more useful, but think it is important to continue to use ACD in unserved areas.

Ten percent of all negative slides and all positives are rechecked if the DHO sends them in. Quality of microscopy was described as generally good.

Geographic reconnaissance is updated yearly, but usually only by estimating populations not through actual counts. Data from some 20 urban areas and all refugee and other health services are not counted in the numerator for API, and the urban and refugee populations are not included in the denominator. Together this makes API unrepresentative and impossible to interpret. Malaria authorities like the fact that API reflects the whole population, however, in a way that SPR by itself cannot, so they are reluctant to abandon it. For spraying purposes, they use absolute numbers of cases—the usual criteria of one falciparum case or five vivax cases justifying spraying. Their plans are frequently altered at higher levels, however, for reasons that are not clear. Dr. Rifaq points out that control at higher levels avoids local political pressures to spray. The teams sometimes spray on their own responsibility nevertheless.

Malaria control officials estimate that their surveillance system captures only about 10% of all cases. The rest self-treat or seek help from private practitioners. (Refugee health services were not mentioned here.) Of all fever cases that present to government health services, malaria slides are taken 46% of the time. For Afghan refugee health services, it is 100%. The considerable data from UNHCR services are not collected. In fact they are sent to Médecins sans Frontières for reasons that are not clear.

The Malaria Surveillance System has maintained well-organized records in a consistent fashion for many years. Figures 15 and 16 were prepared from data from that system. Two MCP personnel have attempted valiantly to use the PAKMAL program on their computer with little success. They do not appear to have tried the other programs and have limited "computer literacy."

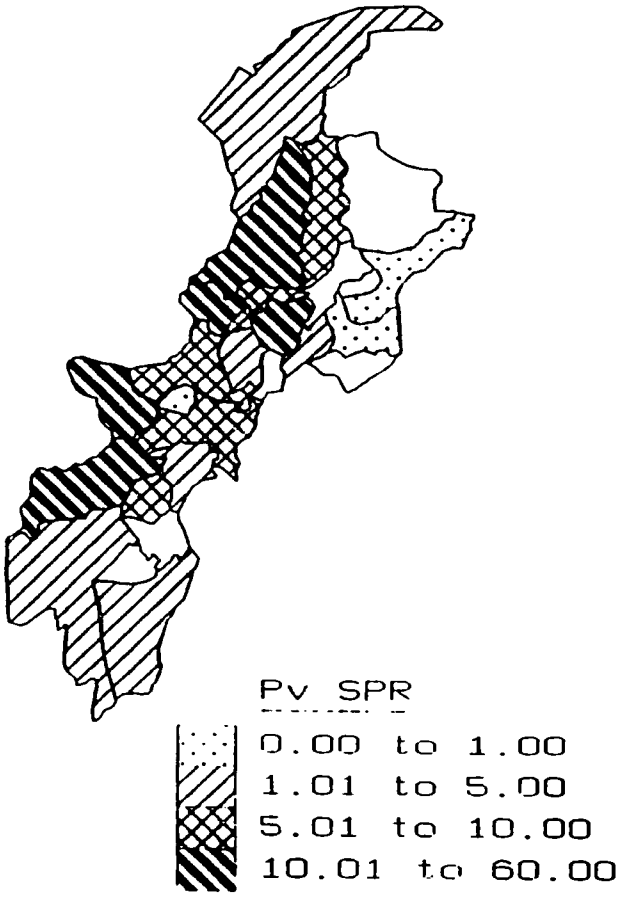
In addition to that of the computer, a number of other problems were cited. To make field trips, MCP staff must often advance personal funds for fuel, reimbursable after a matter of months. Among resource shortages mentioned were Giemsa stain (obtained from MSF) and primaquine (obtained eventually from the MCP). There have been no new sterile lancets for years. They therefore wipe them off with cotton

Figure 15

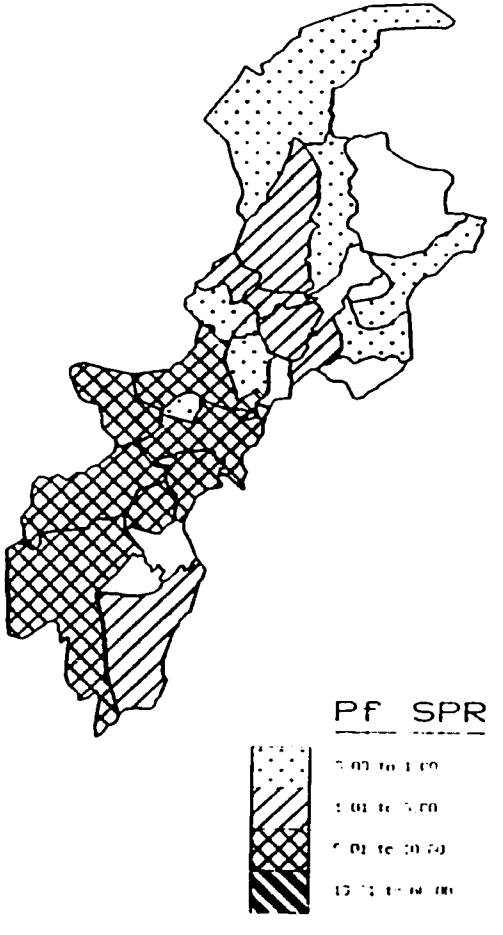
SPR

NWFP Districts and Agencies: 1992

P. vivax SPR

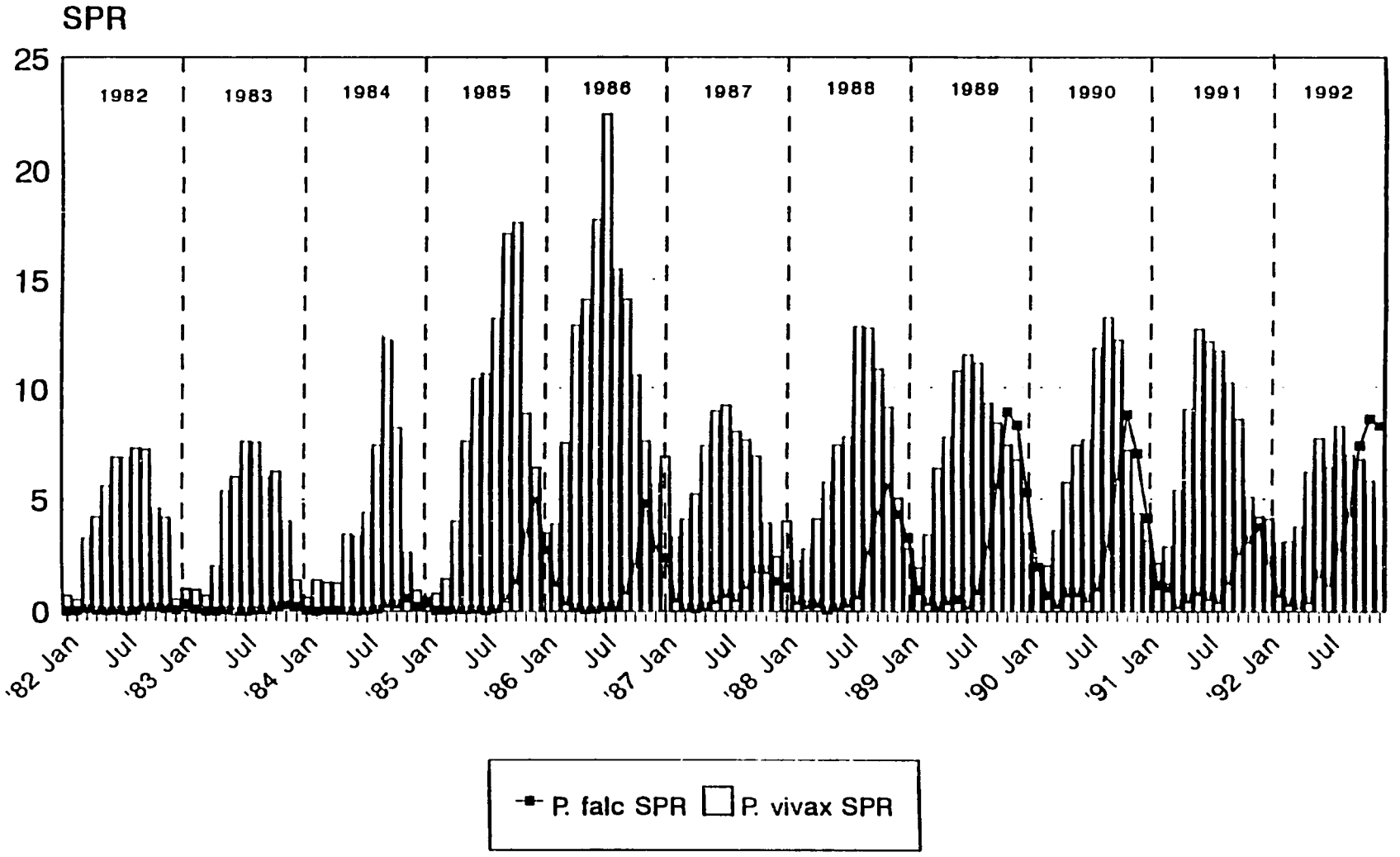


P. falciparum SPR



(Passive Case Detection)

Figure 16. P. falciparum and P. vivax SPR
NWFP Districts: 1982 - 1992
Passive Case Detection System



source of information
Malaria Control Program, NWFP

to be reused. More recently, excess 26 GA. needles were obtained from EPI to prick the skin. They too have been reused with only wiping, but the entomologist in charge worries because it is not possible to wipe the blood from the lumen of the needle. MCP staff do not follow a procedure for sterilization. Now EPI has no more excess needles available. Microscopes are also proving problematic. The microscopes provided by USAID are failing electrically and cannot be adapted for use with other light sources. The monocular Olympus microscopes in use for some 30 years continue to function well. Staff prefer them.

UNHCR health services claim to serve a population of 1,629,700 through some 68 health facilities and 15 sub-stations. They have 43 laboratories and do malaria smears, following procedures outlined in their own workers manual, on all fever cases. They do more than 400,000 PCD slides yearly. Results are aggregated monthly by location, parasite species, age, and sex. They use the MCP recommendations for treatment and spray with malathion and ICON obtained through their own sources. They calculate API and SPR for falciparum and vivax separately. They have already ordered insecticide for next year. Their deputy director for malaria control is seconded part time from the Malaria Surveillance System in Peshawar. No other clear integration with general health services was noted.

MSF is reportedly carrying out malaria-related research in the area, but the authors were unable to meet the director. Among other studies is a pilot insecticide-treated bednet program.

At Kohat District, some 200 Hudson Sprayers were observed neatly arranged in the storeroom. Problems mentioned at that level were a lack of Fansidar for resistant falciparum cases and inadequate funds this year to pay the field spraymen. A number of supervisors paid the spraymen from their own pockets to avoid leaving unused stocks of insecticide in rural communities. They have not yet been fully reimbursed.

The authors were told of a focal epidemic of falciparum malaria noted in August of this year in Marai Bala and Marai Payan, two communities that have not cooperated with spraying in the past. PCD there had reported one slide positive, and ACD had taken 25 slides, three of them positive. The report of an epidemic came through the DHO. The malaria team responded by taking two microscopists and drugs to investigate. 1018 slides produced 166 positives, 130 of them falciparum.

The entomologist found predominantly *An. stephensi*. Facilities for continued case detection and prompt treatment were set up and are still in place. Five of the falciparum cases were retreated because they recurred within a week of three-day treatment. No Fansidar is available. Provincial authorities had not yet been notified. District malaria officials were quite confident they have the situation under control. They appear to have done very well.

The medical officer was visited at the BHU of Togh Bala, but the malaria supervisor only works two days a week (two days as well in another BHU) and his door and records were locked. The doctor indicated that on other days he diagnoses cases clinically. He has no slides to take smears. His clinically diagnosed malaria cases are recorded as "PUO" and do not enter the malaria system. He has treated generally with injectable chloroquine b.i.d. X 2 days, and he reported good results. He appeared to be unaware of the MCP treatment recommendations and did not seem to know that his treatment protocol would generally be considered dangerous and inappropriate. Dr. Rifaq presented him with one of the laminated malaria treatment cards that USAID printed for the program. The doctor reported seeing two cases of cerebral malaria in the last six months.

Recommendations made during the visit to North West Frontier Province

- URGENT ACTION REQUIRED: Insist that all lancets used for the preparation of blood slides are sterile. Inform all malaria and health workers of the danger of hepatitis and HIV transmission. Monitor compliance with sterile practice. Providing new sterile lancets is not enough: the old practices may resume when supplies run out, and the MCP has no system for monitoring stocks of supplies or drugs.

- Abandon ACD. PCD provides sufficiently accurate information for routine monitoring. Special studies can be carried out if needed.

- Abandon any requirement to achieve a 1% ABER as that is meaningless for the current program.

- For computer data management, use a Lotus spreadsheet rather than PAKMAL.

- Coordinate with complementary data sets such as those from UNHCR, urban activities, and the HMIS as it becomes established. These can facilitate integration of services which is essential to assure proper clinical care and appropriate support for malaria control within the DHO structure and the general health services.

- Follow the MSF insecticide treated net project results for indications of whether the MCP should promote nets in certain locations.

- Educate all clinical personnel on recommended treatment protocols and monitor compliance. Include chloroquine and primaquine in the general medical services supply chain. Discourage the use of non-standard treatment unless justified.

- Document severe and complicated cases, treatment failures, and any deaths due to malaria.

- Disaggregate *P. vivax* and *P. falciparum* rates, perhaps as UNHCR does.

- Dissect *An. stephensi* mosquitoes from Marai Bala and Marai Payan.

- Monitor levels of drugs, blood-drawing materials, and laboratory supplies on a regular basis. (This is in the HMIS system.)

- Collect and analyze "PUO" data. Plan to merge eventually with the HMIS for malaria PCD.

5. General Recommendations

The authors made a number of recommendations to health officials, particularly those responsible directly for malaria control, in the four provinces visited, as well as at the DOMC. These recommendations were included in the section above on findings in each province.

The following recommendations, with some explanatory justification for each, are the major recommendations that concern the malaria information system as a whole. Again they are divided into those relating to the information system *per se* and those relating to the computer automation of that information.

Malaria-Related Information

Using available MCP information

The rationale for the major current indicators was reviewed and modifications to these indicators are proposed. The following recommendations can be carried out without adding to the current burden of MCP information collection.

- ***Use PCD data alone for routine malaria surveillance.*** ACD data is of uncertain quality, as noted above, and does not contribute to the sensitivity of the trend data. In fact, from the perspective of information systems and considering the effort it involves, ACD can be discontinued in Pakistan. Data from special studies should be used only to measure the effects for which they are designed.

- ***Abandon ABER as unnecessary for malaria control.*** This relict of the malaria eradication days is not needed for modern malaria control strategies.

- ***Use parasite specific SPR to follow malaria trends.*** Discontinue API reporting where numerator and denominator data are uncertain. Disaggregate *P. falciparum* and *P. vivax* data and report their rates separately. This is more meaningful than the proportion of the total due to one parasite or the other. Figures 15 and 16 showed that they do not necessarily have the same distribution in place or in

time. Noting in each case the population concerned, parasite specific SPR can also demonstrate seasonal fluctuations in infections caused by specific parasites. Figure 17 illustrates how SPR data can be used with EpiMap to indicate areas of varying intensity of malaria.

- ***Monitor malaria by month as well as species.*** Figure 16 demonstrated the seasonality of malaria by malaria species in NWFP. The differences in pattern between *P. vivax* and *P. falciparum* can have implications for the timing of insecticide spraying in particular.

- ***Disaggregate malaria data by local area.*** Figure 5 demonstrated the importance of disaggregating by province. The epidemic on the national malaria curve in 1972-73 was clearly due to an epidemic in the Punjab alone. On the other hand, the 1989 peak in Sindh is hardly noticeable in the national statistics. The same disaggregation is even more useful for local districts and localities. Several of the figures presented have demonstrated how that can be done for the individual provinces.

- ***Combine local epidemiologic information with records of vector control activities to demonstrate their impact.*** Federal officials attribute the fact that the API remains low to effective use of insecticide in highly focal spray operations, but local spray and outcome data are not analyzed to confirm this. Mid-term and long-term planning and resource acquisition would be improved by better knowledge of disease patterns and insecticide efficacy.

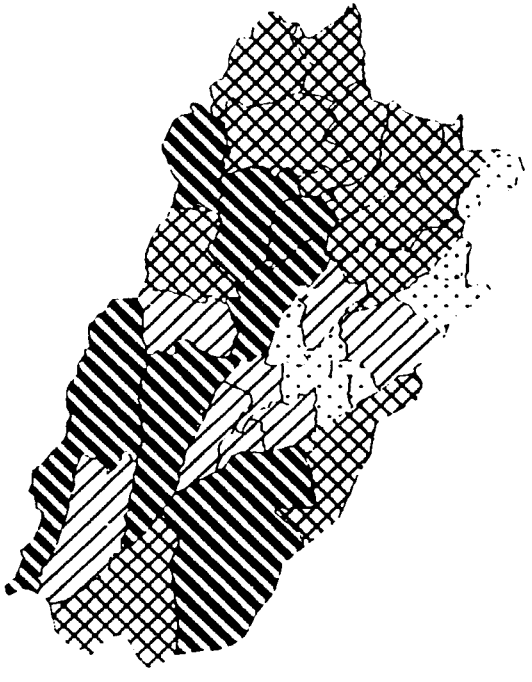
Expanding the information system

- ***Document the contribution of malaria to the burden of ill health in Pakistan.*** In order to obtain government funding—and perhaps external donor funding—the MCP must demonstrate that malaria control should have high priority. Unfortunately, the information currently collected and reported by the MCP does not compare malaria risks with other health risks. Treatment outcome is not

Figure 17

PASSIVE CASE DETECTION

PUNJAB, 1992



Parasite Incidence

- 0.000 to 0.050
- 0.051 to 0.125
- 0.126 to 0.500
- 0.501 to 1.500

Slide Positivity Rate

- 0.00 to 2.00
- 2.01 to 5.00
- 5.01 to 10.00
- 10.01 to 28.00

followed: mortality is not reported in the MCP system; morbidity is limited to a count of cases detected through the government health care system and confirmed positive by laboratory examination of blood smears. Therefore, despite the millions of slides examined yearly for malaria (2.7 million for 1992), neither the incidence not the prevalence of malaria among the population at large can be estimated.

- ***Develop service quality indicators.*** Care is taken in training and supervising spraymen, and microscopists' readings are checked as a quality control measure. Other service quality indicators are lacking. This includes morbidity, mortality, treatment failure, and availability of supplies and services. Signs of expanding resistance to antimalarial drugs should be watched for. Outcome of current program activities will eventually be subject to monitoring through the HMIS when that system covers the country.

- ***Monitor presumptive malaria when blood smears are not taken.*** Malaria diagnosed clinically without laboratory confirmation is defined as pyrexia (fever) of unknown origin (PUO) and excluded from the MCP statistics. Most cases of malaria currently treated in Pakistan are dealt with through self-treatment, however, or are cared for by a variety of health practitioners aside from MCP personnel. Monitoring their practices, and the success with which they deal effectively with presumed malaria, will help to guide policy and to permit the malaria services to promote appropriate malaria control activities by other structures. The diagnosis, treatment, and outcomes of PUOs should be followed as routinely as slide confirmed cases. Special studies and sample surveys can be particularly useful in providing such information.

- ***Monitor vector resistance to insecticides systematically.*** Vector resistance to insecticides is followed intermittently and separately from the rest of the MCP data. A program as heavily dependent on vector control as the Pakistan program has been should make greater efforts to integrate information from its entomologic studies with both epidemiologic data and records of spray operations. Since large quantities of insecticides are used for agricultural

activities as well, monitoring of activities and resistance trends in that sector should also be followed. Finally, the question of the role of *An. stephensi* in the transmission of malaria deserves a properly researched answer.

- ***Assess the quality of malaria-related information.*** Although anecdotal reports from both within and outside the MCP question the reliability of MCP data, the quality of these data is difficult to assess. The data flow towards the center, and there is little supervisory feedback on reports. In such situations, data quality often suffers, since data collectors on the periphery believe little value is placed on this aspect of their work. While some provincial supervisors say they provide feedback on data received, there is no formal feedback mechanism and no procedure to verify data quality.

- ***Develop the management information aspects of the system.*** Time permitted only a swift glance at manpower, training, and logistics information systems. There is no systematic assessment of in-service training needs of MCP staff. Education of care providers in malaria diagnosis and treatment is incomplete and unassessed. The drug and insecticide distribution systems move supplies along as they are available. There is no inventory monitoring to guide stock acquisition and to detect stock outages. The MCP information system had no way to sound an alarm when sterile lancets were absent for the past few years.

Computer Automation of the Information System

- ***Collaborate actively with the HMIS system.*** Where MCP and HMIS system personnel are located in the same facility, collaboration between the two should be maximized. Placing the MCP computer in the air conditioned computer cell of the HMIS will both protect the equipment from dust and provide assistance in developing greater facility with the computer. It may also provide greater access to the machinery so that more than one person within the MCP develops computer expertise in each province. And it will effectively promote greater collaboration between the two units.

- ***Provide additional people with access to the computers.*** Several of the MCP computers were found to be located in the offices of the epidemiologists, effectively limiting access to junior staff members. Moving the computers from the epidemiologists' small offices to more common premises could permit others to exercise and develop their computer skills. The HMIS computer cell is a reasonable choice where that is located near the MCP offices. Elsewhere, another central location should be identified, perhaps near the secretariat of the provincial malaria control director, so that he can appreciate and facilitate its use.

- ***Provide budgetary support from within the MCP.*** Several of the provincial programs reported delays and periods during which the computer system could not be used for lack of minor repairs or supplies such as ink cartridges or even paper. USAID had continued to provide this support until the time of the authors' visit. The MCP should build computer support into its budget, especially now that USAID support is not available.

- ***DOMC should take the leadership role in computerization.*** The DOMC's chief epidemiologist has been trained three times and is certainly capable of using the technology constructively. He should assume a leadership role in encouraging the use of computers. The malaria advisor position no longer exists. The responsibility for encouraging computer use rests now with the MCP.

- ***Use local sources of software expertise.*** The HMIS is an obvious source of continued support as noted above. The HMIS data processing staff at provincial and federal levels have been trained in Lotus 123 and have been introduced to EpiMap. They can provide excellent first-line support. In addition, several sources of support for using spreadsheets and EpiMap software were identified.[1] To encourage development of spreadsheet skills, additional training would be very useful. This might take the form of a week-long workshop on developing spreadsheets for MCP application and include participants from all provinces. Follow-up four to six

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[1] One local trainer with experience in EpiInfo and spreadsheets was identified: Naseem A. Bhatti, Director, Computer Training Centre, UGC Campus, H-9, Islamabad (office phone: 851979). It was not possible to contact her. An expatriate with experience in training medical personnel in using computers is Kate Dickin. She will leave Pakistan in March, 1994.

weeks later would include the trainer visiting provincial offices to answer questions and help consolidate work done during the workshop.

6. Lessons Learned

The MCP's experience with its information system in recent years provides several lessons, both for the MCP and for those providing external assistance. As in sections II and III of this report, the lessons learned are divided into those relating to the information collected and used and its computer automation.

Information Collected and Its Use

- ***The information needs of an organization change over time, and the information system must change or become inadequate.*** In the Pakistan malaria program the transition from eradication to control was not reflected in changes in the information system. No thorough review of information needs was carried out. External malaria advisors do not appear to have been interested in the information system. The indicators and even the forms used by the program remained unchanged for many years. While providing for consistency over time, the indicators became less relevant and are now inadequate for program management.

- ***Monitoring of case management and quality of care requires different indicators from those needed for vector control and control of transmission.*** The MCP continues to use indicators appropriate for a malaria eradication program. It does not provide information to monitor important case management aspects such as treatment complications and failures, appropriateness of care, and cost-effectiveness of services. Nor does it monitor the use of personal protection measures or self-treatment of possible malaria. These questions are central to current malaria control strategies.

- ***Management information is required to facilitate decision-making.*** Surveillance and special study data are not enough. Information documenting current activities, inventories, and deficiencies is essential to solve problems effectively. Information concerning skill levels and interests of personnel is needed to plan staff training and retraining. Careful microscopy and spraying appear to have been emphasized in Pakistan, but other treatment and management aspects of the program have received little attention. This has resulted in inadequate information for program management.

- ***Special investigations can provide excellent information to supplement routine data.*** This was demonstrated in NWFP where the district malaria team investigated a local malaria outbreak and in the Punjab where a worrisome situation was clarified through a special survey. The Pakistan program demonstrates the utility of such expertise.

- ***An organization as extensive as the Pakistan MCP can provide invaluable information and field expertise to other services attempting to achieve wide coverage.*** This may account for the demands made upon the MCP by the EPI, for example. The other side of such a complementary relationship is that the MCP should benefit from the achievements of the other organization. The HMIS Pakistan represents such an opportunity that can be exploited to the advantage of both organizations.

- ***Indicators with many composite parts are subject to the combined weaknesses of the parts.*** The API as currently calculated in Pakistan is almost impossible to interpret because it is composed of information from at least three different collection systems and is interpreted to reflect a population that is not well defined. It also combines the findings regarding two different types of malaria. Disaggregating the component data sets is necessary to be able to interpret the results with confidence.

- ***Parallel information systems exist that can complement MCP information.*** There are other data sets that the MCP could be using to verify the consistency of its findings—and theirs. These include data from urban health systems, the findings of the new HMIS, and UNHCR reports of malaria in Afghans living in Pakistan.

Computer Automation of MCP Information

- ***Automation is not synonymous with an information system.*** Addressing the former without the latter, as seems to have occurred in the Pakistan MCP, where "information system support" included only equipment, software, and training, results in confused objectives and unmet expectations.

The introduction of computer technology in the MCP was called information systems, and the expectation, at least on the part of MCP staff, was that the computers would satisfy their information systems needs. The opportunity to reassess the MCP's information system was lost. Many of the gaps and weaknesses in the information used for malaria control could have been identified, and perhaps corrected, with information systems technical support.

- ***Development or revision of an information system begins with analysis of the information requirements to connect the structural units of an organization, followed by the outline of a system for meeting those requirements.*** The expectation is that good information will be available for making decisions, and the quality of the decisions and of the organization's products will improve. Computer technology may be introduced as a tool to enhance the productivity of workers in tasks they already perform. When that process was not fully respected in Pakistan, the result was inadequately trained personnel trying to use a software package that failed to meet local needs.

  A computer software program designed to process existing MCP data and indicators was included as part of the technical support. Although originally intended as a demonstration of what is possible, it came to be recognized by MCP personnel and its USAID advisors as the heart of a computerized system to replace the manual system. When the new system failed to meet expectations, MCP personnel simply stopped using the computers. Because the system's objectives were not clear, it failed to satisfy anyone.

- ***Institutional commitment is important to the adoption of a new system.*** The MCP did not actively encourage the use of the computers at either federal or provincial levels. USAID/Pakistan, while aware that the computers were not utilized as planned, seems to have expected that additional external technical assistance would solve the problem. The VBC Project, which had supplied the assistance through USAID, was not aggressive in suggesting follow up on its support, even though it provided a series of consultations to the Pakistan Mission.

The MCP appears to have had little input into the system's specifications, and some items important to the MCP were omitted. The reports produced were long and in an unfamiliar format. While the consultants installing the system recognized these problems, recommended changes to PAKMAL, and supplied spreadsheets to use in the interim, there was no prompt and sustained follow-up from either the USAID mission or VBC. Development of a special purpose computer system is a process that requires many iterations. The developer needs to review the system with the client frequently, both during development and after installation. Sufficient time and budget must be allocated for this process.

This situation is not uncommon. A donor, wishing to introduce a new technology into an organization that may not see its usefulness, contracts for technical assistance. Until and unless the organization itself is convinced of the technology's usefulness, it will not be used. Sustained effort by both donor and the technical assistance providers may be necessary before the technology is appreciated. Encouraging the use of the technology should be an explicit part of the technical assistance package.

- ***Institutional support should include a budget for computer maintenance and supplies.*** No continuing MCP budget has been allocated for computer maintenance and supplies. These resources are essential if the technology is to be used. Lack of supplies and no budget for local maintenance impaired use of the MCP computers repeatedly. A MCP or MOH budget for supplies and maintenance would also have engendered greater ownership of the computerization effort. A common estimate for annual maintenance is 10-15% of the price of the equipment. Diskettes, ink cartridges, and paper must also be purchased. An annual allocation of 8000-10000 Rupees for supplies for each computer plus printer would be reasonable in Pakistan.

- ***Developing computer skills requires practice in the workplace to experiment and learn.*** Two individuals per province were trained in two sessions, for a total of four representatives from each

province.[2] Both senior and more junior statistical clerks were trained. The senior people have had little opportunity, given their other responsibilities, to use computers. Junior staff, who might have more reason to use the machinery, were apparently not encouraged to use it. In some cases, the machine was placed in the office of a senior person and access was problematic for junior staff. Even after training, using the technology requires practice in the workplace to experiment and learn. This experimentation must be encouraged.

[2] Punjab had only two since it did not participate in the second session.

Bibliography

Ayalde, Jaime, Paul F. Basch, A.A. El Gaddal, G. Hashim, David Muir, Robert J. Tonn (1992). Pakistan Malaria Control II - 1982-1992: Final Evaluation of Malaria Control Project. VBC Report No. 82132.

Bruce-Chwatt, Leonard Jan (1985). Essential Malariology, Second ed. New York.

Chief Commissionerate, Afghan Refugees (1990). Guidelines, Malaria Control. UNHCR, Islamabad.

Directorate General of Health Services Punjab (1992). Punjab Health Bulletin, II:3. Lahore.

Directorate of Malaria Control, Malaria Control Program. Annual Reports 1967-1992 (unpublished). Islamabad.

Lacey, Lawrence A. and Barry A. Silverman (1989). Field Report: Assessment of Unmet Needs in the Pakistan Malaria Control Program. VBC Report No. AR-106-4.

Lewis, A. N. (1990). An Assessment of How Resistance to Malathion by *Anopheles stephensi* Affects the Incidence of Malaria in Pakistan, November 1-26, 1990. VBC Report No. 81228.

Lippeveld, Theo, Zamin Gul, Nancy Lamprecht (1991). Assessment Study on Health Information Systems in Pakistan. Pakistan Child Survival Project, National Basic Health Services Cell, Ministry of Health, Islamabad.

Pakistan Child Survival Project (1992). Consensus on the Design of Health Management Information System for First Level Care Facilities, January 20-21, 1992. Federal Basic Health Services Cell, Ministry of Health, Islamabad.

Pakistan Child Survival Project (1993). Health Management Information System for First Level Care Facilities: Instruction Manual for First Level Care Facility Staff. Government of Pakistan, Islamabad.

Scholtens, R., L. Cowper, N.G. Gratz, G. Hashim, W. van Dijk (1990). Report of an External Review of the Pakistan Malaria Control Program, March 4-26, 1990. VBC Report No. 81126.

Scholtens, R., D. Dame, N.G. Gratz, A.A. el Gaddal, D.A. Muir, G. Hashim (1991). Report of an External Review of the Pakistan Malaria Control Program, August 28 - September 17, 1991. VBC Report No. 82244.

Scholtens, Robert G. and Martin Wulfe (1992). Initial Steps toward Improvement and Computerization of Pakistan Malaria Surveillance Procedures, February 12 - March 21, 1992. VBC Report No. 82245.

Silverman, Barry A. (1989). Trip Report: Pakistan Malaria Information System, June 2-16, 1989. VBC Report AR-116-4.

Silverman, Barry A. (1990). Trip Report: Pakistan Malaria Information System, October 4-25, 1989. VBC Report AR-116-4A.

Smith, Edgar A., William J.O.M van Dijk, Ray Beach, Ch. A.A. Mujahid (1987). Report of the Terminal Evaluation of the Pakistan Malaria Control Project (391-0472), April 4 - May 3, 1987. VBC Report No. AR-053.

USAID/Islamabad, HPN Office (1991). Notes from Malaria Workshop, September 17, 1991. (Unpublished document).

World Health Organization (1992). Global Malaria Control Strategy. Geneva.

Annex A

STATEMENT OF WORK
PAKISTANT MALARIA CONTROL PROGRAM
(PROJECT NO. 391-0470 PDIF)

Task One: Upgrading the Computerized Malaria Database, Phase II

BACKGROUND: In response to a request from USAID/Islamabad and the Pakistan Directorate of Malaria Control (DOMC) in February 1989, the Vector Biology and Control Project assessed the feasibility and usefulness of computerizing the DOMC epidemiological and entomological databases. During a follow-up visit in June 1989, an initial review of the existing malaria information system was conducted and initial computer formats were prepared. In October of 1989, VBC trained DOMC staff in computer literacy, word processing, spreadsheets and databases. The design of the information system continued and an assessment of the feasibility of expanding a computerized information system in Punjab Province was conducted. In February-March 1992, two VBC consultants, an epidemiologist and a M/HIS specialist, trained provincial malaria staff in the use of computers and in the use of a sample database that VBC prepared for DOMC and installed computers in the provinces.

OBJECTIVE: The major objective of this activity is to follow-up on the VBC technical assistance activity that VBC consultants conducted in February - March 1992 and to implement a prototype provincial malaria information system

In order to accomplish the above mentioned objective, the contractor shall field a team consisting at a minimum of a Management Information Specialist, an Epidemiologist and a Programmer/Epidemiologist. This team will travel to Islamabad, Pakistan for five weeks beginning in January 1993.

STATEMENT OF WORK:

The contractor will perform the following activities:

1. Prepare:
   a. Upgraded digitized map of GOP administrative districts; and
   b. Modified data entry program to capture data from BHU catchment areas.
2. Review:
   a. Status of computerization of malaria data at the provincial level;
   b. Use and flow of computerized data by DOMC and provincial malaria control programs; and
   c. Suitability of computer format designed during February/March 1992 TA.

3. Assess feasibility of integrating provincial MCP data base into the Child Survival Program HIS.

4. Assess whether there has been a further reduction of ACD and increase of PCD within provincial programs.

5. Assess impact of computerization of MCP data base on data collection and the flow of information between the different levels of the program.

6. Implement prototype data base in provincial health and malaria Control.

Deliverables: Prepare a draft trip report to be submitted to R&D/H, Dennis Carroll and pertinent in-country personnel for review. A final report of the consultancy, providing executive summary, findings and recommendations. Identify cost effective ways of implementing recommendations. The final trip report shall be submitted to R&D/H, Dennis Carroll and USAID/Islamabad within 30 days of their departure from Pakistan.

Annex B

Itinerary

September 1993

1 Complete preparations, VBC Project, Arlington, Virginia.

3 Arrive Islamabad.

4-7 Islamabad: meet with USAID, DOMC; review computer use at DOMC.

8-12 Lahore: work with Punjab Province CDC malaria program; visit Lahore District Health Office and CDC; visit Manga Rural Health Centre.

12-13 Hyderabad: work with Sindh Province malaria program.

14-18 Quetta: work with Balochistan Province malaria program.

19-22 Islamabad: review findings, preferred data presentation, and tentative recommendations with DOMC, USAID; meet with Child Survival HMIS, UNICEF.

23-25 Peshawar: work with North West Frontier Province Malaria Surveillance System program;
Kohat: visit District malaria program and Health Office; Togh Bala: visit Basic Health Unit.

26-30 Islamabad: meet with DOMC to identify preferred formats for data presentation; meet with Child Survival Project HIS staff and DOMC to agree on compatible formats to facilitate future coordination and eventual merger; complete report; and debrief (September 27 with USAID HPN with DOMC).

Annex C

Persons Contacted

Islamabad

Ministry of Health

Directorate of Malaria Control

Mr. Chaudhary A. A. Mujahid, Director
Dr. G. Hashim, Epidemiologist
Dr. Jan Rosendahl, Malaria Advisor
Mr. Noor Alam, Statistical Officer
Mr. Aslam Khan, Health Education Officer
Clerical staff

Pakistan Child Survival Project

Dr. Theo Lippeveld, HIS Advisor
Dr. Nasim Hoque, HMIS Federal Coordinator
Mr. Shafat Sharif, Computer Specialist

NIMRT (Lahore)

Dr. Imtiaz Hussain Shah, Director

USAID/Pakistan

Dr. Lois Bradshaw, Chief, Health, Population, and Nutrition
Dr. Rifaq Ahmed Ismail, Project Officer, Malaria Control Project
Dr. Rushna Ravji, Project Officer, HPN

UNICEF

Dr. Jason Weisfeld, Sr. Project Officer, Health and Nutrition

Aga Khan Foundation

Dr. Pierre Claquin, Programme Officer, Health

Punjab Province

Department of Health, Government of the Punjab (Lahore)

Dr. Abdul Qadir Khan, Director General
Dr. Aslam Malik, Director, CDC
Dr. Afzal Malik, Assistant Director, Malaria Control
Dr. Jamil Tahir, Assistant Director, AIDS and TB
Mr. Mukhtar Ahmed Shah, Parasitologist, Malaria Control
Dr. Naeem-ud-Din Mian, Project Director, ADB Schemes, Punjab
Mr. Ahmed Amer Butt, Computer Specialist, Evaluation and Monitoring Cell

District Health Office, Lahore

Communicable Disease Control, Lahore District

Rural Health Centre, Manga Mandi Lahore

Dr. M. Iqbal Saleemi, Medical Officer

Sindh Province

Health Department, Sindh, (Hyderabad)

Dr. M. Sajan Memon, Director General of Health Services

Malaria Control Programme

Dr. Nabi Bakhsh Kazi, Director
Mr. Sumar Sadruddin, Epidemiologist

Balochistan Province

Health Department, Balochistan (Quetta)

Dr. Abdul Rehman Khan, Director General of Health Services

Malaria Control Programme

Dr. Abdul Majeed Kansi, Provincial Chief

Dr. Mahmood Paracha, Epidemiologist
Mr. Noorullah Khan, Health Education Officer
Mr. Abdul Jallil, Insect Collector
Mr. Bashir, Insect Collector
Mr. Shefullah, Assistant Malaria Supervisor

HMIS Monitoring and Evaluation Cell

Mr. Rahim, Chief

North West Frontier Province

Malaria Surveillance System, Peshawar

Mr. Fazle Raziq, Entomologist, Assistant Director, NWFP MCP
Mr. Shaudat Parvez, Assistant Entomologist
Dr. Sher Bahader, Asst. DMO, Khyber Agency
Mr. Ata Mohammed, Technician
Mr. Hashim Khan, Malaria Supervisor
Mr. Aziz Khan, Deputy Director Malaria Control, UNHCR

UNHCR Afghan Refugee Health Programme, Peshawar

Dr. Ahmed El Zein, Health Coordinator
Dr. Naveeda Bano, Programme Officer (Health)

District Health Office, Kohat

Dr. Kausar Alil Shah, District Health Officer

Malaria Surveillance System, Kohat District

Mr. Ahmed Saeed, Assistant Entomologist
Mr. Javed Akhtar, Assistant Malaria Superintendant
Mr. Mohammed Israf Khan, Senior Microscopist

Basic Health Unit, Togh Bala

Dr. Shah Jehan, Medical Officer

Annex D

Brief on Malaria Control Project

1. INTRODUCTION:

Historically Malaria has been the major public health problem of Pakistan and will continue to pose a potential threat to the health of millions of people for years to come because of our socio-economic conditions and suitable epidemiological situation prevailing throughout the country.

2. BACKGROUND OF THE PROJECT:

Pakistan joined the WHO sponsored malaria eradication campaign in 1960. Since none of the developing countries could achieve eradication because of socio-economic and epidemiological factors, it was decided to convert the eradication programme into control programme on WHO advice. The programme has been provincialized and its implementation has been handed over to Provincial Governments, while the Federal Government assumed the responsibility of policy, technical advice, coordination, evaluation, research, training and supply of insecticides/ equipments to the provinces.

3. CURRENT MALARIA CONTROL PROJECT (1987-88 TO 1992-93):

The current Malaria Control Project for the period from 1987-88 to 1992-93 is under implementation with estimated cost of Rs. 923.93 million with foreign exchange component of Rs. 787.81 million to be met under USAID grant assistance. WHO is also assisting the Project in the form of advisory services and laboratories supplies etc. etc.

3.1. Objective and Achievements:

The major objective of Project is to achieve low level of malaria (0.5 cases/1000 population) so that it does not become a major public health problem in the country. The current project strategy has been based

mainly to contain the incidence of malaria as well as to achieve the self-reliance by reducing the expenditure through gradually reduced use of insecticides and improved case detection at all health out-lets. The Project is successfully being executed and the major progress/achievements made in this respect are given as under:-

(i) The disease has been brought down from annual incidence of 13.00 cases (per thousand population) in 1973 to 0.854 cases/1000 population during 1992, however, there was a rise in malaria cases in flood affected districts in 1992. The over all malaria situation, however, remained under control and posing no major public health problem in the country. The country epidemiological data from 1973 to 1992 is attached as Annexure-A.

(ii) The use of insecticide has been reduced from 4000 M.Tons in 1985 to 1400 M.Tons in 1992 through highly selective spraying strictly in accordance with the epidemiological needs in order to reduce the expenditure on the project to make the country self-reliance.

(iii) Malaria diagnostic laboratories have been decentralized to establish the diagnostic centres at the Rural Health Centres (RHCs) and subsequently at Basic Health Units (BHUs) for quick examination and prompt treatment of the cases.

(iv) The contribution of slides collected through Passive Case Detection mechanism has improved from 12 % (1985) to 25 % (1992) by establishing the case detection mechanism at health out-lets (RHCs, BHUs, dispensaries and hospitals).

(v) In view of huge training requirements of health personnels in malaria microscopy, training centres were established at each Provincial Health Headquarters through creation of the master trainers.

(vi) The important task of providing basic and in-service training in Malariology to Malaria Control personnel and selected officers of the General Health Services was continued.

(vii) Effective system of safe use/handling of insecticides was established in the country, which resulted into almost no intoxication problem among the labour and public during spraying operation.

(viii) Evaluation of Malaria Control Project was carried out during 1991 and 1992 by a team consisting of the experts from WHO, USAID and Government of Pakistan, The major findings of the team are as under:-

- "The malaria transmission has been contained at an acceptable level while insecticidal usage was gradually reduced."

- "The current control strategy has been very successful. Using case detection to carefully focus insecticide spraying has reduced insecticidal usage and dependency."

4. FUTURE PROGRAMME/PLAN (1993-94 TO 1997-98):

4.1. Malaria Control Project is an active and successful component of the health services and will have to be continued for years to come to maintain the gains already achieved and to keep the malaria at low level. The malaria control must receive continued priority if resurgence is not to occur. The disease has a history of cyclic epidemic in the country which has been causing great economic and social damages.

4.2. As the current Project is going to end on 30th June, 1993, so a new extended Malaria Control Project for the period from 1993-94 to 1997-98 was prepared which was approved by CDWP (Central Development Working Party) for a total cost of Rs. 444.00 million with foreign exchange component of Rs. 394.00 million.

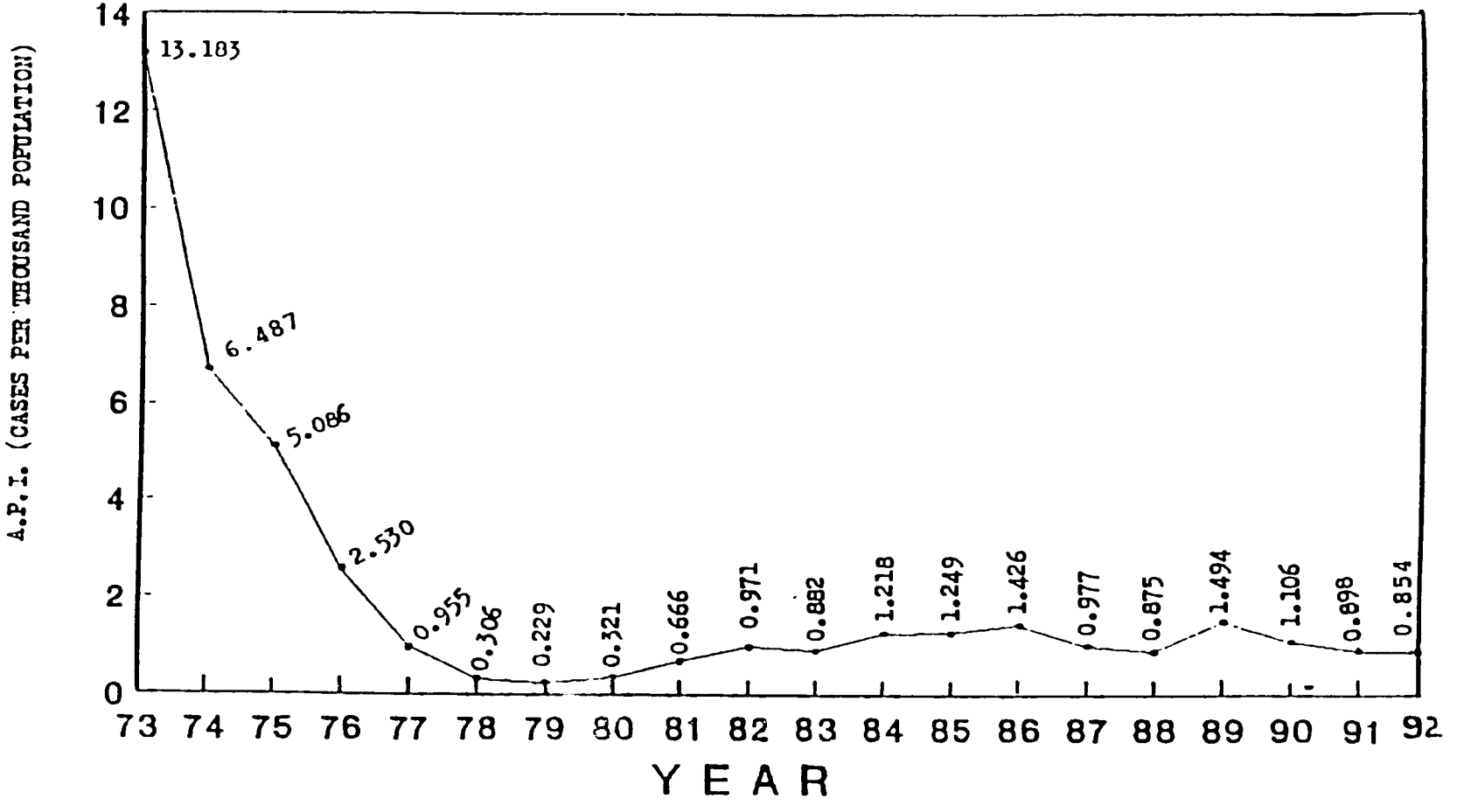
4.3. Selective indoor insecticidal spray on epidemiological grounds, case detection at health outlets and treatment of malaria cases will be continued to keep the malaria under control. Simultaneously other alternate methods for the control of malaria such as environmental management and biological will have to be promoted to achieve the sustainability in the programme. The programme now is providing the cover almost to the entire population from the ravages of malaria especially to the population living in rural areas who are always under great risk of disease transmission.

5. FINANCING PLAN INCLUDING FOREIGN AID:

The foreign exchange component of the current project was being financed under USAID grant assistance till 30th September 1992. As the USAID now has discontinued the financial support to the Project, so the alternate suitable foreign donors are actively being search out to fund the foreign exchange component of the new extended project (1993-94 to 1997-98) for the import of insecticides/equipments. EC, ODA, Government of Japan etc. etc. have been approached by Government of Pakistan and till date no donor has come forward to commit financial support to the Project.

In the light of the current malaria situation in the country, it has been estimated that there will annually be a minimum requirement of nearly $ 3.5 million for the import of insecticides to keep the disease under control. In case no foreign donor is available, the Foreign Exchange component of the Project will have to be met by Government of Pakistan from their own resources. The expenditure of the Project in local currency is, however, met by the Government from their own resources.

ANNUAL PARASITE INCIDENCE - PAKISTAN
1973 TO 1992



CONSOLIDATED EPIDEMIOLOGICAL DATA FOR THE YEAR 1992
(F I N A L)

PROVINCE	A. C. D.		P. C. D.		OTHERS(ECS,MBS FOLLOW UP		T O T A L		C L A S S I F I C A T I O N				SPR%	API%	POPULATION (Million)
	Slides	+ve.	Slides	+ve.	Slides	+ve.	Slides	+ve.	V	F	M	Mix			
PUNJAB	1245138	16797	202163	12319	139669	10531	1586970	39647	19050	20632	-	35	2.49	0.563	70.16
SINDH	297882	4971	249169	20304	46182	3457	593233	28732	8516	20267	-	51	4.84	1.464	19.62
N.W.F.P.	196550	5766	209883	21475	41404	1136	447837	28377	17422	10964	-	9	6.33	1.430	19.84
BALOCHISTAN	10058	242	8610	543	22289	1474	40957	2259	717	1561	-	19	5.52	0.354	6.38
TOTAL :	1749628	27776	669825	54641	249544	16598	2668997	99015	45705	53424	-	114	3.71	0.854	116.00

PROVINCE	PCD PERCENTAGE OF		FALCIPARUM RATIO (%)	VIVAX RATIO(%)	TOTAL +VE CASES
	SLIDES	+VE CASES			
PUNJAB	12.74	31.07	52.04	48.05	39647
SINDH	42.00	70.66	70.54	29.64	28732
N.W.F.P.	46.86	75.68	38.64	61.39	28377
BALOCHISTAN	21.02	24.04	69.10	31.74	2259
PAKISTAN	25.09	55.18	53.96	46.16	99015

N.B: Previously our Malaria Control Operations were limited to rural areas only now during five year extension plan, 1987-88 to 1992-93, major emphasis was also placed in our strategy for control of malaria in urban areas, with the result the programme has succeeded to establish a good case detection system. As the epidemiological data now is based on both rural and urban population so the entire population of the country has, therefore, been considered to be correct denominator instead of rural population only for the calculation of different malaria indices i.e. annual parasite incidence.

The malaria cases have been increased during 1992 in flood affected districts while the malaria situation almost remained the same as of 1991 in other areas. The rise in malaria cases in flood affected districts was because of (i) presence of most suitable ecological condition for transmission including the availability of ideal breeding sources for vector spp. (ii) Effective screening of flood affected population for malaria by raising special teams/Mobile Squads. This is a temporary rise in cases and the malaria situation will again be brought down. The over all malaria situation, however, remained under control and posed no major public health problem in the country.

ANNEXURE - A

YEARLY EPIDEMIOLOGICAL POSITION
1973 TO-DATE

Year	Slides collected	No.of Positive cases	SPR%	API%0
1973	4,252,184	599,177	14.09	13.183
1974	3,094,098	303,936	9.82	6.487
1975	3,205,689	238,315	7.43	4.934
1976	3,857,854	122,219	4.28	2.454
1977	2,667,315	47,571	1.78	0.928
1978	2,588,257	16,160	0.62	0.306
1979	2,682,351	12,304	0.46	0.228
1980	3,006,624	17,707	0.59	0.321
1981	3,018,468	37,923	1.26	0.666
1982	3,303,067	56,360	1.71	0.971
1983	2,587,920	51,596	1.99	0.883
1984	3,255,853	73,996	2.27	1.218
1985	3,119,695	77,607	2.49	1.249
1986	2,919,894	91,289	3.13	1.426
1987	2,961,881	64,271	2.16	0.975
1988	2,960,786	59,386	2.01	0.875
1989	3,098,759	104,447	3.37	1.493
1990	2,608,398	79,689	3.05	1.106
1991	2,712,586	66,586	2.45	0.897
1992*	2,668,997	99,015	3.71	0.854

SPR (Slides Positivity Rate) : $\frac{\text{Total +ve Cases} \times 100}{\text{Total Slides}}$

API (Annual Parasite Incidence) : $\frac{\text{Total +ve Cases} \times 1000}{\text{Population}}$

As the epidemiological data (malaria cases) now is based on both rural and urban population, so the entire population of the country has, therefore, been considered to be correct denominator for the calculation of malaria indices/API.

Annex D, Tables

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MALARIA BLOOD SMEARS: PAKISTAN 1961 - 1992

YEAR	PROVINCE	ACD SLIDES	+VE	PCD SLIDES	+VE	SPR	OTHER SLIDES	+VE	TOTAL SLIDES	+VE	CLASS Pv	Pf	MIX	Pf %	Pv %	PCD SLD	% OF +VE SLD	INDICATORS FROM TOTAL SLIDES SPR	Pf SPR	Pv SPR	ABER	API	POPULATION (MILLION)
1992	TOTAL	1749628	27776	669825	54641	8.16	249544	16598	2668997	99015	45705	53424	114	54	46	25	55	3.71	2.00	1.71	2.30	0.85	116.00
1992	PUNJAB	1245138	16797	202163	12319	6.09	139669	10531	1586970	39647	19050	20632	35	52	48	13	31	2.50	1.30	1.20	2.26	0.57	70.16
1992	SINDH	297882	4971	249169	20304	8.15	46182	3457	593233	28732	8516	20267	51	70	30	42	71	4.84	3.42	1.44	3.02	1.46	19.62
1992	NWFP	196550	5766	209883	21475	10.23	41404	1136	447837	28377	17422	10964	9	39	61	47	76	6.34	2.45	3.89	2.26	1.43	19.84
1992	BALOCHISTAN	10058	242	8610	543	6.31	22289	1474	40957	2259	717	1561	19	69	31	21	24	5.52	3.81	1.75	0.64	0.35	6.38
1991	TOTAL	1831738	18212	693827	43675	6.29	185021	4699	2710586	66586	39726	26928	68	40	60	26	66	2.46	0.99	1.47	2.41	0.59	112.60
1991	PUNJAB	1292345	7024	216318	5275	2.44	95201	1639	1603864	13938	9694	4247	3	30	70	13	38	0.87	0.26	0.60	2.36	0.20	68.10
1991	SINDH	313100	5441	242044	15172	6.27	30288	1499	585432	22112	6963	15183	34	69	31	41	69	3.78	2.59	1.19	3.07	1.16	19.04
1991	NWFP	206070	5222	224808	21574	9.60	36485	1044	467363	27840	22007	5853	20	21	79	48	77	5.96	1.25	4.71	2.42	1.44	19.28
1991	BALOCHISTAN	20223	525	10657	1654	15.52	23047	517	53927	2696	1062	1645	11	61	39	20	61	5.00	3.05	1.97	0.87	0.44	6.19
1990	TOTAL	1731913	19429	666124	48850	7.33	210361	11410	2608398	79689	36583	43175	69	54	46	26	61	3.06	1.66	1.40	3.62	1.11	72.03
1990	PUNJAB	1275789	7426	250371	6679	2.67	85590	1638	1611750	15743	10517	5233	7	33	67	16	42	0.98	0.32	0.65	3.70	0.36	43.56
1990	SINDH	232526	6777	191429	18817	9.83	32012	4362	455967	29956	6862	23130	36	77	23	42	63	6.57	5.07	1.50	3.74	2.46	12.18
1990	NWFP	197150	4394	212970	21201	9.95	38416	3525	448536	29120	18056	11081	17	38	62	47	73	6.49	2.47	4.03	3.64	2.36	12.33
1990	BALOCHISTAN	26448	832	11354	2153	18.96	54343	1885	92145	4870	1148	3731	9	76	24	12	44	5.29	4.05	1.25	2.33	1.23	3.96
1989	TOTAL	1960969	28600	691426	62404	9.03	446364	13443	3098759	104447	49437	55125	115	53	47	22	60	3.37	1.78	1.60	4.43	1.49	69.93
1989	PUNJAB	1404227	14499	273240	13385	4.90	200122	5700	1877589	33584	21388	12211	15	36	64	15	40	1.79	0.65	1.14	4.44	0.79	42.29
1989	SINDH	253156	8101	245925	30881	12.56	12690	5186	511771	44168	10123	34114	69	77	23	48	70	8.63	6.67	1.98	4.33	3.73	11.83
1989	NWFP	289586	5416	167436	17609	10.52	209741	1254	666763	24279	16524	7785	30	32	68	25	73	3.64	1.17	2.48	5.57	2.03	11.97
1989	BALOCHISTAN	14000	584	4825	529	10.96	23811	1303	42636	2416	1402	1015	1	42	58	11	22	5.67	2.38	3.29	1.11	0.63	3.84
1988	TOTAL	2188313	22524	528052	30422	5.76	244421	6440	2960786	59386	37407	22030	51	37	63	18	51	2.01	0.74	1.26	4.36	0.87	67.89
1988	PUNJAB	1568664	11326	209865	6548	3.12	122020	2855	1900549	20729	14854	5882	7	28	72	11	32	1.09	0.31	0.78	4.63	0.50	41.06
1988	SINDH	300538	4194	153459	8857	5.77	66410	2069	520407	15120	6794	8361	35	55	45	29	59	2.91	1.61	1.31	4.53	1.32	11.48
1988	NWFP	265773	5007	150066	13830	9.22	55991	1516	471830	20353	15150	5212	9	26	74	32	68	4.31	1.10	3.21	4.06	1.75	11.62
1988	BALOCHISTAN	53338	1997	14662	1187	8.10			68000	3184	609	2575		81	19	22	37	4.68	3.79	0.90	1.82	0.85	3.73
1987	TOTAL	2184867	28469	555711	28274	5.09	221303	7528	2961881	64271	41650	22821	200	35	65	19	44	2.17	0.77	1.41	4.50	0.98	65.76
1987	PUNJAB	1584395	15286	233200	9225	3.96	100460	2298	1918055	26809	19054	7770	15	29	71	12	34	1.40	0.41	0.99	4.68	0.65	41.01
1987	SINDH	317673	8704	148331	7049	4.75	52197	2054	518201	17807	8745	9195	133	51	49	29	40	3.44	1.77	1.69	4.91	1.69	10.56
1987	NWFP	260986	4035	160918	11626	7.22	66203	3148	488107	18809	13489	5365	45	28	72	33	62	3.85	1.10	2.76	4.39	1.69	11.12
1987	BALOCHISTAN	21813	444	13262	374	2.82	2443	28	37518	846	362	491	7	58	42	35	44	2.25	1.31	0.96	1.22	0.28	3.06

MALARIA BLOOD SMEARS: PAKISTAN 1961 - 1992

YEAR	PROVINCE	ACD SLIDES	+VE	PCD SLIDES	+VE	SPR	OTHER SLIDES	+VE	TOTAL SLIDES	+VE	CLASS Pv	Pf	MIX	Pf %	Pv %	PCD % OF +VE SLD	SLD	INDICATORS FROM TOTAL SLIDES SPR	Pf SPR	Pv SPR	ABER	API	POPULATION (MILLION)
1986	TOTAL	2109845	40912	478942	38833	8.11	331107	11544	2919894	91289	61685	29884	280	33	67	16	43	3.13	1.02	2.11	4.56	1.43	64.00
1986	PUNJAB	1485370	27116	208349	13296	6.38	196642	6694	1890361	47106	32053	15098	55	32	68	11	28	2.49	0.80	1.70	4.62	1.15	40.94
1986	SINDH	289025	7237	118068	7050	5.97	66970	2802	474063	17089	6775	10444	130	61	39	25	41	3.60	2.20	1.43	4.62	1.67	10.26
1986	NWFP	313705	6366	139305	17832	12.80	63230	2036	516240	26234	22400	3918	84	15	85	27	68	5.08	0.76	4.34	5.25	2.67	9.83
1986	BALOCHISTAN	21745	193	13220	655	4.95	4265	12	39230	860	447	424	11	49	51	34	76	2.19	1.08	1.14	1.32	0.29	2.98
1985	TOTAL	2359739	37322	404737	26598	6.57	355219	13687	3119695	77607	48556	29327	276	38	62	13	34	2.49	0.94	1.56	5.02	1.25	62.13
1985	PUNJAB	1694917	24415	181614	11674	6.43	253562	9327	2130093	45416	28527	16979	90	37	63	9	26	2.13	0.80	1.34	5.36	1.14	39.75
1985	SINDH	292120	6689	115867	5204	4.49	57800	2372	465787	14265	5988	8417	140	58	42	25	36	3.06	1.81	1.29	4.68	1.43	9.96
1985	NWFP	346337	5855	90716	9100	10.03	36140	1773	473193	16728	13616	3139	27	19	81	19	54	3.54	0.66	2.88	4.96	1.75	9.54
1985	BALOCHISTAN	26365	363	16540	620	3.75	7717	215	50622	1198	425	792	19	65	35	33	52	2.37	1.56	0.84	1.75	0.41	2.89
1984	TOTAL	2547350	40923	373988	19849	5.31	334515	13224	3255853	73996	49539	24708	248	33	67	11	27	2.27	0.76	1.52	5.36	1.22	60.75
1984	PUNJAB	1702930	30881	151603	11562	7.63	229689	11380	2084222	53823	34275	19648	100	36	64	7	21	2.58	0.94	1.64	5.33	1.38	39.08
1984	SINDH	275527	4738	128090	4368	3.41	36089	428	439706	9534	5996	3611	73	38	62	29	46	2.17	0.82	1.36	4.51	0.98	9.75
1984	NWFP	541394	5068	79120	3431	4.34	48378	1265	668892	9764	8748	1083	67	11	89	12	35	1.46	0.16	1.31	7.14	1.04	9.36
1984	BALOCHISTAN	27499	236	15175	488	3.22	20359	151	63033	875	520	366	8	41	59	24	56	1.39	0.58	0.82	2.46	0.34	2.56
1983	TOTAL	1969688	25856	347050	15109	4.35	271182	10631	2587920	51596	36119	15696	223	30	70	13	29	1.99	0.61	1.40	4.38	0.87	59.14
1983	PUNJAB	1272858	19953	75843	3972	5.24	131785	5693	1480486	29618	19773	9927	86	33	67	5	13	2.00	0.67	1.34	3.89	0.78	38.10
1983	SINDH	184939	2578	197004	7219	3.66	64130	2668	446073	12465	8379	4154	68	33	67	44	58	2.79	0.93	1.88	4.66	1.30	9.58
1983	NWFP	487690	2956	58528	3189	5.45	65777	2010	611995	8155	7219	957	21	12	88	10	39	1.33	0.16	1.18	6.74	0.90	9.07
1983	BALOCHISTAN	24201	369	5675	729	4.65	9490	260	49366	1358	748	658	48	47	53	32	54	2.75	1.33	1.52	NA	NA	
1982	TOTAL	2518330	28337	336149	14803	4.40	395372	12357	3249851	55497	45826	9842	110	18	82	10	27	1.71	0.30	1.41	5.56	0.95	58.47
1982	PUNJAB	1502496	16396	92033	3649	3.96	182208	4340	1776737	24385	18164	6289	7	26	74	5	15	1.37	0.35	1.02	4.72	0.65	37.65
1982	SINDH	364108	3544	111131	2549	2.29	45679	858	520918	6951	4604	2389	42	34	66	21	37	1.33	0.46	0.88	5.57	0.74	9.35
1982	NWFP	622301	8158	118753	8161	6.87	155756	7001	896810	23320	22538	820	38	4	96	13	35	2.60	0.09	2.51	9.88	2.57	9.07
1982	BALOCHISTAN	29425	239	14232	444	3.12	11729	158	55386	841	520	344	23	40	60	26	53	1.52	0.62	0.94	2.32	0.35	2.39
1981	TOTAL	2181250	5803	245372	7595	3.10	591846	24525	3018468	37923	32988	5053	120	13	87	8	20	1.26	0.17	1.09	5.20	0.65	58.07
1981	PUNJAB	1385229	3606	47189	966	2.05	241684	12595	1674102	17167	14863	2346	42	14	86	3	6	1.03	0.14	0.89	4.45	0.46	37.65
1981	SINDH	290679	1682	111396	2084	1.87	107516	1286	509591	5052	3506	1587	41	31	69	22	41	0.99	0.31	0.69	5.45	0.54	9.35
1981	NWFP	475918	449	72914	4211	5.78	231207	10578	780039	15238	14328	936	26	6	94	9	28	1.95	0.12	1.84	8.87	1.73	8.79
1981	BALOCHISTAN	29424	66	13873	334	2.41	11439	66	54736	466	291	184	11	39	61	25	72	0.85	0.34	0.53	2.41	0.21	2.27

MALARIA BLOOD SMEARS: PAKISTAN 1961 - 1992

YEAR	PROVINCE	ACD SLIDES	+VE	PCD SLIDES	+VE	SPR	OTHER SLIDES	+VE	TOTAL SLIDES	+VE	CLASS Pv	Pf	MIX	Pf %	Pv %	PCD % OF +VE SLD	SLD	INDICATORS FROM TOTAL SLIDES SPR	Pf SPR	Pv SPR	ABER	API	POPULATION (MILLION)
1980	TOTAL	2438480	9322	256648	3415	1.33	311496	3970	3006624	16707	13996	3797	86	21	79	9	20	0.56	0.13	0.47	5.28	0.29	56.93
1980	PUNJAB	1592145	6720	78996	729	0.92	158592	1751	1829733	9200	7319	1912	31	21	79	4	8	0.50	0.10	0.40	4.94	0.25	37.05
1980	SINDH	302027	1187	108810	1712	1.57	45437	593	456274	3492	2301	1211	20	34	66	24	49	0.77	0.27	0.50	4.98	0.38	9.16
1980	NWFP	509636	1283	52836	695	1.32	100648	1565	663120	3543	4160	401	18	9	91	8	20	0.53	0.06	0.63	7.70	0.41	8.61
1980	BALOCHISTAN	34672	132	16006	279	1.74	6819	61	57497	472	216	273	17	56	44	28	59	0.82	0.47	0.38	2.72	0.22	2.11
1979	TOTAL	2181250	5803	175658	2884	1.64	325443	3607	2682351	12294	7472	4921	75	40	60	7	23	0.46	0.18	0.28	4.87	0.22	55.10
1979	PUNJAB	1385229	3606	49475	361	0.73	176973	1840	1611677	5807	3425	2409	27	41	59	3	6	0.36	0.15	0.21	4.45	0.16	36.19
1979	SINDH	290679	1682	68060	1880	2.76	49422	745	408161	4307	2376	1990	35	46	54	17	44	1.06	0.49	0.58	4.76	0.50	8.58
1979	NWFP	475918	449	41773	481	1.15	65488	885	583179	1815	1436	389	10	21	79	7	27	0.31	0.07	0.25	6.92	0.22	8.43
1979	BALOCHISTAN	29424	66	16350	162	0.99	33560	137	79334	365	235	133	3	36	64	21	44	0.46	0.17	0.30	4.16	0.19	1.91
1978	TOTAL	2025782	9315	195841	4531	2.31	366634	2314	2588257	16160	10930	5717	90	34	66	8	28	0.62	0.22	0.42	4.89	0.31	52.88
1978	PUNJAB	1311657	6355	28983	413	1.42	192963	1051	1533603	7819	6165	1677	26	21	79	2	5	0.51	0.11	0.40	4.34	0.22	35.35
1978	SINDH	233614	2659	115028	3634	3.16	39425	1025	388067	7318	3955	3820	57	49	51	30	50	1.89	0.98	1.02	4.58	0.86	8.47
1978	NWFP	455104	192	38264	314	0.82	115470	140	608838	646	565	84	3	13	87	6	49	0.11	0.01	0.09	8.36	0.09	7.28
1978	BALOCHISTAN	25407	109	13566	170	1.25	18776	98	57749	377	245	136	4	36	64	23	45	0.65	0.24	0.42	3.25	0.21	1.78
1977	TOTAL	0	0	0	0	NA	0	0	2667315	47571	32404	15309	142	32	68	0	0	1.78	0.57	1.21	5.06	0.90	52.74
1977	PUNJAB					NA			1706053	36629	26815	9887	73	27	73	0	0	2.15	0.58	1.57	4.96	1.06	34.43
1977	SINDH					NA			397140	8553	3492	5110	49	59	41	0	0	2.15	1.29	0.88	4.81	1.04	8.26
1977	NWFP					NA			505363	1915	1817	103	5	5	95	0	0	0.38	0.02	0.36	6.11	0.23	8.27
1977	BALOCHISTAN					NA			58759	474	280	209	15	43	57	0	0	0.81	0.36	0.48	3.30	0.27	1.78
1976	TOTAL	0	0	0	0	NA	0	0	2857854	122219	85578	36948	307	30	70	0	0	4.28	1.29	2.99	5.57	2.38	51.28
1976	PUNJAB					NA			1994264	105432	72653	32966	187	31	69	0	0	5.29	1.65	3.64	5.95	3.14	33.54
1976	SINDH					NA			333221	6170	3243	2989	62	48	52	0	0	1.85	0.90	0.97	4.15	0.77	8.03
1976	NWFP					NA			494460	10163	9528	689	54	7	93	0	0	2.06	0.14	1.93	6.08	1.25	8.13
1976	BALOCHISTAN					NA			35909	454	154	304	4	66	34	0	0	1.26	0.85	0.43	2.28	0.29	1.58
1975	TOTAL	2938886	215501	77201	7209	9.34	0	0	3205689	238315	119971	91189	273	43	57	2	3	7.43	2.84	3.74	6.44	4.79	49.80
1975	PUNJAB	2280700	200690	38300	3773	9.85			2382225	209094	118754	90605	265	43	57	2	2	8.78	3.80	4.99	7.29	6.40	32.66
1975	SINDH					NA			36090	1793	1217	584	8	32	68	0	0	4.97	1.62	3.37	0.47	0.23	7.75
1975	NWFP	640820	14716	33374	3244	9.72			763208	27138				NA	NA	4	12	3.56	NA	NA	9.69	3.44	7.88
1975	BALOCHISTAN	17366	95	5527	192	3.47			24166	290				NA	NA	23	66	1.20	NA	NA	1.60	0.19	1.51

MALARIA BLOOD SMEARS: PAKISTAN 1961 - 1992

YEAR	PROVINCE	ACD SLIDES	ACD +VE	PCD SLIDES	PCD +VE	PCD SPR	OTHER SLIDES	OTHER +VE	TOTAL SLIDES	TOTAL +VE	CLASS Pv	CLASS Pf	CLASS MIX	Pf %	Pv %	PCD % OF +VE SLD	PCD % OF +VE SLD	INDICATORS FROM TOTAL SLIDES SPR	Pf SPR	Pv SPR	ABER	API	POPULATION (MILLION)
1974	TOTAL	3090130	291321	142686	8255	5.79	0	0	3094098	303936	0	0	0	NA	NA	5	3	9.82	NA	NA	6.81	6.69	45.45
1974	PUNJAB	1973413	284046	79742	5756	7.22			2029668	292032				NA	NA	4	2	14.39	NA	NA	NA	NA	
1974	SINDH	221112	2445	27565	864	3.13			260345	3667				NA	NA	11	24	1.41	NA	NA	NA	NA	
1974	NWFP	836508	4495	25605	1317	5.14			724177	7503				NA	NA	4	18	1.04	NA	NA	NA	NA	
1974	BALOCHISTAN	59097	335	9774	318	3.25			79908	734				NA	NA	12	43	0.92	NA	NA	NA	NA	
1973	TOTAL	0	0	0	0	NA	0	0	4252184	599177	0	0	0	NA	NA	0	0	14.09	NA	NA	9.36	13.18	45.45
1973	PUNJAB					NA			2853419	583681				NA	NA	0	0	20.46	NA	NA	NA	NA	
1973	SINDH					NA			644823	11069				NA	NA	0	0	1.72	NA	NA	NA	NA	
1973	NWFP					NA			671996	3310				NA	NA	0	0	0.49	NA	NA	NA	NA	
1973	BALOCHISTAN					NA			81946	1117				NA	NA	0	0	1.36	NA	NA	NA	NA	
1972	TOTAL	0	0	0	0	NA	0	0	4413647	643380	0	0	0	NA	NA	0	0	14.58	NA	NA	NA	NA	0.00
1972	PUNJAB					NA			3054043	621631				NA	NA	0	0	20.35	NA	NA	NA	NA	
1972	SINDH					NA			613378	9504				NA	NA	0	0	1.55	NA	NA	NA	NA	
1972	NWFP					NA			668565	10239				NA	NA	0	0	1.53	NA	NA	NA	NA	
1972	BALOCHISTAN					NA			77661	2006				NA	NA	0	0	2.58	NA	NA	NA	NA	
1971	TOTAL	0	0	0	0	NA	0	0	3784300	202658	0	0	0	NA	NA	0	0	5.36	NA	NA	NA	NA	0.00
1971	PUNJAB					NA			2539948	171130				NA	NA	0	0	6.74	NA	NA	NA	NA	
1971	SINDH					NA			579200	11251				NA	NA	0	0	1.94	NA	NA	NA	NA	
1971	NWFP					NA			596444	18137				NA	NA	0	0	3.04	NA	NA	NA	NA	
1971	BALOCHISTAN					NA			68708	2140				NA	NA	0	0	3.11	NA	NA	NA	NA	
1970	TOTAL	0	0	0	0	NA	0	0	3847538	107999	0	0	0	NA	NA	0	0	2.81	NA	NA	NA	NA	0.00
1970	PUNJAB					NA			2827986	85509				NA	NA	0	0	3.02	NA	NA	NA	NA	
1970	SINDH					NA			534586	12108				NA	NA	0	0	2.26	NA	NA	NA	NA	
1970	NWFP					NA			439377	8571				NA	NA	0	0	1.95	NA	NA	NA	NA	
1970	BALOCHISTAN					NA			45589	1811				NA	NA	0	0	3.97	NA	NA	NA	NA	
1969	TOTAL	0	0	0	0	NA	0	0	4705567	45929	0	0	0	NA	NA	0	0	0.98	NA	NA	NA	NA	0.00
1969	PUNJAB					NA			3682718	35858				NA	NA	0	0	0.97	NA	NA	NA	NA	
1969	SINDH					NA			713286	8997				NA	NA	0	0	1.26	NA	NA	NA	NA	
1969	NWFP					NA			309563	1074				NA	NA	0	0	0.35	NA	NA	NA	NA	
1969	BALOCHISTAN					NA			0	0				NA	NA	NA	NA	NA	NA	NA	NA	NA	

MALARIA BLOOD SMEARS: PAKISTAN 1961 - 1992

YEAR	PROVINCE	ACD SLIDES	+VE	PCD SLIDES	+VE	SPR	OTHER SLIDES	+VE	TOTAL SLIDES	+VE	CLASS Pv	Pf	MIX	Pf %	Pv %	PCD % OF +VE SLD	SLD	INDICATORS FROM TOTAL SLIDES SPR	Pf SPR	Pv SPR	ABER	API	POPULATION (MILLION)
1968	TOTAL	0	0	0	0	NA	0	0	3251953	12562	0	0	0	NA	NA	0	0	0.39	NA	NA	NA	NA	0.00
1968	PUNJAB					NA			2671125	6375				NA	NA	0	0	0.24	NA	NA	NA	NA	
1968	SINDH					NA			410063	5846				NA	NA	0	0	1.43	NA	NA	NA	NA	
1968	NWFP					NA			170765	341				NA	NA	0	0	0.20	NA	NA	NA	NA	
1968	BALOCHISTAN					NA			0	0				NA	NA	NA	NA	NA	NA	NA	NA	NA	
1967	TOTAL	0	0	0	0	NA	0	0	2574664	6465	0	0	0	NA	NA	0	0	0.25	NA	NA	NA	NA	0.00
1967	PUNJAB					NA			2295099	3256				NA	NA	0	0	0.14	NA	NA	NA	NA	
1967	SINDH					NA			179474	2407				NA	NA	0	0	1.34	NA	NA	NA	NA	
1967	NWFP					NA			100091	802				NA	NA	0	0	0.80	NA	NA	NA	NA	
1967	BALOCHISTAN					NA			0	0				NA	NA	NA	NA	NA	NA	NA	NA	NA	
1966	TOTAL	0	0	0	0	NA	0	0	556391	2988	0	0	0	NA	NA	0	0	0.54	NA	NA	NA	NA	0.00
1966	PUNJAB					NA			529892	2861				NA	NA	0	0	0.54	NA	NA	NA	NA	
1966	SINDH					NA			26499	127				NA	NA	0	0	0.48	NA	NA	NA	NA	
1966	NWFP					NA			0	0				NA	NA	NA	NA	NA	NA	NA	NA	NA	
1966	BALOCHISTAN					NA			0	0				NA	NA	NA	NA	NA	NA	NA	NA	NA	
1965	TOTAL	0	0	0	0	NA	0	0	882724	6981	0	0	0	NA	NA	0	0	0.79	NA	NA	NA	NA	0.00
1965	PUNJAB					NA			858590	6546				NA	NA	0	0	0.76	NA	NA	NA	NA	
1965	SINDH					NA			24134	435				NA	NA	0	0	1.80	NA	NA	NA	NA	
1965	NWFP					NA			0	0				NA	NA	NA	NA	NA	NA	NA	NA	NA	
1965	BALOCHISTAN					NA			0	0				NA	NA	NA	NA	NA	NA	NA	NA	NA	
1964	TOTAL	0	0	0	0	NA	0	0	396969	5922	0	0	0	NA	NA	0	0	1.49	NA	NA	NA	NA	0.00
1964	PUNJAB					NA			379950	4902				NA	NA	0	0	1.29	NA	NA	NA	NA	
1964	SINDH					NA			17019	1020				NA	NA	0	0	5.99	NA	NA	NA	NA	
1964	NWFP					NA			0	0				NA	NA	NA	NA	NA	NA	NA	NA	NA	
1964	BALOCHISTAN					NA			0	0				NA	NA	NA	NA	NA	NA	NA	NA	NA	
1963	TOTAL	0	0	0	0	NA	0	0	233664	5077	0	0	0	NA	NA	0	0	2.17	NA	NA	NA	NA	0.00
1963	PUNJAB					NA			233664	5077				NA	NA	0	0	2.17	NA	NA	NA	NA	
1963	SINDH					NA			0	0				NA	NA	NA	NA	NA	NA	NA	NA	NA	
1963	NWFP					NA			0	0				NA	NA	NA	NA	NA	NA	NA	NA	NA	
1963	BALOCHISTAN					NA			0	0				NA	NA	NA	NA	NA	NA	NA	NA	NA	

MALARIA BLOOD SMEARS: PAKISTAN 1961 - 1992

YEAR	PROVINCE	ACD SLIDES	+VE	PCD SLIDES	+VE	SPR	OTHER SLIDES	+VE	TOTAL SLIDES	+VE	CLASS Pv	Pf	MIX	Pf %	Pv %	PCD SLD	% OF +VE SLD	INDICATORS FROM TOTAL SLIDES SPR	Pf SPR	Pv SPR	ABER	API	POPULATION (MILLION)
1962	TOTAL	0	0	0	0	NA	0	0	82325	759	0	0	0	NA	NA	0	0	0.92	NA	NA	NA	NA	0.00
1962	PUNJAB					NA			82325	759				NA	NA	0	0	0.92	NA	NA	NA	NA	
1962	SINDH					NA			0	0				NA	NA	NA	NA	NA	NA	NA	NA	NA	
1962	NWFP					NA			0	0				NA	NA	NA	NA	NA	NA	NA	NA	NA	
1962	BALOCHISTAN					NA			0	0				NA	NA	NA	NA	NA	NA	NA	NA	NA	
1961	TOTAL	0	0	0	0	NA	0	0	20527	648	0	0	0	NA	NA	0	0	3.16	NA	NA	NA	NA	0.00
1961	PUNJAB					NA			20527	648				NA	NA	0	0	3.16	NA	NA	NA	NA	
1961	SINDH					NA			0	0				NA	NA	NA	NA	NA	NA	NA	NA	NA	
1961	NWFP					NA			0	0				NA	NA	NA	NA	NA	NA	NA	NA	NA	
1961	BALOCHISTAN					NA			0	0				NA	NA	NA	NA	NA	NA	NA	NA	NA	

Sources of Annual Indicator Data by Year

1986 - 1992: Tables supplied by Dr. G. Hashim, Chief Epidemiologist, Directorate of Malaria Control, Pakistan.

1985: Annual Report, 1985-1986, Directorate of Malaria Control.
Combined Surveillance Data: Table 5, p. 12; ACD: Table 6, p. 13;
PCD: Table 7, p. 14.
Population: Annexure C.
P. falciparum and P. vivax data: Annexure A.

1984: Annual Report, 1984-1985, Directorate of Malaria Control.
Combined Surveillance Data: Table 4, p. 7; ACD: Table 5, p. 7;
PCD: Table 6, p. 8.
Population: Annexure C.
P. falciparum and P. vivax data: Annexure A.

1983: Annual Report, 1983-1984, Directorate of Malaria Control.
Combined Surveillance Data: Table 4, p. 7; ACD: Table 5, p. 8;
PCD: Table 6, p. 9.
Population: Table 10, p.14.
P. falciparum and P. vivax data: Annexure A.

1982: Annual Report, 1982-1983, Directorate of Malaria Control.
Combined Surveillance Data: Table 4, p. 6; ACD: Table 5, p. 6;
PCD: Table 6, p. 7.
Population: Table 8, p. 10.
P. falciparum and P. vivax data: Annexure A.

1981: Annual Report, 1981-1982, Directorate of Malaria Control.
Combined Surveillance Data: Table 2, p. 6; ACD: Table 3, p. 7;
PCD: Table 4, p. 8.
Population: Table 6, p. 12.
P. falciparum and P. vivax data: Annexure A.

1980: Annual Report, 1980-1981, Directorate of Malaria Control.
Combined Surveillance Data: Table 2, p. 5; ACD: Table 3, p. 6;
PCD: Table 4, p. 6.
Population: Table 6, p. 9.
P. falciparum and P. vivax data: Annexure A.

1979: Annual Report, 1979-1980, Directorate of Malaria Control.
Combined Surveillance Data: Table 2, p. 4; ACD: Table 3, p. 5;
PCD: Table 4, p. 6.
Population: Table 6, p. 9.
P. falciparum and P. vivax data: Annexure A.

1978: Annual Report, 1978-1979, Directorate of Malaria Control.
Combined Surveillance Data: Table 2, p. 4; ACD: Table 3, p. 5;
PCD: Table 4, p. 5.
Population: Table 9, p. 8.
P. falciparum and P. vivax data: Annexure A.

1977: Annual Report, 1977-1978, Directorate of Malaria Control.
Combined Surveillance Data: p. 5; ACD and PCD disaggregated data not available.
Population: p. 3.
P. falciparum and P. vivax data: Annexure I.

1976: Annual Report, 1976-1977, Malaria Control Programme.
Combined Surveillance Data: p. 6; ACD and PCD disaggregated data not available.
Population: p. 4.
P. falciparum and P. vivax data: Annexure I.

1974-1975: Annual Report, 1975-1976, Malaria Control Programme.
Combined Surveillance Data: Table VII, p. 8; ACD: Table V, p. 7;
PCD: Table VI, p. 8.
1975 Population: Table III, p. 5; 1974 population not available.
P. falciparum and P. vivax data: 1975, Annex 1; 1974 not available.

1971-1972: Annual Report, 1972-1973, Malaria Eradication Board.
Combined Surveillance Data: p. 20; ACD and PCD disaggregated data not available.
Population: not available.
P. falciparum and P. vivax data: not available.

1973, 1961-1970: Table Showing Total Slides ... from 1961 Onwards, supplied by Dr. G. Hashim, Chief Epidemiologist, Directorate of Malaria Control, Pakistan..
Combined Surveillance Data only; ACD and PCD disaggregated data not available.

Population: not available.
P. falciparum and P. vivax data: not available.

Annex E

Brief History of Malaria Control Efforts in Pakistan

In the heady days of enthusiasm for malaria eradication of the 1960s, a comprehensive program of residual insecticide spraying of households was established in Pakistan. A vast, almost paramilitary force of malaria spraymen, malaria supervisors, entomologists, and coordinating staff was organized to map the patterns of malaria and its vectors throughout the country, spray the inside walls of homes on a precise, scientifically calculated schedule, and eliminate through treatment with chloroquine and primaquine malaria parasites in the human hosts so as to interrupt transmission.

It was essential to be able to detect the parasites microscopically and provide drugs to eliminate those parasites whenever detected. An information system was established to assure that sufficient blood smear examinations were carried out to monitor the incidence of malaria parasitemia in the human population quite accurately. The annual blood smear examination rate monitored the percent of the population examined each year to assure high coverage rates.

Program effectiveness was measured in the 1960s by the proportion of the population sampled in whom parasites had been detected microscopically during the year, expressed by the single statistic of the slide positivity rate (SPR). In 1973, under pressure from WHO and USAID to use a statistic reflecting the whole population at risk, the MCP began to use the annual parasite incidence, the number of positive blood smears per thousand persons in the entire population under surveillance.

Complete coverage of the population was essential. Methods of active case detection were devised whereby malaria workers would canvas the country door-to-door at regular intervals, usually monthly, asking whether anyone in each household had had a fever during that month. Blood smears were prepared for those individuals, and presumptive malaria treatment was given immediately. The slides were carried to laboratories for examination. Positive slides sent the malaria worker back to the household with drugs for radical treatment. Importantly, primaquine was always included with chloroquine to assure the destruction of falciparum gametocytes, preventing further transmission

and the liver stage of vivax parasites (to prevent relapse). Every micro-reservoir of potential transmission was thus eliminated.

It was a rigorously planned, efficient system. Parasite densities, fairly easily noted when reading blood smears, were not necessary, so they were not recorded. Clinical manifestations of malaria, even mortality, were unimportant in the context of eradication, so they were not noted. Age and sex were not relevant and, although recorded, not reported. *P. vivax* and *P. falciparum* required somewhat different radical treatment, and their epidemiologic patterns might differ, so the species was noted and reported. Only information required for decision making was collected. Other information was collected by mass blood survey, malariometric survey, or other special study as needed. It was all very soundly planned epidemiologically.

The maps and population census figures produced by the program's geographical reconnaissance were so precise and accurate as to be declared militarily confidential. For maximum efficacy the army of malaria workers was organized into a vertical program. The system had its own field and laboratory staff, vehicles, census and mapping capabilities, a communications and information system, and a system for drugs and supplies.

Malaria in urban areas was not considered to pose a significant risk of transmission, so the malaria program did not extend to urban areas leaving these cases in the hands of municipal health authorities and private practitioners. Cases there were not collected into the annual figures of the MCP, and their populations were not counted in the denominators for API. Even after Karachi experienced a serious urban malaria epidemic in 1967 following the banning of farm animals from the city, the urban areas remained outside the malaria program's purview. Only in the 1990s has the MCP included the Karachi population in the population of Sindh Province. In one year the provincial population rose some 56% and the API fell. Malaria reporting from Karachi is incomplete.

The malaria eradication program in Pakistan began by focusing on a few of the most highly endemic malaria zones. These zones did not necessarily correspond with political divisions or those of the general health services, and additional areas were added from time to time. The data from the early years are thus highly selective and difficult to

compare with recent data. It was only in 1970 that the program had expanded to cover the entire country, with the notable exception of urban areas where only the fringes were included in the malaria program proper.

By the 1970s when it was clear that eradication was unlikely if not impossible, arguments for integration of malaria services into the general health services were reflected in the annual reports of the malaria program. The Malaria Eradication Programme began calling itself the Malaria Control Programme by 1976, and the eradication effort was officially terminated in 1979. Integration meant that all provincial and more peripheral staffs and services were placed under the administrative support of the general health services. Before 1976, malaria control was organized by sectors and subsectors within districts. These smaller units were selected to have similar population sizes and were not the same as the political subdivisions. In that year the MCP merged its peripheral structures with those of the general health services. Since that time political divisions have been respected. The Directorate of Malaria Control continued to exist at the federal level to provide policy guidance, coordination of epidemiologic and entomologic monitoring, training coordination, liaison with donors, and provision of the large quantities of insecticide and other supplies required for malaria detection and spray operations.

From the early years of the malaria eradication program passive case detection was included, even if ACD remained the backbone of the surveillance system. Where clinical facilities existed, people presenting with fever would have blood slides read and malaria diagnosed and treated. Cases of malaria thus detected were of interest to malaria eradication, and summary statistics of these cases were collected as PCD data. Malaria suspected—and even treated—but unconfirmed by blood smear examination was not clear evidence of malaria transmission because it could be due to other causes. It was therefore not useful to the eradication system. Such cases were classified as pyrexia of unknown origin (PUO) and defined specifically <u>not</u> to be cases for the purposes of the malaria program. PUO numbers simply indicated failure to perform blood smear examination. There was continued encouragement to examine blood for <u>every</u> fever case. It was important for the program, as well as for correct diagnosis and patient care, to increase PCD and to reduce PUOs.

In recent years the percentage of all slides obtained through PCD has been used as an indicator of integration of malaria activities with general health services. Unfortunately, it is also not entirely clear how much of the modest increase that has occurred has been due to strengthened PCD. It is not known how much is the result of "activated" passive case detection whereby otherwise unintegrated malaria workers provide case detection and treatment within health facilities. Other possible explanations for the increase may have been a decline in ACD efforts or a greater tendency to present to health facilities as falciparum malaria increases.

Annex F

Malaria Specific Portions of HMIS and Its Reporting Form

INDICATOR	FREQUENCY[3]
5.0 Malaria	
5.1 % of new cases of fever out of total new cases	M/Y
5.2 % of cases for which slides were collected out of total new cases of fever	M/Y
5.3 % of MP positive (Malaria Parasite) cases out of total fever cases for which slides were collected	M/Y
5.4 % of *P. falciparum* positive cases out of total MP positive cases	M/Y
5.5 % of cases clinically resistant to chloroquine out of total *P. falciparum* positive cases	M/Y
5.6 No. days of stock-outs of anti-malarial drugs	M/Im
5.7 % of slides with correct malaria diagnosis in centers with laboratory services as verified through supervisory checklist	Q

In addition <u>standard case definitions</u> are to be developed for:

- Fever
- Malaria parasite positive case
- *P. falciparum* positive case
- Malaria case clinically resistant to chloroquine

<u>standard case management procedures</u> are to be developed for:

- Fever/suspected malaria

<u>standard definitions</u> will be defined for:

[3] Frequency of aggregation and reporting. M = monthly Y = yearly
Im = immediate Q = quarterly.

- First level care facility catchment area
- New case
- Old case
- Referred case
- Essential drugs/supplies

HMIS format for monthly reporting by first level care facilities, malaria section

F. Malaria							
(From Abstract Register)	Blood Slides						Total Fever Cases
	Exam. in Facility		Sent Out		Not Taken		
104. Number of Fever Cases (New casees all ages)		%		%			
(From Laboratory Register)	Internal		External				
(Only Outpatient New Cases)	No.	% Pos.	No.	% Pos.			
1. Total Number of Slides Examined (New Cases)							
2. Number of Slides Malaria Parasite Positive		%		%			
3. Number of Slides Plasmodiium falciparum Positive		%		%			

Annex G

MONTHLY REPORT FORM FOR MALARIA CONTROL ACTIVITIES

PHU: Ali Ta Kaci Camp MONTH: July

REFUGEE VILLAGES: All YEAR: 93

DISTRICT: All

	Total Slides Examined	POSITIVE SLIDES				
		P.v	P.f	Mix	Total	S.P.Rate
New Slides	9010	2067	(A) 116	(B) 21	(C) 2204	24.29
Follow up Slides	(D) 146	4	(E) 9	(F) 1	14	9.58
Total	9156	2071	125	22	2218	24.06

MONTHLY RESULTS ACCORDING AGE, SEX AND TYPE OF MALARIA

Age	MALE			FEMALE			TOTAL
	P.v	P.f	Mix	P.v	P.f	Mix	
1 Year	19	—	—	16	—	—	35
1 - 4	189	8	—	121	2	1	321
5 - 14	479	29	6	464	22	3	943
15	464	40	6	379	24	6	919
Total	1151	77	12	920	48	10	2218

Total Number of New Malaria Cases: (C) = _____

Total Number of New P.f Infections: (A) + (B) = _____

Follow up Coverage: $\frac{(D)}{(A) + (D)} \times 100\% =$ _____%

Failed Treatment in follow up cases: $\frac{(E) + (F)}{(D)} \times 100\% =$ _____%

P.v = P. vivax
P.f = P. falciparum
Mix = Mixed infection
S.P. Rate = Slide Politive Rate