nourished children, the group at highest risk of death, participated in the feeding program. At the same camps, the public health services were also relatively understaffed but were responsible for immunizations, disease and death surveillance, communicable disease control activities, home visits and followup, bringing defaulters back for therapeutic feeding, and so on. These camps were not unique. In fact, they were rather typical in terms of the excessive emphasis on clinical, curative medicine.

Summary

Many of the conditions no doubt have already improved in those areas where international relief efforts are under way. The comments made here are based on observations by my colleagues and myself during the emergency phase of the famine and refugee crises and perhaps should be considered more as lessons learned that are better applied to newly emerging situations than to those relief efforts already in progress. In summary, the highest priority emergency health requirements identified during the current crisis have been, in my opinion, the provision of food and supplementary and therapeutic feeding, measles immunization, vitamin A prophylaxis, and oral rehydration therapy, plus the two management issues—rapid needs assessment with continued monitoring and adequate allocation of resources to prevention and control activities.

One final note—from discussions with colleagues who were involved in the 1973–74 drought and famine in Africa, this crisis appears to be a repeat. A comprehensive, long-term approach would be beneficial so that these emergency responses are no longer necessary.

Introduction of a Microcomputer for Health Research in a Developing Country—the Bangladesh Experience

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Synopsis ....

In November 1984, a powerful microcomputer was taken to Dhaka, Bangladesh, to aid health professionals at the National Institute for Preventive and Social Medicine (NIPSOM) in processing and analyzing locally derived health data. It was anticipated that this installation and an accompanying workshop on the analysis of health, population, and family planning data by microcomputer would enable the faculty at NIPSOM to share the results of their research with other public health and medical colleagues, provide administrators with timely analyses for policy or program implementation, and assist with internal management of information essential to the workings of the institute.

This paper provides (a) a brief overview of NIPSOM and its recognized need for computing assistance, (b) a brief description of the 2-week workshop, (c) a description of the assembled software and hardware, and (d) a summary of the experience and the various problems encountered in bringing the computer to Dhaka and in teaching its use to educated health professionals with no prior computer contact.

When attempting to understand the etiology of some disease condition, medical researchers in technologically less developed nations often find that accumulated data cannot be properly analyzed by available manual methods. Computers for automated processing and analysis of data have generally not been available to health workers in many of the poorer nations. When researchers in these countries have had funds available to buy a computer, they have often found the computer to be difficult to program and maintenance costs to be more than they had budgeted. Moreover, they have been unable to retain the services of programmers offered higher salaries in the private sector. As a result, health researchers in the less developed areas of the world have usually had to rely on manual collection and tabulation methods for producing even the most elementary analyses.

Use of Microcomputers

Microcomputers are currently being used in most of the industrialized nations for a wide variety of tasks, including collection of routine health information and maintenance of community-based disease registers (*1*).

Within the past few years, the World Health Organization conducted a pilot study in various Egyptian communities which illustrated that a microcomputer-based information system can also be maintained in less developed regions of the world (*2*). Public officials in other developing nations have been using microcomputers for a wide variety of functions, examples of which are summarized in a 1983 U.S. Government publication (*3*). Agricultural research and extension scientists working in developing nations have recently been turning to microcomputers for help in data collection, processing, and analysis—the same tasks that need to be done by epidemiologists and other health professionals. The Department of Agricultural Economics at Michigan State University has published a series of working papers describing its overseas experience with microcomputers and selected statistical programs (*4,5*). Anthropologists have also used microcomputers for processing data in the field (*6*).

Bouckaert and his colleagues at the Epidemiology Unit of Catholic University in Louvain, Belgium, have recently described their experience with the use of microcomputers in a long-term project focused on epidemiologic aspects of natural disaster (*7*). This was the only published journal article we could find documenting the experiences of epidemiologists with this new information-processing technology. The only major problems they reported regarding use of the microcomputer in the field were lack of electrical stability and power breakdowns caused by electrical storms.

Constraints placed on the operation of a computer in what is often termed a "hostile" environment were mentioned by the authors of most of the documents we reviewed. Case stated, for example, that "Introduction of unfriendly elements like extremes of temperature and humidity, contamination by dust and other foreign matter, and general abuse in the field can quickly reduce a computer to electronic junk" (*6*). Ingle and his associates, in an excellent report on microcomputers in developing countries, wrote that the "paramount and most common problem for microcomputers in developing countries is dirty power—electrical power problems" (*8*). Both dust and humidity were also mentioned, as was the need for adequate local maintenance and repair services.

'With the increased availability of microcomputers, it appears that the gap between developed and less developed countries with respect to the analysis of research data could be substantially reduced.'

With the increased availability of microcomputers, it appears that the gap between developed and less developed countries with respect to the analysis of research data could be substantially reduced. Yet several areas of concern remain:

- Can computer technology be easily exported to poorer countries, given bureaucratic import restrictions, unfavorable climatic conditions, and electrical problems?
- Is it feasible to train intelligent but computer-illiterate professionals, in a relatively short period, to operate a computer, or would training costs greatly exceed the cost of the equipment?
- Is software available that is both powerful enough to process sizable data sets and easy enough for researchers to use? (The microcomputer and its component parts are usually referred to as "hardware," while the set of instructions telling the machine what to do is termed "software.")

To answer these and other related questions, we took a microcomputer, a printer, and assorted software to the National Institute for Preventive and Social Medicine (NIPSOM) in Dhaka, Bangladesh, in November 1984 and introduced them in a 2-week educational workshop. In this presentation, we will provide a detailed account of the experience, focusing as well on recent developments in microcomputer hardware and software that are of importance to investigators in developing countries.

The Bangladesh Experience

NIPSOM is the principal postgraduate educational institution in Bangladesh responsible for preparing physicians and others for work in the public health field.

As part of its assistance to NIPSOM, the United Nations Fund for Population Activities (UNFPA) had contracted with the Western Consortium for the Health Professions, Inc., a nonprofit firm based in San Francisco, CA, for services related to manpower and institutional development. An American public health physician was assigned by the Western Consortium to Bangladesh and given additional assistance in development activities by short-term consultants. In a related contract, mention was made of a microcomputer, but no progress had been made.

The idea of a workshop on research methods, incorporating a microcomputer, was suggested by the Western Consortium to the NIPSOM faculty in April 1984. The concept was accepted, and arrangements were begun, both in the United States and Dhaka, to procure the necessary software and hardware for importation.

At first, it was suggested by NIPSOM personnel that the computer be purchased locally in Dhaka through a distributor of IBM and Tandy products. This suggestion was rejected by both NIPSOM and the Western Consortium because there was no guarantee that the computer, with various internal modifications to expand its capacity and to enhance performance, could be delivered in working order prior to the scheduled start of the workshop in November. Subsequent discussions with donor-agency personnel in Dhaka indicated that these concerns were warranted; local delays of 4 to 6 months were described as being realistic, with longer delays for internal boards or chips necessary to enhance the computer for full utilization of more powerful new software.

Workshop. The purpose of the 2-week workshop was to teach epidemiologic research methods to the NIPSOM faculty and to show how a microcomputer could be used to facilitate the collection, processing, and analysis of newly derived health and population data. Fifteen faculty members participated.

One day was spent in setting up the equipment. Classes were scheduled on the 9 remaining days for 2 to 3 hours each day; additionally, five core members of the faculty group returned each day for another 2 hours of personalized instruction on the technical aspects of the hardware and software.

The workshop was divided into five parts: (*a*) introduction to population-based investigations, the microcomputer, and an example data set; (*b*) measurements and errors of measurement; (*c*) measures of association and causation; (*d*) experimental studies; and (*e*) nonexperimental (observational) studies. Integrated into each daily instruction period was either a presentation or a discussion of microcomputer hardware and software.

To serve as a practical example, a questionnaire and an artificial data set were prepared for the workshop participants. Though fictitious, the data were derived in principle from two recently published journal articles on tetanus in Bangladesh newborns (*9,10*). A two-page questionnaire was constructed for an artificial cohort study of 1,000 births, aimed at identifying the determinants of neonatal mortality. Specific research questions were identified and analyses were performed to answer the questions posed. For example, when the intent of the analysis was to determine if there is a benefit with respect to neonatal mortality—independent of the birth weight of the infant—in having trained instead of untrained birth attendants, the BMDP 4F program (described later in this paper) was used. The program provided multiway frequency tables showing the risk of neonatal mortality among infants delivered by trained and by untrained attendants, stratified on three categories of birth weight. The data were presented in graphs as well as tables, to show the various associations clearly.

After the workshop was completed, further intensive training was provided, during an additional 3 days, for the five core faculty members, four of whom attended on a regular basis. Two of the five were subsequently appointed by the director of NIPSOM to be in charge of the newly created Computer Center and to start a training program for other faculty members and students.

Software selected. Three types of computer programs were considered essential for the Bangladesh project. First, we felt it necessary to generate a program for entering data into the computer that would require limited instructions and could be used by medical and public health students or inexperienced personnel. Second, we wanted a powerful, but widely used, statistical package that would be of immediate use yet would allow for future growth. We envisioned that once the power of the microcomputer was fully appreciated, the NIPSOM faculty would most likely request additional statistical consultation to explain some of the newer techniques of analysis. Finally, we wanted a computer program to illustrate in graphic form the results of the various analyses.

Since the workshop had to be taught in a relatively short period, all programs had to have clear documentation and be relatively easy to learn. The identified software would then help determine the optimum hardware (see the box for a complete listing of our selections in both categories), since the programs could run only on certain specific computers.

For data entry, we purchased PFS:File (*A*), a simple database management system that allowed for the construction of up to 32 entry screens. Each screen (or image on the computer monitor) is a replica of a single page of a questionnaire or an interview form. The person entering the data merely copies numbers or words from the written page onto the screen, via convenient programmed skips from one item to the next. After the data are entered, they can be sorted, edited for values outside a specified range, and corrected with minimal effort. The instruction book for this software package is very well written, and the instructions can be learned in a relatively short time. Most important, the data can be stored in the computer in the form of an ASCII (American Standard Code for information interchange) file.

ASCII is the most generally used format for presenting textual information and exchanging it among computers. Under this code, each of the 96 characters (letters, numbers, and symbols) is given a unique binary number code that can be understood by many other programs. Since software packages are frequently not designed to interrelate with programs produced by other companies, the ability to convert the PFS data to an ASCII file was a very important feature. Unfortunately, the instructions for the conversion are not clearly described in the booklet accompanying PFS:File. In setting up the system in Los Angeles, we had to telephone the manufacturer of PFS for clarification on performing this conversion step. Special instructions were subsequently written by one of us (R.R.F.) in Dhaka to supplement the published material.

The statistical package selected was BMDP Statistical Software (*B*), which had recently been converted for use on IBM personal computers. It required 640 kilobytes (K) of random access memory (RAM), an 8087 math coprocessor, and a 10-megabyte (MB) fixed disc. BMDP is divided into a series of modular programs, each with an identifying number. All of the modules are available on mainframe computers in academic institutions

Microcomputer hardware, software, and instruction books taken to Bangladesh

Hardware

1. IBM portable personal computer, 256 kilobytes (K) of internal memory, 2 disc drives
2. Six-Pak Plus memory expansion and 1/0 card (includes 64 K)
3. 320 K of additional memory expansion (total memory is 640 K)
4. 8087 math coprocessor
5. IBM memory expansion unit 001 (includes a 10-megabyte hard disc)
6. Holding rack for portable computer
7. Epson FX-80 printer (dot matrix)
8. IBM parallel 6-foot cable from computer to printer
9. Topaz ultra-isolator, 1 kVA, model 91001-11
10. Topaz voltage regulator, 1 kVA, model 77101-30

Software

1. PFS:File
2. PFS:Graph
3. BMDP Statistical Software Master (2 copies)
4. BMDP 1D—simple data description
5. BMDP 2D—detailed data description, including frequencies
6. BMDP 3D—comparison of two groups with *t* tests
7. BMDP 5D—histograms and univariate plots
8. BMDP 6D—bivariate (scatter) plots
9. BMDP 7D—description of groups (strata) with histograms and analysis of variance
10. BMDP 4F—two-way and multiway frequency tables
11. BMDP 4M—factor analysis
12. BMDP 7M—stepwise discriminant analysis
13. BMDP 1R—multiple linear regression
14. BMDP 2R—stepwise regression
15. BMDP AR—derivative-free nonlinear regression
16. BMDP 2T—Box-Jenkins time series analysis
17. BMDP 2V—analysis of variance and covariance, including repeated measures

Instruction books

1. IBM Disc Operation System (DOS 2.10)
2. IBM Disc Operating System (DOS) User's Guide
3. IBM Basic
4. IBM Guide to Operations, Portable Personal Computer
5. PFS:File User's Manual
6. PFS:Graph User's Manual
7. BMDP Statistical Software (1983 revised printing)
8. BMDP User's Guide
9. BMDP User's Guide to BMDP on the IBM PC
10. Epson User's Manual

throughout the United States and Europe. Fourteen of these modules were purchased for the NIPSOM faculty. Although we anticipated that only a few of these programs would be used in the beginning, we added the other modules to allow the faculty to expand their use of the system.

The NIPSOM workshop represented the first time that this sophisticated series of statistical programs had been presented to a group from a technologically less developed nation. (The series was released for commercial sale in summer 1984.) The workshop instruction focused on only two programs, 1D (simple data description) and 4F (two-way and multiway frequency tables). The formatting steps necessary to set up these two programs, however, apply to other modules as well. Therefore, in a sense, the workshop participants have become trained in use of the entire set of programs (providing, of course, that they develop an understanding of the statistical principles of the more advanced programs).

BMDP has an excellent book that explains each statistical module. A smaller book prepared for use of the modules with the microcomputer was less informative, and numerous telephone calls to BMDP while we were setting up the system in Los Angeles were required to clarify the instructions. One of us (R.R.F.) eventually added a series of notes to the BMDP instruction booklet and prepared a separate, step-by-step set of instructions for the NIPSOM faculty.

The final program selected was PFS:Graph (*A*). The instruction book for this graphics program was written in the same clear manner as PFS:File, and it used many of the same key strokes. The program could be used to graph the results from the BMDP program or could be used directly with the PFS:File program. All output was printed on a dot-matrix printer.

Each of the software packages had to be prepared for use by the microcomputer. This usually involved some individual programming steps that linked the computer to the fixed disc and then to the printer. Because the software packages were not all sold by the same company, it took some time to coordinate all of the programs so that they would work together. Fortunately, we were able to assemble the complete system in the United States and do the linkage work before leaving for Bangladesh.

Hardware selected. We selected five major pieces of hardware equipment: the microcomputer, a memory expansion unit with a 10-MB fixed disc, a dot-matrix printer, a voltage transformer, and a voltage regulator.

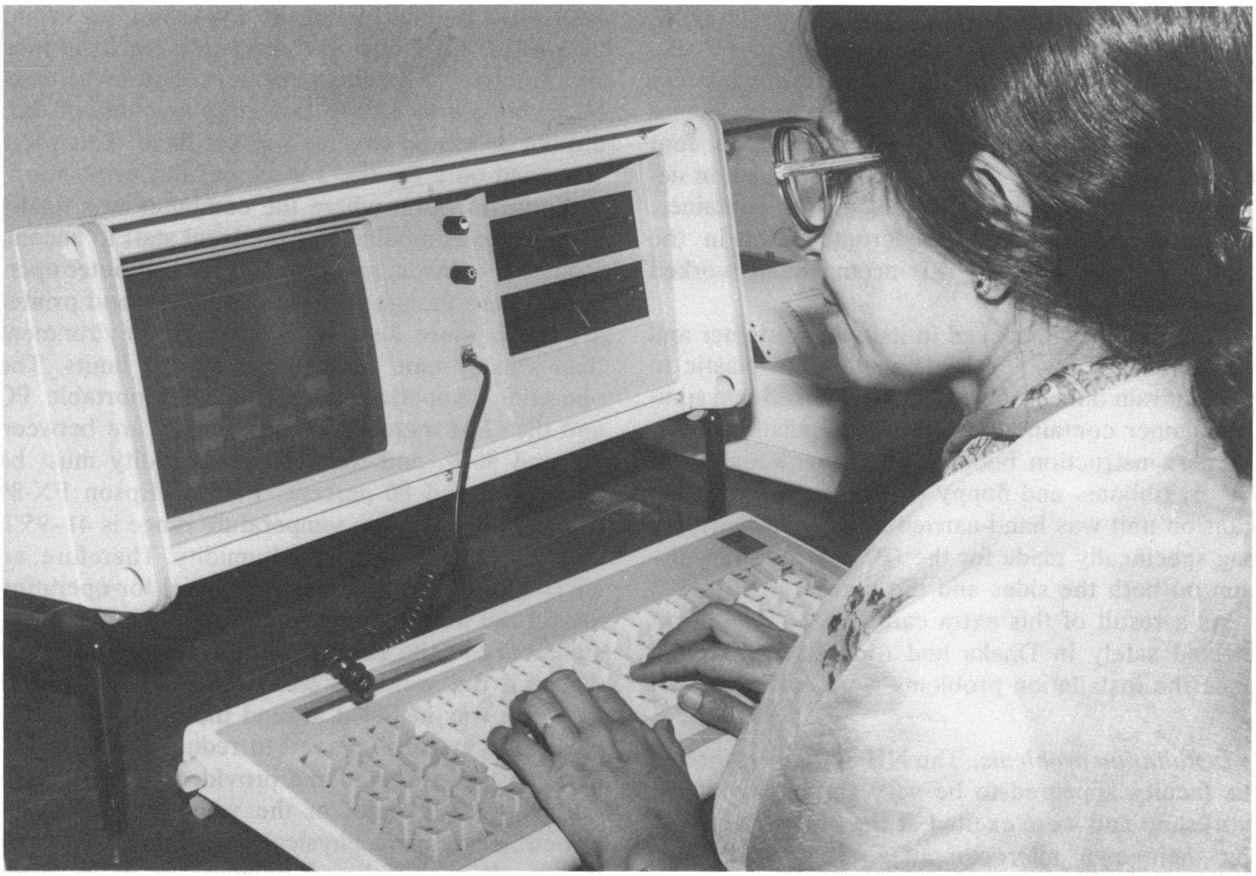
The microcomputer was an IBM portable personal computer (PC) with 640 K of RAM and an 8087 math coprocessor (*C*). Maintenance service is available in Dhaka for IBM products—the major reason for selecting the IBM computer. The portable model was selected because it is durable, is reasonably transportable (the entire unit weighs approximately 30 pounds with its sturdy case and cover), has a built-in 9-inch monitor, and uses the same system board as the IBM PC XT.

The memory expansion unit for the IBM computer was necessary only because some of the software required the availability of a 10-MB fixed disc. Unlike many competing companies, IBM does not have a fixed disc that fits in its portable. Therefore, a memory expansion unit (which has room for a second 10-MB fixed disc and various other internal boards) was purchased. This unit was the most delicate piece of equipment taken to Dhaka; it was hand-carried during the entire trip by one of us (R.R.F.).

The dot-matrix printer was an Epson FX-80 (*D*), selected because of its excellent reputation for durability and high-quality graphics. Service for the printer also is available in Dhaka.

Electrical current in Dhaka is 220 volts, but the hardware equipment required 110 volts. Thus, a voltage transformer was required. This heavy-duty piece of equipment, purchased from Topaz (*E*), also prevents damage to the computer caused by temporary electrical current spikes, which may go up to 500 volts or more. A voltage regulator was also required to prevent unusual declines in electrical current (or "brownouts") from damaging the equipment. Thus, the computer, memory expansion unit, and printer were all shielded from the potentially harmful effects of local electrical problems in Dhaka.

All of this equipment was purchased and tested by one of us (R.R.F.) in Los Angeles to ensure that it was functioning properly. The first portable computer we acquired had to be returned for a different machine when intensive testing identified a major problem. In addition, the instructions for the special wiring of the voltage transformer were in error, a fact that was finally discovered after a number of telephone calls to the manufacturer. These problems could not have been solved in Dhaka, even if the equipment had been available there. Thus, it was fortunate that we were able to obtain the approval of NIPSOM and UNFPA for purchase of the equipment before we left the United States.



A NIPSOM faculty member exercises her new computer skills

Problems and solutions. For the successful introduction and utilization of the microcomputer in Bangladesh, four categories of problems needed to be solved: approval and clearance, transportation, installation, and education of the NIPSOM faculty in use of the equipment.

Approval and clearance problems. Instead of imposing a computing system on the NIPSOM faculty, we wanted to obtain a consensus from them before we purchased the equipment. After months of communication—by telex, telephone, and letters—focusing on features of hardware and software, availability of service, transportability, and approval criteria of Bangladesh government agencies, we felt that a consensus on the technical aspects of the computer equipment had finally been reached. After the equipment was purchased, and while it was being assembled in the United States, however, it became apparent that other, less defined issues were still unresolved.

While the computer was perceived by the NIPSOM faculty as representing a significant step in the institution's development, other Bangladesh government agencies either resented the potential increase in prestige that would be accorded to NIPSOM or felt that the faculty were not ready for such sophisticated technology (Roy G. Smith, Western Consortium and the University of Hawaii, personal communication, April 9, 1985).

Even with the active assistance of high officials in the Bangladesh government and in UNFPA, final customs clearance was not obtained until the day before one of us (R.R.F.) brought the equipment into the country. After the computer was set up at NIPSOM, several local officials at various international agencies expressed surprise on learning that final approval had been granted, since they had been trying unsuccessfully for up to 2 years to import microcomputers for other educational or governmental institutions. On reflection, we feel that to ensure the success of such a venture as ours, it is imperative to learn as much as possible about such important—but often ill-defined—restrictions on the importation of new technology.

Transportation problems. Even though the IBM portable microcomputer was assumed to be reasonably durable, we were not sure how much stress it could take in being transported halfway around the world. Consequently, we purchased a foot locker, padded its interior with foam insulation derived from the IBM cardboard packing container, and packed the portable microcomputer in the locker with great care. This arrangement worked exceptionally well.

The printer was packed in its own container and wrapped with a waterproof, heavy-duty plastic to prevent rain damage. Other boxes packed in a similar manner contained the voltage regulator; transformer; instruction books; and a year's supply of paper, ribbons, and floppy discs. The memory expansion unit was hand-carried in a canvas carrying bag specifically made for the IBM PC, with insulation on both the sides and the bottom.

As a result of this extra care, all the equipment arrived safely in Dhaka and functioned perfectly once the installation problems were solved.

Installation problems. The NIPSOM director and his faculty appeared to be very supportive of the workshop and were excited at the prospect of having their own microcomputer. They were well aware that many of their research findings were not published in international journals because they were either unable to process and analyze the collected data (collection and analysis were usually done by hand) or unable to perform the higher level of statistical analyses required for many publications. Even the production of graphs for slide shows often cost more money than was available. Thus, most of the faculty were very cooperative and were willing to provide space on their floor for the computer.

We encountered two problems with the physical plant, one electrical and the other the choice of a suitable room.

The first room made available had no electrical power, and the local electricians could not install the computer. The second room had a functioning 220-volt outlet but, when we checked the voltage with a portable voltage tester brought from the United States, we found that the three outlet wires (a "hot" wire, a "common" wire, and the ground wire) had melted together in the wall of the building because of gradual corrosion caused by high humidity. Thus, all the wires were "hot." This problem also could not be solved by the local electricians.

A third room was identified, a former classroom with one wall of windows. While the rainy season had ended by the time of the workshop, prevailing high winds blew dust in through the cracks around the windows. All equipment items had to be carefully covered to ensure that large amounts of dust did not enter and adversely affect them. This room was used only for the 2 weeks of the workshop.

A fourth room, where the computer was finally installed, was modified by the local staff to accommodate the unique requirements for computer operation. Even though the microcomputer and printer are much more durable in a hostile environment than a mainframe computer, there are limits. The operating temperatures for the IBM portable PC and the IBM memory expansion unit are between 60° and 90°F, and the relative humidity must be between 8 and 80 percent. For the Epson FX-80 printer, the operating temperature range is 41–95°F with 10–80 percent relative humidity. Therefore, an air conditioner was deemed essential for operation during the hotter, more humid months; it was installed above the entry door. To safeguard against dust, all the windows were sealed, and weather stripping was installed around the door. Since the air conditioner also served to reduce the humidity during the wet season and provided air circulation during the remainder of the year, the room furnished an excellent physical environment for both the operators and the equipment.

Educational problems. When we first introduced the concepts of research design and use of the microcomputer to the workshop participants, it became clear that they were reasonably familiar with the former but completely uninformed about computer operations. The faculty had no experience with a computer, and most of them could not type; thus, they found it difficult to use the keyboard effectively as a command or data entry device.

A telling story of the level of expertise at the beginning involves the game "Donkey," which is supplied by IBM with the disc operating system. In the game, a two-lane highway appears on the screen, and a car is seen racing down one side of the street. Suddenly a donkey appears on the road just ahead of the car. The operator must hit the space bar on the keyboard to move the automobile to the second lane to avoid hitting the donkey. If the operator is too slow, the car hits the donkey and sends pieces flying in all directions. The game is essentially one of eye-hand coordination. For one reason or another, at the beginning of the workshop the NIPSOM faculty members could not avoid hitting the donkey. Two weeks later, all that had changed.

For most of the workshop participants, the instruction was given via lectures, with some limited discussion. Since no tests were administered, there was no way to evaluate whether the material was truly understood. All faculty members were encouraged to participate, but since most were not relieved of their administrative and educational responsibilities, attendance at times was uneven. The detailed structure of the course outline and the readings provided to the participants, however, made it easy for them to catch up on missed material.

At the beginning of the workshop, the NIPSOM director designated three faculty members to receive detailed, "hands-on" instruction. One was a biostatistician, the second a specialist in maternal and child health, and the third an epidemiologist. After the first day, two more faculty members appeared who desired the more intensive training: one was a community medicine specialist, the other an epidemiologist. At first, the instructor (R.R.F.) resisted the presence of five persons in the core group and gave more attention to the original three. It soon became apparent, however, that the two new members were highly motivated; by the end of the workshop one of them was acknowledged by all as the local computer expert. We learned an important lesson from this experience: it is better to allow for the emergence of a "natural" expert than to try to assign people (based on position) to learn something that they may not find easy to grasp or understand.

Both PFS:File and PFS:Graph were relatively easy to explain; each of the five core members was able to use them with minimum instruction. They had difficulty, however, in understanding the commands for the BMDP program (that is, identifying the variables, stating the transformations, describing the desired tables, and the like) and figuring out how to link the PFS programs with the BMDP program. Repeatedly, it was emphasized to the workshop participants that books rather than instructors are the ultimate authority. If there was a point they did not understand, they were encouraged to seek the answer in the various reference manuals we had brought to Dhaka.

Most of the participants were reluctant to read the manuals, possibly because of the technical nature of the explanatory material. In general, they tried to remember the detailed instructions they had been given during the workshop or the individual tutorial sessions. Unfortunately, computer instructions are difficult to retain for more than a short time unless they are frequently practiced. Thus, most participants had problems the following day remembering what steps should be used.

To remedy this, and to provide information on linking together the various programs, one of us (R.R.F.) wrote a set of instructions for the faculty after hours on his lap-sized computer (TRS80 Model 100; reference *F*) and printed them out the following day on the dot-matrix printer. Each of the five participants was encouraged to assemble a notebook with the set of detailed instructions, to serve as a reference. Besides the linking instructions, the material also covered such topics as turning the machines on and off and listing all reference books as part of a checkout system.

From the instructor's standpoint, the last day of the specialized instructions was the most heartening. Given the level of insight on his arrival, it was very gratifying during the last 2 days to see the core group of four (by now, one had become somewhat erratic in his attendance) create for one of their own data sets an entry screen (using PFS:File), enter information on 25 cases, set up the format for the desired BMDP analyses, and print out the final tables. A sample output was given to the instructor as he left for the airport.

Clearly, it was possible to teach a relatively complex series of instructions to a computer-illiterate group in a relatively short period of time. The only remaining question is, Will they maintain their new skills and add to them in the coming years? This issue will be briefly addressed in the section on evaluation.

Two final points deserve comment. It was suggested to the NIPSOM director that he appoint one or two persons to head the new Computer Center; this involved assigning both responsibility for the equipment and a key to the computer room. He elected to appoint two persons. When the instructor (R.R.F.) approached one of them about practicing in the late afternoons after the others had gone home (NIPSOM closes at 2 p.m.), this person, obviously nervous, reluctantly declined to follow his advice. As it turned out, in Bangladesh, if a piece of equipment becomes inoperative, there is a tendency to blame whoever may have been using it at the time. Since salaries are extremely low in relation to the value of the equipment, no one wants to be in a room alone with a potentially malfunctioning computer when blame is so easily assigned. Instead, most prefer to work in groups of at least two so that if something goes wrong, someone else can explain that the occurrence was accidental. It is not clear how this will work out, since it is not always feasible to have two persons in the computer room.

The second point involves use of staff rather than faculty to operate the computer. After many discus-

'The experience demonstrated that it was possible to assemble and transport a powerful computer system to a technologically less developed country and to train, in a relatively short period, a group of intelligent but computer-illiterate professionals to use the computer in an effective manner.'

sions with computer people in Bangladesh, it became apparent that trained computer operators were difficult to keep in an academic environment because of the much higher salaries offered by private industry. Thus, by restricting the training to faculty members, NIPSOM would avoid relying on staff to run the Computer Center and would encourage the faculty to maintain their newly acquired skills. It was emphasized to the workshop participants that they should train their students in computer use and thus provide an expanding pool of computer-literate persons to conduct research studies and the like.

Evaluation

Our intention in the workshop was for the faculty to learn new analytic research strategies and learn how to use a microcomputer for doing their analyses. No tests were given, at either the beginning or the end of the workshop, because we felt they would have discouraged faculty participation. Our evaluation is therefore based on informal impressions extending beyond the immediate time of the workshop.

One of the authors (R.M.) returned to Bangladesh 3 months after the end of the workshop to observe the state of affairs. He noted that the computer continued to be used on a frequent basis by two of the core group of faculty. At the same time, however, the NIPSOM administration expressed a strong desire for additional training assistance to enhance the knowledge of the core faculty and to teach other faculty members who were unable to attend the initial workshop to use the computer. (A followup workshop and a more complete evaluation of the program were conducted in June 1985 by Jeffrey Gould, Western Consortium and the University of California, Berkeley, and a report will be forthcoming.)

In addition, we received a letter this spring from one of the faculty participants in Bangladesh, reporting that the graduate students at NIPSOM were collecting data for their research projects and were expected to use the computer in the coming months for their analyses. This same letter stated that no problems had been encountered with the operation of the computing equipment during the first 4 months (Sadiqa T. Khanam, personal communication, March 13, 1985).

Conclusion

As part of a 2-week workshop on the analysis of population, family planning, and health data by microcomputer, a portable IBM microcomputer and other equipment were taken to NIPSOM in Dhaka, Bangladesh. While the emphasis of the workshop was on the analysis of various types of data, most participants appeared to be especially interested in learning more about the microcomputer and how it could be used.

At the beginning of the workshop, none of the 15 participants had any knowledge of a computer. Two weeks later, a core group of five faculty members had been sufficiently trained to enter data of their own, using a database management program; to conduct sophisticated analyses, using an advanced statistical analysis program; and to plot results in graphic form, using a dot-matrix printer.

The experience demonstrated that it was possible to assemble and transport a powerful computer system to a technologically less developed country and to train, in a relatively short period, a group of intelligent computer-illiterate professionals to use the computer in an effective manner. Equally important was our discovery that the entire process of decisionmaking and granting of approval by foreign governmental officials can be lengthened and made otherwise difficult by lack of consensus on the technology and by the placing of restrictions on its introduction.

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Equipment

A. Software Publishing Corporation, 1901 Landings Drive, Mountain View, CA 94043.
B. BMDP Statistical Software, 1964 Westwood Blvd., Suite 202, Los Angeles, CA 90025.
C. IBM Corporation, 445 S. Figueroa, Los Angeles, CA 90071.
D. Epson America, Inc., Torrance, CA 90505.
E. Topaz, 9150 Topaz Way, San Diego, CA 92123.
F. Radio Shack, Tandy Corporation, 300 One Tandy Center, Fort Worth, TX 76102.

Childbearing Characteristics of U.S.- and Foreign-Born Hispanic Mothers

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Synopsis

This study compares maternal and infant health and sociodemographic characteristics of U.S.-born and foreign- or Puerto Rican-born Hispanic mothers and their babies, using data from the national vital statistics system and the 1980 National Natality Survey. While nearly half of all Hispanic mothers and Mexican and Puerto Rican mothers were born in the United States, less than 10 percent of Cuban and other Hispanic mothers were U.S. born.

Compared with foreign- or Puerto Rican-born Hispanic mothers, U.S.-born mothers tended to be younger, to have had fewer high-order births, to be less likely to receive delayed or no prenatal care, to have higher educational attainment, and to be more likely to be unmarried.

The incidence of low birth weight among infants born to Hispanic mothers, particularly Mexican and Cuban women, was relatively low. When the proportions of low birth weight were examined by nativity status, infants born to foreign- or Puerto Rican-born women were consistently less likely to be of low birth weight. In an effort to account for these findings, the mother's smoking status before and during pregnancy is examined. Compared with non-Hispanic mothers, Hispanic mothers were much less likely to have smoked before or during pregnancy. These data are examined to see if they account for the better outcome as measured by birth weight for Hispanic births, especially those to foreign- or Puerto Rican-born women.

To examine differences in childbearing characteristics among U.S.-born and foreign- or Puerto Rican-born Hispanic mothers in the United States, birth statistics for 1981 compiled by the National Center for Health Statistics (NCHS) and unpubished data from the 1980 National Natality Survey were used. Characteristics under study include the proportions of teenage mothers, higher order