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*Vector Biology
and Control Project*

**Initial Steps Toward Improvement
and Computerization of Pakistan
Malaria Surveillance Procedures**

February 12 - March 21, 1992

by

Robert G. Scholtens

and

Martin Wulfe

VBC Report No. 82245

Authors

Robert G. Scholtens, a tropical disease epidemiologist, was formerly with the Centers for Disease Control, professor of parasitology at the University of Tennessee, and Director of the international Livestock Centre for Africa.

Martin Wulfe is a management information specialist.

Acknowledgments

This mission was made possible because of the special interest of Dr. Dennis Carroll, A.I.D./Washington, and Professor Ansari, former Director-General of Health, Ministry of Health, Government of Pakistan, in promoting a better understanding of the frequency and distribution of malaria in Pakistan. The support of Dr. Kifay of USAID/Islamabad and Mr. Chaudhary Mujahid of the Directorate of Malaria Control, Ministry of Health, was also very important. But it is the interest, enthusiasm, and participation of the Malaria Control Program computer-trainees and those responsible for malaria surveillance in the provinces that will make possible any long-term improvement in malaria surveillance procedures. We wish them well.

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1. Introduction

The initial steps toward modernization of malaria surveillance procedures were taken several years ago when Dr. Barry Silverman of the Vector Biology and Control Project introduced the idea of computerizing case reporting procedures. He also set up the first microcomputer in the Pakistan Malaria Control Program (MCP) headquarters in Islamabad and trained headquarters staff. In 1991, the Directorate of Malaria Control (DOMC) ordered five computers and the needed software. The computers were delivered in late 1991 and an introductory course on microcomputers and standard application programs was given to 12 MCP staff from the provinces and headquarters from February 2 to 27, 1992.

The objectives of this technical support mission were to:

- Instruct the trainees in the computer methods that might be used to improve overall malaria surveillance efforts;
- Install computer hardware and software in MCP provincial offices;
- Install and initiate trial systems for computerized management of malaria data.

Two applications were prepared as examples for these trials, based on malaria surveillance methods and needs as observed during MCP annual evaluations in 1990 and 1991. Martin Wulfe wrote a database program (PAKMAL) that might replace some current reporting procedures. PAKMAL included mapping capabilities to facilitate visualization of the geographical distribution of malaria in Pakistan. Robert Scholtens constructed seven spreadsheet templates for use with Lotus 1-2-3 to facilitate more accurate and rapid recording of data derived from current case reporting methods.

2. Observations

The team arrived February 14, 1992, and spent the first two weeks in Islamabad. Here, after discussions with Mr. Chaudhary Mujahid, Director, and Dr. G. Hashim, Epidemiologist, the Directorate of Malaria Control (DOMC) prepared the two computers (one in place, one new) for future operations. One day was used for discussions with Dr. Dennis Carroll, A.I.D./Washington, and Dr. Rifaq, USAID/Islamabad, concerning the potential results of this consultancy and plans for a follow-up trip early in 1993. Because of recent changes in Ministry of Health staff, a previously scheduled workshop for senior health officials was not held.

While in Islamabad we met with staff of the Pakistan Child Survival Project (CSP), who are responsible for developing a national health information system (HIS). This scheme is strongly supported by the Ministry of Health and is well-advanced. CSP has completed and published a detailed study of existing health statistics, health delivery capabilities, and reporting methods and objectives. Two national planning conferences have been held and consensus reports officially endorsed. These have been followed up with a plan to replace all existing reporting methods with a single HIS scheme to be in place by October 1992. The reportable diseases, including malaria, have been identified, and definitions for identifying probable and confirmed cases are now being finalized. All first-line health service facilities will supply data for the HIS. Rates and indices of effectiveness for each first-line facility will be calculated by "catchment area" populations. These catchment areas are to be defined by district committees during the next few months; they may in many cases be equivalent to a union council, but this is very uncertain.

After an early trip to Rawalpindi District Office with Dr. Hashim to review malaria case detection and reporting methods, we spent five days studying existing reports and entering data into the trial programs. Data from monthly reports to the DOMC by 83

districts in four provinces were used to identify deficiencies and make subsequent revisions to the programs we had prepared before we arrived in Pakistan.

We used the last two days in Islamabad before we left for the provinces to introduce MCP staff in the computer familiarization course to the special programs for malaria data management (PAKMAL and 1-2-3 templates) and their possible uses in the provinces. The overall quality of the training course appeared to be excellent, and the trainees were devoted students. However, the marginal value of the equipment used in the course compromised the results. The usefulness of the hardware was further reduced by the presence of a "DarkAvenger" computer virus, and the course no doubt facilitated the virus's spread.

During the next three weeks, we traveled to the MCP provincial headquarters in Peshawar, Quetta, Hyderabad, and Lahore. A new Epson Equity 386 SX computer with a 40 MB hard disk and both 5 1/4" and 3 1/2 " floppy disk drives was installed at each of the provincial headquarters. Each computer came with a Best, MICRO-FERRUPS QME7C0VA power supply to protect it from the electrical power interruptions and voltage variations that are common in Pakistan. The VGA monitors were made by Packard Bell.

The application programs provided with the computers included WordPerfect 5.1, dBase IV, Lotus 1-2-3 Ver. 3.1, Harvard Graphics 2.3, and Norton Utilities 5.0.; except for Lotus, these were installed. Lotus 1-2-3 Ver. 3.1 is not closely related to the widely-used 2.x series. We installed version 2.3 at each site because 1-2-3 Ver. 2.3 had been delivered and installed at DOMC, and the templates designed for use in managing malaria case data had been prepared using version 2.3. Thus, using version 2.3 will ensure that the spreadsheets created at each MCP computer site will be compatible. We also installed the special applications we had brought for MCP use: the CDC/WHO Epi Info program and manual, PAKMAL, and the Lotus 1-2-3 templates.

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Finally, staff were trained in the use of the special applications for malaria case data management. This training included the entry of data from a limited number of locations and periods for numbers of slides, numbers of positive slides, numbers of falciparum slides, and populations. Specific suggestions on how to use PAKMAL and the 1-2-3 templates during 1992 were made in each province.

USAID/Islamabad contracted the services of EGS(Pvt) Ltd., an engineering services firm with offices throughout Pakistan, to install and service the five new computers provided by USAID. EGS technical staff members were enormously helpful. Their skills in adapting the computer hardware to local electrical conditions were very useful. And when hardware failed, as in Quetta, the zeal of their emergency assistance kept our limited time at each provincial MCP from being wasted.

The five computer systems delivered to DOMC and the provincial headquarters had several problems. First, was each provided with an internal streaming tape backup and controller card, but, with both 5 1/4" and 3 1/2" floppy disks installed (both were required), no bay was available for this tape system. Although the tape backup systems could not be installed, they are not really necessary, because diskettes can be used to make back-up copies of files.

Another deficiency was the absence of dust covers for all computers, although these were specified. The offices where the computers were installed are dusty, some extremely so, and only one is air-conditioned, so dust may be a serious problem. Plastic bags are being used temporarily to protect the computers from dust overnight and on weekends.

Finally, no printer cables were provided, and there is a potential problem with the printers provided. These HP DeskJet 500 inkjet printers are excellent, but replacement inkjet cartridges may be difficult to find and are likely to be very expensive by MCP standards. Also, the paper sent by USAID to each provincial office was 8 1/2 by 11 inch fan-fold paper for the tractor feeders used with dot-matrix printers. It is not the standard size used at these offices

(which is A4), and can be used in the DeskJet printers only if the paper edges are removed and the pages separated. This a time-consuming task.

NWFP/MCP

At Peshawar, hardware and software installation was problem-free. The computer was installed at the MCP offices, which are on the fourth floor of a building in central Peshawar. EGS found that the building electrical system lacks a ground but in other ways appears suitable. Steps to ground the system were promised. The computer was installed next to the desk of Mr. Shaukat Pervaz, who appears to be one of the more talented computer trainees. He and the other trainee from NWFP/MCP, Mr. Atta Muhammad, worked closely with us on the programs and malaria case data entry. Considerable experience was gained and numerous provincial data, which seem quite complete and in good order, were entered into PAKMAL and 1-2-3 files.

Baluchistan/MCP

The situation was less hopeful in Quetta. The computer had previously been taken to the Baluchistan MOH for use in a training course in early February, and for reasons unknown the hard disk had crashed. Only emergency service by Muhammad Abid of EGS, done overnight to reduce time lost from our schedule, made it operational. The cost of a replacement disk and labor was RS 10,700, which we partly defrayed by trading in the unusable tape backup for RS 5,000. USAID will be billed for the remainder.

Although Dr. Paracha shows talent in use of computers, the overall situation there is not promising, since there are only token malaria surveillance operations in Baluchistan. Program support levels are appallingly low, and few useful data are available, even from areas where malaria is known to be a severe problem. The physical surroundings at the installation site are also marginal. Because of the dust and heat, further problems with computer equipment are likely.

Sindh/MCP

We arrived in the MCP offices in Hyderabad before EGS. The computer shipment had not been unpacked but was, nonetheless, missing WordPerfect, Harvard Graphics, and Norton Utilities. We managed to assemble the hardware and install the software by the end of the first day by improvising, but after two hours operation, the UPS alarm signaled problems. We shut down the system and called EGS.

The next day the UPS appeared normal. When the EGS field engineer arrived he said that the problem was most likely a voltage surge in excess of 250V, something quite common in Hyderabad. The UPS that was provided cannot stabilize such extreme voltages and can be damaged by them. A heavy-duty voltage stabilizer is recommended to protect the UPS, and should be installed as soon as possible.

Later, after the departure of the EGS engineer, a brief power failure occurred, and the power to the computer ceased immediately, indicating failure of the UPS. We summoned EGS again the next morning. They came, reluctantly, and concluded that the circuit board on the UPS had malfunctioned. The entire UPS was taken to EGS, Karachi. If it cannot be quickly repaired or replaced, a heavy-duty voltage stabilizer should be purchased and delivered to Sindh/MCP to permit relatively safe use of the computer. Once the UPS has been repaired, this stabilizer should remain with the MCP computer to protect it.

Prior to the failure of the UPS, we were able to provide about 10 hours of training to Sumar Sadruddin and his assistant, Syed Shariful-ul-Hussain, on use of the computer and its various application programs. Both are very capable computer operators. Sindh also appears to have some of the best organized, most complete and diverse malaria case data of any of the provincial programs.

Punjab/MCP

The situation in Lahore is promising. The computer is installed in the Computer Section of the Directorate General of Health Services, where six other computers are under the care of a Data Management Officer. The room is clean and air-conditioned, and the computer is freely available for use by appropriate staff.

The Packard Bell monitor provided with the MCP computer was found to have a defective switch. EGS repaired the switch, but when an attempt was made to use the monitor, it failed again. EGS will have to repair this monitor. A replacement monitor was provided for the installation of software and training of staff.

We had an excellent training session with Mokhtar Shah (Punjab/MCP), Dr. Hashim (DOMC), and Raja Abdul Qayyum (Azad Kashmir/MCP). The last two traveled to Lahore for the training, and to advise us on possible program modifications. Dr. Naqvi was on leave.

3. Conclusions

As noted in previous reports about the Pakistan MCP, its greatest resource remains the vitality and dedication of its many loyal staff. Those responsible for malaria case detection and data recording are among the most diligent and active employees at both national and provincial levels. But this close look at malaria case detection procedures and the potential for improving them by computerizing records has uncovered some difficulties that confuse results and likely courses of action.

One of these difficulties is the fundamental question of what data should constitute a computer-based record: is it to be a case, or compiled monthly blood-slide examination results by village, union council, tehsil, district, or some other level? The extent of data entry required depends on the definition of a record, as illustrated in the table below. The deciding factor must be the availability of data that satisfy surveillance purposes.

What data are available? First, we found that blood slide test result data, in monthly reports from the District Health Officer (DHO) to the Provincial Health Officer, originate in the laboratories. We were very pleased to learn that copies of these reports go to the DOMC. Where there are few or no laboratories, disease surveillance is inadequate. This dependence on laboratories for the aggregation of case data is the result of the emphasis that has been placed on blood-slide examination as the sole means of monitoring malaria in the population.

Second, we found that details of actual cases, including disease transmission sites, name, age, and sex of patient, are often obscured because the data being managed mainly pertain to blood slides and their origin. The result is that many particulars that might be recorded if suspected and confirmed cases could be entered individually are unavailable at the provincial headquarters offices (PHOs), where the four new computers are located.

Table 1
Pakistan: Administrative Units & Malaria Cases, 1990

Unit	Punjab	Sindh	NWFP	Baluchistan	Totals
Divisions	6	4	6	6	22
Districts	29	13	21	20	83
Tehsils	88	78	56	29	251
U. Council	2,377	542	631	192	3,842
Villages	24,311	5,941	5,684	6,082	42,018
Cases	15,743	29,957	29,120	4,870	79,689

Third, unless the existing reporting system is completely revised, malaria information system design must conform to the constraints of data available in current reports from districts to provinces, or obtainable from existing registries.

In this context, the current design of PAKMAL to record populations and case data at the Union Council level is not practical; the necessary case-level data are rarely available at PHOs. PAKMAL would be far more useful if, somehow, computers could be used at the DHOs. We suggest how to modify PAKMAK for maximum effectiveness below.

Overall, we judge the effort to date successful. Trained staff are using the computers and software provided. Data are being entered to hone skills, ideas for use of existing applications are being tested, and steps toward a more coordinated case reporting effort have been taken.

During the last two days of this consultancy, debriefing meetings were held with Ms. Barbara Spaid, Acting Chief, HPN, USAID/ Islamabad and, because the new Director-General was out of the country, Mr. Faris Rehman Khan, Secretary of Health, MOH/ Pakistan. (We learned at the latter meeting that the MCP/DOMC is now directly under the supervision of the Secretary of Health and not the Director-General.) At both meetings considerable interest in this project was expressed, and invitations were issued for a follow-up trip. The agreed purpose of the follow-up trip is described in recommendations 2, 3, and 4 below.

4. Recommendations

1. Computer Hardware

The hardware provided to the MCP is in place and operating. With the exceptions mentioned elsewhere in this report, the uninterruptible power supplies and the Epson Equity computers appear to be functioning well. With one exception, the monitors are in use and all the printers are operational. But no substantial nationwide computerized information system is likely to thrive for long with only six widely spread computers. Although the services of EGS will be very useful, additional hardware is needed if revised methods of malaria case reporting are to be permanently adopted.

We recommend that USAID/Islamabad provide five additional relatively inexpensive, portable computers to support the development of this malaria information system and supplement the core units now in place; one should go to Azud Kashmir and one to each of the other provinces. The computers should be 386SX laptop or notebook models with VGA screens, at least 2 MB RAM, and hard disks with at least 40 MB capacities, that will run for at least two hours on their internal batteries. These retail for about \$2000 now in the United States. They would be used to retrieve data unavailable at the PHO and as back-up units for the desktop computers now in operation. Portable machines such as these may be essential to the retrieval of individual case data such as those proposed for collection by a 1993 version of PAKMAL.

Due to extreme voltage fluctuations, heavy duty (1000-watt) voltage stabilizers are also needed to protect uninterruptible power supplies and computer hardware in Hyderabad and Quetta, and perhaps at other sites as well. Stabilizers in Hyderabad and Quetta should be provided as soon as possible through EGS. USAID/Islamabad should also provide a supply of ink cartridges for the HP DeskJet printers. We suggest six cartridges for the printers in each province — perhaps also through EGS.

2. Computer Software

Two problems were encountered with the software applications provided. Most serious is the lack of Lotus 1-2-3 version 2.3 in the provincial offices. We installed copies of this program at each site so that the work could proceed on schedule. But four copies of Lotus 1-2-3 version 2.3 should be purchased and sent to the provinces as soon as possible. This will legalize their use and give the computer operators the program documentation that they need to make effective use of this most essential program.

Second, it is important that the Sindh PHO be sent the software missing from its shipment: Harvard Graphics, Norton Utilities, and WordPerfect 5.1.

The essential software that should be provided with the laptop computers is WordPerfect 5.1, Lotus 1-2-3 Ver. 2.3, and a revised PAKMAL.

3. PAKMAL Changes

The first version of this self-contained program attempted to do two things: graphically define malaria distribution at the district level and assist in identifying localities with malaria levels high enough to justify insecticide spraying. The first objective was met but the second, in light of what we have learned about case detection data management, is too difficult to remain a reasonable objective at this time. PAKMAL can be the means of efficient malaria case data management by largely untrained lower-level staff in Pakistan and other malaria control programs if the following modifications are made in two steps.

First, minor improvements that will result in PAKMAL version 1.1 should be completed by June 1992. These will affect only the way the program reports and displays data, with no fundamental alterations in the way data are entered or stored. These changes will make the current version more responsive to staff needs by altering the formats of the reports, graphs, and maps, providing individual

maps for each of the four provinces, and including new line graphs that show changes over time. The data that are entered and stored will not change.

Major modifications to be incorporated by January 1993, which will result in PAKMAL version 2.0, will change the reporting base to match the existing data management system and expected changes resulting from the CSP HIS.

It is proposed that two databases be maintained in PAKMAL 2.0: one to manage most of the current conventional MCP data at the district level, and the second to record individual confirmed case information, including a case number, age, sex, location (province, district, tehsil, union council, and village if available), and date of onset.

The district-level data, reports, graphs, and maps in PAKMAL 2.0 will be similar to those in the current version of PAKMAL, and will be derived from the regular monthly district reports. Data for individual cases must come from sources such as laboratory case registers. These can be used to plot temporal frequencies such as epidemic curves, and to identify transmission sites more specifically.

With both levels of data available, the statistical accuracy, in terms of confidence intervals, could be calculated for some of the case-level data.

4. Further Technical Support

The MCP produces massive amounts of data, from geographical reconnaissance, case detection, spray operations, and entomologic monitoring and from its management systems. This consultancy was particularly concerned with strengthening case detection efforts through improved data management because malaria control operations are increasingly dependent on rapid, reliable information about the distribution of the disease. Revising PAKMAL so that it can make use of data derived from both existing reports and the changing health information system will do much to strengthen

surveillance efforts. But the other data management needs of the MCP, especially those to facilitate spray operations, entomologic monitoring, and vehicle management, also need to be addressed.

We recommend sending suitable advisors to Pakistan with pre-planned applications using Lotus 1-2-3, or perhaps dBase IV, to help meet these needs early in 1993. Installation and training in the use of the PAKMAL 2.0 should also take place then.

5. Health Information Systems

Implementation of the HIS in Pakistan through the CSP has three principal implications for the malaria program. First, current PCD procedures will be disrupted. Second, the subsector or union council population reporting base for calculation of indices may be replaced by catchment areas. And third, the potential for detecting and using reported probable (clinical) cases of malaria will materialize.

Although these changes will be disruptive, they also offer great potential advantages. The movement from ACD to PCD has been official policy for a decade, and dropping both classifications for a "confirmed" case category will be constructive. Because the MCP is still enmeshed in the prolonged shift from subsectors to union councils and sectors to tehsils, a further shift to catchment areas, providing they are adequately defined, may also be useful. But the potential usefulness of quite rapid and reasonably complete reporting of probable malaria cases could be enormously useful. Malaria, especially in outbreaks, is clinically quite distinctive. Since the disease is no doubt much underreported now, the possibility of recording clinical cases will permit better definition of malaria's true importance in Pakistan.

We recommend that the MCP strongly support the development of the HIS and the reporting of clinical (probable) cases of malaria.

5. People Contacted

AID/R&D/H/CD

Dr. Dennis Carroll

MCP/Azad Kashmir

Raja Abdul Qayyum, Computer Trainee/CDC Officer

MCP/Baluchistan

Dr. Mohamad Hussain, Chief, Malaria Control Program
Muhammad Jali, Computer Trainee/Ento. Technician
Dr. Mahmood Sultan Paracha, Computer Trainee/Epidemiologist
Abdul Sattar, Senior Malaria Superintendent
Mohd Sadiq, Malaria Superintendent

MCP/DOMC

Chaudhary A.A. Mujahid, DOMC Director
Dr. G. Hashim, Computer Trainee/Epidemiologist
S.B. Mustafa, Computer Trainee/Stenographer
Muhammad Riaz, Computer Trainee/Assistant Incharge

MCP/NWFP

Fazil Razik, Entomologist
Atta Muhammad, Computer Trainee/Ento. Technician
Shaukat Pervaz, Computer Trainee/Assistant Epidemiologist
Dr. Mohammad Iqbal, Chief, MCP

MCP/Punjab

Mokhtar Shah, Computer Trainee/Parasitologist
Dr. Mohsin Naqvi, Computer Trainee/Assistant Director (CDC)
Aamir Siddique Butt, Data Management Officer
Majid Mirza, Senior Entomologist

MCP/Sindh

Syed Shariful-ul-Hussain, Computer Trainee/Senior Evaluator
Sumar Sadruddin, Computer Trainee/Epidemiologist
Dr. Ghulam Rasool Shaikh, Director of Malaria

MOH/Pakistan

Dr. Syed Mohsin Ali, Director-General
Mr. Faris Rehman Khan, Secretary of Health

MOH/Punjab

Dr. Aftab Ahmed, Director, CDC

Pakistan Child Survival Project

Dr. Duane Smith, Chief of Party
Dr. Theo Lippeveld, HIS Advisor
Zainab H. Barlas, Information Manager

USAID/Islamabad

Barbara Spaid, Acting Chief, HPN
Dr. Rifaq A. Ismail, Project Officer, MCP II

6. Itinerary

February 1992

- 12 Left USA
- 14 Arrived Islamabad
- 15 Meetings with Dr. Rifaq and Mr. Mujahid
- 16 Attended USAID-sponsored computer training course; computer installation, DOMC
- 17 Meeting with Pakistan Child Survival Project staff; computer installation, DOMC
- 18 Visit to Rawalpindi District Health Office
- 19 Meetings with Drs. Carroll and Rifaq at USAID; arranged travel to provinces
- 20 Computer installation and data entry, DOMC
- 22 Computer installation and data entry, DOMC
- 23-25 Data entry and program rewriting, DOMC
- 26-27 Teaching of computer course trainees
- 28 Travel, Islamabad to Peshawar

March 1992

- 1-3 Computer installation and training, NWFP/MCP
- 4 Travel, Peshawar to Quetta; examination of computer installation

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- 5-8** **Computer installation and training, Baluchistan/MCP**
- 9** **Travel, Quetta to Hyderabad**
- 10-12** **Computer installation and training, Sindh/MCP**
- 12** **Travel, Hyderabad to Lahore**
- 13-16** **Computer installation and training, Punjab/MCP**
- 17** **Travel, Lahore to Islamabad**
- 18-19** **Debriefing and report writing**
- 20** **Depart Islamabad for USA**