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Installation of a Computerized EPI Information System

Turkey

May 8 - 19, 1989

Resources for Child Health Project

REACH



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EPI Information System**

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Edward Wilson

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Table of Contents

I. <u>Executive Summary</u>	1
II. <u>Background</u>	4
A. CEIS	4
B. Turkey	4
III. <u>Activities and Findings</u>	5
A. System specification	5
1. The EPI and its reporting system	5
2. Current and future analyses	6
3. Parameters for calculations	6
4. Data captured by the CEIS	7
5. The CEIS reports and graphs	7
B. System programming	8
C. Data entry	9
D. Testing	9
E. Training	9
IV. <u>Conclusions and Recommendations</u>	9

I. Executive Summary

At the request of the Turkish Ministry of Health, Primary Health Care Directorate, Expanded Program on Immunization Division (MOH/EPI), technical assistance in the installation and customization of a Computerized EPI Information System (CEIS) was provided to the MOH/EPI from May 8 - May 19, 1989 in Ankara, Turkey.

A CEIS was installed in the MOH/EPI in Ankara to allow the MOH/EPI to process and analyze at the central level routine vaccination and disease surveillance data and to feedback data to the provinces on EPI vaccine coverage, tetanus toxoid vaccine coverage, and communicable disease incidence. Prior to the CEIS the MOH/EPI was using a combination of LOTUS 1-2-3[™] and DBASE III PLUS[™] files with no standardized processing, report production, or feedback to the provinces.

The CEIS provides a standardized format for data entry, report generation, and graph production. It uses FoxBASE + for the data entry and report production and LOTUS 1-2-3 to produce the graphs. The CEIS in Turkey was customized to permit the specification of age groups for the EPI vaccines, to permit the specification of age groups for the communicable diseases cases and deaths, and to permit the monitoring of as many communicable diseases as the MOH/EPI would like, limited only by storage space on the computer. All of the reports, graphs, data entry screens, menus and prompts were translated into Turkish.

The conclusions and recommendations from this visit fall into two categories: those specific to the CEIS implementation in Turkey and those about the CEIS as a generic tool.

Conclusions and recommendations about the CEIS in Turkey include the following.

- The MOH/EPI team is an excellent group who should be able to make good use of the CEIS capabilities in helping to analyze the EPI's performance.
- Coverage data and disease incidence data for 1988 were entered while the consultant was in Turkey. The MOH/EPI should validate the coverage data entered by hand into the CEIS by comparing it with the data contained in its LOTUS 1-2-3 files. This will serve two purposes: verify that the data entered into the CEIS is correct and permit an explanation of any discrepancies between the two based on differing assumptions or population figures.
- The MOH/EPI should enter at least two more years of historical data for both cases and deaths and coverage. This will permit the evaluation of trends in coverage and disease incidence and allow the comparison of intrayear coverage rates and disease incidence.
- The MOH/EPI should enter current data on a monthly basis and test all of the reporting and graphing capabilities of the system,

determining which are most useful both for analysis at the central level and feedback to the provinces.

- All of the MDs in the MOH/EPI unit should be trained in the operation of the CEIS. This will, hopefully, offer them the possibility of easily accessing EPI data and stimulate them to do more analytical thinking about the EPI and its performance.
- The MOH/EPI should develop a list of enhancements that they would like to see made to the CEIS and keep a log of any bugs or problems that they have with the CEIS.
- Another technical assistance visit to Turkey should be made in August, 1989 to determine how the CEIS is being used, to correct any bugs in existing programs, and to provide some or all of the enhancements identified by the MOH/EPI. At that time a certain number of modifications to the system should be made that were not made this time. These include: a utility that allows the user to backup to diskette a single year's worth of data from any of the data bases and then delete that data from the active data base; a utility that allows the user to restore data from a diskette to an existing data base; an interface between Harvard Graphicstm and FoxBASE+ a modification of the graph programs showing data for a single year to display a comparison between the previous year's data with the current year's data; and a routine to allow the user to delete a coverage or a cases and deaths record. If several years of disease incidence data have been entered by the next visit, the consultant could assist the MOH/EPI in generating graphs showing average disease incidence trends for non-epidemic years.

Conclusions and recommendations for CEIS in general include the following.

- The CEIS currently is quite inflexible. Each installation involves a lengthy customization process. If a core set of functions could be agreed on and the program rewritten to be data driven (the user specifies the data and the program knows how to accommodate it), that would be a great improvement. This could be done in DBASE III PLUS or FoxBASE+ and has been done to some extent by Resources for Child Health consultant Mimi Church in Nepal. Her enhancements warrant close study.
- The technical and user documentation of the CEIS is scarce and makes the customization process difficult for a consultant who has not done it before. A concerted effort should be made to document, at least in summary fashion, each installation of the CEIS. The minimum system documentation would include a description of each system, the program structure, the operation of each procedure and the parameters required for each procedure. A user's guide should include a description of system operation, a description of all reports and graphs, an explanation of the data entry process, and details on backing up and restoring data and programs. These two

documents would require two to four days to produce and would allow other colleagues to understand and use the system more easily and other programmers to enhance the system more easily.

- A technical assistance visit of three weeks is the minimum for a first time installation visit. Two weeks were spent in Turkey because of time constraints both on the consultant and the EPI team. Three weeks would have provided greater opportunity to test the system, add additional system utilities, provide additional training, and develop more system and user documentation.
- It is essential to include, at least in the initial installation visit, an epidemiologist and a systems analyst/programmer. The epidemiologist can help determine which denominators should be used in calculating coverage for children and pregnant women and morbidity and mortality for the various diseases. The systems analyst/programmer, in addition to customizing/installing the system, can be of assistance in evaluating the information system and suggesting ways to improve reporting, better management indicators, or strategies for streamlining the system.
- FoxBASE+ should be used for all CEIS installations. FoxBASE+ facilitates the modularization of the computer programs by allowing user-defined functions, the declaration of public and private variables, and the passing of parameters between programs.

The consultant would like to express his appreciation for the cooperation and assistance provided by the entire EPI unit, and especially Drs. M.A. Biliker and Levent Eker.

II. Background

A. CEIS

The CEIS was originally developed by the South East Asia Regional Office of WHO (SEARO). It was written in DBASE III PLUS with an interface for the graphs to LOTUS 1-2-3. The CEIS was developed as a tool to help EPI managers better organize, process and analyze their data. It was designed to move the EPI manager's focus from adding up numbers to thinking about what the numbers mean. Both past and present versions of the CEIS provide a simple menu-driven system for entering data, producing reports, and generating graphs. The CEIS can be installed to collect and report on coverage data, cases and deaths data, funding data, training data, and coverage survey data.

Although the CEIS was initially developed at SEARO, it has been refined and installed in a variety of countries with the assistance of the Resources for Child Health Project (REACH) and through a WHO contract with a private company based in the Philippines, Data Transport Services (DTS). WHO, REACH, and DTS have approximately two year's worth of experience with the CEIS in 10-15 countries. For a summary of that experience, please refer to the minutes from the most recent CEIS consultative meeting in Washington, DC from April 24-26, 1989 (see appendix 1).

Over the past two years it has become clear that the CEIS is not really a generic tool, but a concept. There is no generic implementation of the CEIS. All implementations of the CEIS are different depending on the country and the programmer. The common elements of the CEIS are: it runs using DBASE III PLUS or FoxBASE+ and LOTUS 1-2-3 or Harvard Graphics; it provides a menu driven system for collecting data on coverage and disease incidence, and producing reports and graphs; and it should facilitate the production of reports that WHO requests from all of its members on immunization coverage and disease incidence.

There are advantages and disadvantages to the CEIS being somewhat vague. The main advantage is that it can be tailored to suit an individual country's needs and be very responsive. However, there is a price. The implementation process is slow, requiring a computer programmer to spend significant time at each site just to get the basic system up and running. Because much of the computer code must be rewritten for each installation, new bugs are likely to be introduced into each system, making support and maintenance an ongoing operation. Each system, being different, requires its own technical and user documentation, further lengthening the installation process.

B. Turkey

The MOH/EPI first expressed interest in installing and using the CEIS in February, 1988, during a visit by a WHO/UNICEF/REACH team (which included this consultant, Ms. L. Brenzel, REACH Health Care Financing Technical Associate, Dr. P. Claquin, REACH Associate Director for EPI, and Mr. A. Wylie, REACH EPI Advisor to the MOH/Philippines) to assist with a series of coverage surveys. The request was reiterated in March, 1989, during a subsequent visit by Dr.

Claquin. The MOH/EPI perceived that the CEIS would help integrate and simplify their data management operations.

The MOH/EPI collects monthly reports from all 67 provinces on vaccine doses administered by age group for both the childhood vaccines and tetanus toxoid and on the cases and deaths of communicable diseases by age group, including but not limited to the EPI diseases (see appendix 2). To date there is no set of standard reports produced by the MOH/EPI using either coverage or cases and deaths information. They generate reports and graphs based on internal needs or requests from the MOH. There is no systematic feedback of information to the provinces, although the MOH/EPI has begun experimenting with producing graphs on a quarterly basis as a feedback tool.

To handle the data from the provinces, the MOH/EPI developed capabilities for managing coverage and cases and deaths data, but not in an integrated way. They used LOTUS 1-2-3 to keep track of the coverage data, DBASE III PLUS to track the cases and deaths data, and Harvard Graphics to produce graphs. The data and programs were spread over 4 personal computers with two different operating systems, requiring many person-hours to do any aggregate analysis, production of reports, or generation of graphs.

III. Activities and Findings

During the two weeks of this assignment the technical assistance activities were divided into a number of categories: system specification and design, system programming, data entry, testing, and training. The primary contact and client for each phase was the MOH/EPI, although UNICEF was regularly briefed and consulted.

A. System specification

The system specification phase took about a day. It involved discussions with the EPI team on how the EPI works in Turkey, how reports are prepared and how they move through the system, how data is aggregated at each level, what the frequency of reporting at each level is, what the needs are at the central level for both data and analysis, what analyses or reports the MOH/EPI is currently generating, and what they would like to be able to do.

1. The EPI and its reporting system

In Turkey, EPI services are delivered at health centers, by private practitioners, and at hospitals. Each health center has from 2-4 health posts per health center with a midwife responsible for each health post. She does not vaccinate but provides other maternal and child health and family planning services.

Data on vaccinations and cases and deaths is aggregated weekly by the health center and sent to the province. This is scheduled to change to monthly soon with the caveat that if there is a problem (eg, an unusual rise in cases) the province will be notified by phone immediately. There appear to

be problems of under reporting both for vaccinations and cases and deaths. The extent of the problem is not known.

The province receives reports from its health centers and, in theory, from teaching hospitals and other hospitals in the province, but this does not happen on a systematic basis. This is cause for concern mostly for the reporting of communicable diseases cases and deaths. It is unclear what can be done to improve this.

The province aggregates its data monthly and sends it to the MOH/EPI in Ankara. In the past there have been some difficulties in getting the provinces to send their reports to Ankara on time. They traditionally have waited for all the health centers to report before aggregating their data. This could take a long time, especially in the eastern part of the country where transportation and communication are difficult. A new rule recently went into effect which seems to have solved the problem. The provinces are to report their data as soon as at least 75% of their health centers have reported. The rest can be reported the following month. The only difficulty with this system is that some provinces lump the previous month's late reports and the current month's totals together instead of submitting two separate reports. This should be corrected shortly with additional training by the MOH/EPI. The MOH/EPI currently gets 95% of its reports within 30 days of the end of the month. See appendix 2 for copies of the reporting forms.

The MOH/EPI enters the reports from the provinces on a monthly basis in either a LOTUS or DBASE file and produces graphs and reports as needed.

2. Current and future analyses

Currently, the MOH/EPI does no routine analysis of the monthly reports. They use their data to generate coverage figures nationally and by province on an ad hoc basis. They also calculate disease incidence by age group when requested by the Minister of Health or the Under Secretary of Health.

The MOH/EPI would like to be able to see on a national and provincial basis the EPI results over time and the current EPI results compared with current targets. They would also like to be able to look at the seasonal variations and the interyear comparisons of communicable disease incidence as well.

The MOH/EPI intends to feed back to the provinces either monthly or quarterly information on their own and other provinces' activities. The exact information to be fed back and its format is under discussion. Currently, graphs showing cumulative coverage results by month compared with the provincial target are being prepared and sent to the provinces, but not on a systematic basis.

3. Parameters for calculations

There are three important variables used in calculations in the CEIS: the denominator for coverage for children, the denominator for coverage for pregnant women, and the population figures used to calculate disease

incidence. There are a variety of possible data sources for these figures in Turkey.

Every five years a national census is carried out which produces population, birth rate and infant mortality rate (IMR) figures. These are the official national figures. Unfortunately, it can take a long time for a census to be finalized. Some figures from the most recent census in 1985 are still not official, such as the IMR. Projections are then made for the non census years based on the figures for the census year.

Every year the MOH does a mid year census of the catchment populations of all its health centers. Because the catchment areas encompass the whole country, these figures could be used as provincial population figures. However, there seems to be some doubt about the quality of the figures because they are not systematically verified or corrected. These are the figures that the MOH/EPI would eventually like to use in its calculations. They plan to begin verifying these figures and using them in the CEIS as soon as possible.

The MOH/EPI decided that the denominator for coverage for childhood vaccines would be survivors (rather than live births), for tetanus toxoid coverage among pregnant women it would be newborns, and for disease incidence it would be total provincial population.

The total population figure for each province was projected from the most recent official census, 1985. Newborns were calculated for each province by using the total population and multiplying by the birth rate. The birth rate was known by province. Survivors were calculated by subtracting the number of infant deaths estimated through the infant mortality rate. The best infant mortality figure available was from the 1980 census and it is a national figure. There were no provincial figures.

4. Data captured by the CEIS

The CEIS will contain data on coverage, disease incidence and population. The data collected is very similar to the data contained on the forms used by the MOH/EPI. There are some simplifications. For coverage data some of the age categories have been omitted. Only data on under ones and one to four year olds will be captured for the childhood vaccines and only the total number of doses given will be captured for each tetanus toxoid vaccine. For disease incidence, the data will be entered by age group but not by sex. Only the totals by age group will be captured. The MOH/EPI will capture data on approximately fifteen important communicable diseases and not on the 30 or so which are listed on the reporting form.

5. The CEIS reports and graphs

Because the MOH/EPI does not have a standard set of reports and graphs, the CEIS was developed to give them the generic set that a CEIS is supposed to provide. After working with these reports and graphs for a time, the MOH/EPI can determine whether the reports and graphs meet their needs and, if not, what modifications are required.

The CEIS produces five coverage reports, five cases and deaths reports, five coverage graphs and five cases and deaths graphs. For both coverage and cases and deaths the reports and graphs include a single year report for a single province or the summary of the entire country, a multiyear report for a single province or the summary of the entire country, and a single year report for all the provinces. For a more detailed description of the reports and graphs, see appendix 3.

B. System programming

The system programming took approximately 40-50 hours spread over the two week period. The bulk of the programming time was spent on modifying the graphs and reports and translating the reports, graphs, menus and prompts into Turkish.

The implementation of the CEIS in Turkey differs from most of the other implementations that the consultant knows about in several important ways. The data bases in Turkey are dynamic. In most implementations of the CEIS, the data bases are generated for a fixed number of years when the system is installed; the CEIS can only manage data for those predetermined years. In Turkey, records can be added as needed; the system is not limited to a specific time interval. In addition, the CEIS in Turkey can be used to track disease incidence for any disease, not only the EPI diseases, and any number of diseases.

In reprogramming the CEIS for Turkey, the consultant attempted to modularize the CEIS as much as possible. Modularization means that a program should perform a specific and well defined function, it should perform an entire function, and it should be self-contained except for explicitly stated variables that it either receives from the program(s) that call it or that it passes to the program(s) that it calls. The use of FoxBASE+ greatly facilitated this because FoxBASE+ allows user-defined functions, the declaration of public and private variables, and the passing of parameters between programs.

The consultant noticed that there seems to be a dearth of technical documentation on CEIS. This makes the first installation by a programmer a bit of a challenge. Unfortunately, having recognized this deficiency, the two weeks of time allotted for the consultancy did not permit the development of a detailed system manual or a full commenting of the computer code. In order to give some idea of what this implementation of CEIS does and how, a brief technical reference was drafted, see appendix 4. A detailed users manual was not developed either, although a draft description of the reports and graphs and some notes on data entry and backup were prepared, see appendix 3.

There are a couple of enhancements that should be made to the system during the next CEIS technical assistance visit. A utility for backing up a single year's worth of data from any data base and then removing that data from the data base should be developed. A utility to restore data to a data base from a diskette without destroying the data currently present should be developed. An interface with Harvard Graphics, possibly along the lines of

the CEIS/Nepal, should be developed. The graph programs that display one year's worth of data should be altered to include the display of the previous year's data also if it exists. There was not time to add these features during this visit.

C. Data entry

The MOH/EPI entered one year's worth of coverage data while the consultant was in Ankara. In addition, one year's worth of disease incidence data was imported from a variety of DBASE III PLUS files. The data entry was done by Dr. Levent Eker and his staff from the MOH/EPI.

D. Testing

Testing was done to check the data that was entered and to validate the results displayed in the graphs and reports.

The disease incidence data was taken directly from DBASE III PLUS files. After it was loaded, a selection of records was checked to make sure the conversion program worked correctly.

The coverage data was entered manually. Provincial totals by vaccine were produced and checked for gross errors. Over the next few weeks, the coverage data will be checked against the MOH/EPI's figures as recorded in their LOTUS spreadsheets.

As each report and graph was generated, the results were validated by manually totaling the figures in the database to make sure that no miscalculations were occurring.

E. Training

Dr. Levent Eker worked closely with the consultant during the installation of the system and was trained in all aspects of its operation. He in turn trained the data entry operators who entered the coverage data and demonstrated the system to his colleagues in the EPI unit and members of UNICEF.

Drs. Levent and Biliker discussed with the consultant the system's operation and maintenance. Data back up procedures were established; two sets of rotating backup diskettes will be used to backup the data once a month after it has been entered. Dr. Levent will be in charge of the system and will either perform or oversee all data entry, file backup and training.

IV. Conclusions and Recommendations

In general, the consultant felt that the CEIS installation process went quite well given the limited time period of this consultancy, two weeks. The CEIS in Turkey is a new tool that the Turkish MOH/EPI will have to experiment with and refine to meet their particular needs and circumstances. Ideally, the CEIS will be a tool that is both useful and dynamic. It should meet

present needs, give rise to new needs as the EPI and the MOH/EPI evolve, and be adaptable enough to meet those needs.

The conclusions and recommendations from this consultancy fall into two categories: those concerning Turkey in particular and those concerning the CEIS as a tool in general. All of the conclusions and recommendations are contained in the Executive Summary, section I.

Appendix 1

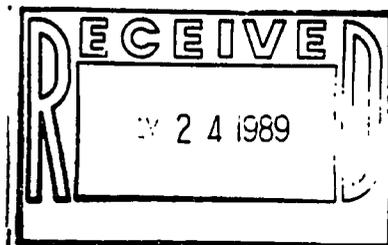
Minutes from CEIS Collaborative Meeting



Téléphone Central/Exchange: 791.21.11
Direct: 791 4167

In reply please refer to: EPI/I8/87/1-89
Prière de rappeler la référence:

Dr Pierre Clauquin &
Ms Ann Yanoshik
REACH
1100 Wilson Boulevard, 9th Floor
Arlington, VA 22209
Etats-Unis d'Amérique



18 May 1989

Dear Dr Clauquin and Ms Yanoshik,

Draft report on CEIS meeting, Washington 24-26 April 1989

We would like to thank you for your participation and the valuable contribution you made to this meeting. Your enthusiasm and the consolidated support by the participants of the CEIS made the meeting a success.

The draft report on this meeting is attached for your comments. We would appreciate receiving any comments by 30 June at the latest.

Best regards,

A handwritten signature in cursive script that reads "Carole".

Carole Chan
Technical Officer
Expanded Programme
on Immunization

WHO/EPI/GEN/89.5
Original: ENGLISH

***** D R A F T *****

REPORT OF THE MEETING ON GLOBAL STRATEGIES FOR
COMPUTERIZED EPI INFORMATION SYSTEMS

24-26 APRIL 1989

WASHINGTON D.C., USA

Indicators that will require specifications for such data transfer from Regional level to EPI Geneva may include:

1. Immunization coverage of EPI vaccines:

- * Reported number of doses of BCG, DPT, Polio, measles in children less than one year of age for each calendar year, by country.
- * Reported number of doses of TT2 and any booster doses for pregnant women and/or women of childbearing age for each calendar year, by country.
- * For polio vaccine, reported numbers, or percentage coverage, for third dose or second dose (if this is the last), by district, by quarter.
- * Coverage surveys - The utility of these data is being reviewed by EPI Geneva to determine whether this section should be retained for sub-national survey data.

2. Cases of EPI diseases.

- * Reported number of each of the seven diseases (neonatal tetanus reported separately from total tetanus) by country for each calendar year.
- * For polio, number of reported cases by category:
 - vaccine associated
 - wild virus/imported
 - wild virus/indigenous
 - others/unknown

3. Training courses.

- * Type of course (PM, MLM, CC, BLG), dates, country, number of participants - The utility of these data is being reviewed by EPI Geneva to determine if this section should be retained.

4. Vaccine quality and source.

- * Any changes in status from previous report or report no change.
 - Supplier for each of the EPI vaccines.
 - Whether it conforms to WHO requirements.

4. Global support for Hardware, Software and Modules.

This group recommended that hardware and software should be chosen according to the user's needs and the country's situation. A function (performance) standard recommended for hardware and software for CEIS installations and currently supported at the global level are as follows:

The Assumptions module would provide documentation on all assumptions and formulas used to calculate numerators, denominators and population and be accessible to all bona fide users. A further enhanced assumptions module would allow for changes in the assumptions and the formulas by using a restricted password which would automatically change all calculations in the programme.

The Reporting module is for automatic diskette and/or electronic data transfer from lower levels to higher levels.

The Vaccine quality and source module is for Regions and countries to maintain information on the standard and suppliers of EPI vaccines.

Other modules which will need more research and may be developed in the future are:

- Recording of immunization schedules
- Cost of running an immunization programme (interactive module)
- Funding (for country level only)
- Stock control (Syringes, spare parts, sterilizers, vaccines etc.)
- Cold chain inventory system for country level equipment (possibly based on PAHO's, J.P. Triquet's and DTS's models).
- Estimated cases and deaths occurring and prevented (an interactive module where a national manager could calculate cases and deaths occurring or prevented according to percentage coverage entered).

Some or all of the following additional modules will be available as part of a computerized information systems clearing house and may be installed according to the needs of the user; but are not currently supported by the global programme:

- Sentinel surveillance (possibly based on Liberian system).
- Module based on specifications of the PAHO Polio Eradication Surveillance System (PSAS and PESS).
- Outbreak investigation package (EPI INFC).

5. Enhancements.

It was recommended that the following features be explored as possible enhancements:

- * Ranking of data as in Java system, to screen and printer.
- * Develop a shell to accommodate other EPI software - COSAS, EPIC, EPICost, PESS (Polio Eradication Surveillance System), and others as and when they are developed. Each software to be well developed but not necessarily linked. Ability to transfer data between the packages would be an advantage.
- * Retain graphics capability, but search for method of improving the quality of graphics. This may involve better interfacing with Harvard Graphics. Next Lotus release may provide the solution.

5

9. Software issues

EPI Geneva should review the current Lotus system and consider the possibility of using a database system to allow more developed reporting capability and flexibility.

EPI Geneva should strengthen collaboration and coordination of the CEIS with other WHO programmes - specifically CDD, Malaria (to help integrate CCCD project into CEIS standard) and GPA. It was noted that it may be difficult to integrate 3-4 programmes at national level since most managers want their own system and it may not be technically feasible to develop a global, regional or national WHO information system for Primary Health Care on personal computers (the large databases required may require more memory and speed than currently available microcomputer hardware can supply).

All software and associated manuals must eventually be available in English, French and Spanish. A file or a language table for titles and other common fields in each language should be developed for easy translation. This will be developed by August 1989.

It was estimated that the cost of maintaining software is the cost of software development plus 10%.

The Polio Eradication Surveillance System (PESS) is programmed in Spanish on Foxbase and has no graphic capabilities. PESS will be installed in 10 endemic countries of the American Region starting in May 1989. Training on the use of PESS takes 2-3 days. The programmer of this system is Mr Fernando Vargas in EPI/PAHO. EPI/Geneva will request a translation of PESS into English to be used in other Regions and explore the possibility of merging district names and population and confirmed polio cases into the CEIS.

As systems expand, it may be useful to transfer data into a restructured file for faster data analysis and graph and report generation than would occur if the whole database had to be accessed. At present, the PAHO system which is not yet compiled, takes about an hour to generate some of the graphs and reports.

All source codes of software should be available to countries and new source codes for new modules should be shared. EPI Geneva should be the clearing house for source codes and should have a library of each system installed. DTS will formalize source codes for all consultants by end June 1989.

10. Training

EPI Geneva should develop a training plan for at least 2 categories of people: operators who will probably have to be trained "one on one" and for Mid-level Managers who need to understand the system and be able to support it and its operator(s). Some tutorial material may be added to the CEIS system. Training should be specific "Need to know" for operating and maintaining the CEIS. The trainer should watch how his trainee trains the second or third person to ensure comprehension of the system.

Personnel selected for the use and maintenance of the CEIS should be at the correct level and training has to be focused at the appropriate level. Hence a manager/user should be trained separately from a data entry person.

An article on the CEIS will be prepared for the WER.

EPI should consider a formal evaluation of CEIS. Two technical experts on CEIS are required and the CEIS should be reviewed every 2 years. In addition, EPI Geneva will explore the feasibility of combining CEIS evaluations along with programme reviews.

Focal persons were identified from each agency to report to EPI Geneva on the status of installations and progress of the CEIS on the first Monday of each quarter. Funding information should also be included. Based on these reports, EPI Geneva will consolidate and share this information with all the contributing parties. The next report date will be July 1989 and the persons responsible are as follows:

AFRO	Lahouari Belgharbi
AMRO	Roxane Eikhof
CDC/CCCD	Kelly Bussell
DTS	Carilu Pacis
REACH/SEARO	Dinesh Gupta
UNICEF	Philip van Haecke

EPI/Geneva will request similar status reports from EMRO (Dr Wit), EURO (Dr Bytchenko) and WPRO (Dr Jansen).

REACH informed that the CEIS is now installed at city level in Jakarta. Surabaya will soon have the CEIS installed. It was agreed that installation should ideally consist of a team of 2 people, an epidemiologist and a CEIS computer specialist.

Coordination and planning of installations are the responsibility of Regional Offices and in some Regions this needs to be improved. The countries should select dates of installation in consultation with the ROs. ROs need to ensure all resources are available before the consultant arrives. If ROs offer software, these should be sent prior to the consultant's arrival.

Problems that have been encountered include:

1. Resolving population denominators
2. Lack of funds for follow-up visits (The suggestion was made that it may be necessary to slow down their first time installation visits to allow resources to be put into follow-up visits.)
3. Translating English Lotus macros into French
4. Adverse environment - humidity, dust, supplies shortage, power failures.
5. Convincing MOH to use CEIS as it is not a complete package for national health. MOH needs to be convinced that CEIS is the entry point of a core system for national health programmes. If MOH participates at this stage, they can build from this EPI information system.

17

SUMMARY OF PRIORITIZED ACTIONS AND TARGET DATES

- (1) Finalize this report after participants have had a two week opportunity to review the draft (Chan)
Target date: Draft for review 19 May, Final report 1 July 1989.
- (2) Confirm use of same denominators with UNICEF (Chan)
Target date: 30 May 1989
- (3) Follow up on UNET in Brazzaville with UNICEF (Chan)
Target date: 30 May 1989.
- (4) Follow up on WHO telecommunications system (Chan)
Target date: 30 May 1989.
- (5) Follow up on Brazil/Washington and Washington/Geneva electronic data transfer (Chan, DTS, PAHO)
Target date: 30 May 1989.
- (6) Prepare article on CEIS meeting for WER (Chan, Cheyne)
Target date: May 1989
- (7) Arrange working group of DTS, REACH and key users to determine exact specifications of data transfer format for electronic transmission from regional to global level. Include responsibilities for implementation, financial support and development. (Chan)
Target date: Group to meet by 5 June. First draft of specifications to be completed by 30 July.
- (8) Coordinate with WHO programmes on CEIS to determine feasibility of collaborating on the development of global PHC information systems (Chan et al)
Target date: June 1989
- (9) Include enhancements under point 5 of report into existing systems. (DTS, REACH, Chan)
Target date: June 1989.
- (10) Establish policy on WHO hardware donations. (Cheyne)
Target date: June 1989
- (11) Develop high priority module on Feedback (DTS, REACH, Chan)
Target date: Completion by 31 July 1989.
- (12) Explore possibilities of electronic bulletin board (Chan, Robertson)
Target date: July 1989.
- (13) Enhance EPI Information System Summary for July update. (Chan)
Target date: July 1989.
- (14) Prepare CEIS Update for August publication (Chan, Cheyne, Wilkie, Clem)
Target date: July 1989
- (15) Develop other modules on Assumptions, Backup, Reporting and Vaccine quality and source. (DTS, REACH, Chan)
Target date: 30 August 1989.

6

Appendix 2
MOH/EPI Reporting Forms

A Ş I		YAŞ GRUPLARINA GÖRE HEDEF NÜFUSA YAPILAN AŞI					
	UYGULAMA	0 Yaş (0-11 Ay)	1-4 Yaş (12-50 Ay)	5-6 Yaş	10-14 Yaş	15 Yaş Uzeri	TOPLAM
DPT (DİBİ) EĞİTİM VE KÜLTÜR BAKANLIĞI	I						
	II						
	III						
	Rapel						
MILLÎ EĞİTİM BAKANLIĞI	I						
	II						
	III						
	Rapel						
MILLÎ SAĞLIK BAKANLIĞI	I						
	Rapel						
MILLÎ SAĞLIK BAKANLIĞI	Yapılan						
	Çıkarılan						
	Neti						
MILLÎ SAĞLIK BAKANLIĞI	I						
	Rapel						
MILLÎ SAĞLIK BAKANLIĞI							
MILLÎ SAĞLIK BAKANLIĞI	Program Gözetim I						
	Program Gözetim II						
	Özel Uygulamalar						

İl: Pınarice
Sağlık Ocağı: _____

(V = Vaka O = Ölüm)

K D D	Yaş YAS GRUPLARI	C I M S	BOĞANCA	DİFTERİ	TETANOS	HEPATİT TETANOS	KIZAMIK	POLİOMYELIT	GUILLAIN- BARRE SENDROMU	İSHALLER (Etkeni Belir- lenmemiş)	TİFO (Salmonel- losis)	PARATİFO (S. paratyphi)	B. DİZANTERİ (Shigello- zis)	A. DİZANTERİ (Amöbiya- zis)	BULASICI SARILIK (Hepatit A)	SERUM HEPATİT (Hepatit B)	KUDUZ SÜPHELİ İSİRİK	KUDUZ	MENENJİT (Menen- koksis)	
			V : O	V : O	V : O	V : O	V : O	V : O	V : O	V : O	V : O	V : O	V : O	V : O	V : O	V : O	V : O	V : O	V : O	V : O
1	0	E K																		
2	1 - 4	E K																		
3	5 - 9	E K																		
4	10 - 14	E K																		
5	15 - 24	E K																		
6	25 - 44	E K																		
7	45 - 64	E K																		
8	65 +	E K																		
9	TOPLAM	E K EK																		

Sağlık Ocağı Hekiminin Adı Soyadı: _____
İmza :Sağlık Müdürü: _____
İmza :

22

Appendix 3
User Reference Document

CEIS-Turkey
User Reference

I. Data Entry

PLEASE DO NOT ADD OR CHANGE DATA OUTSIDE OF THE CEIS PROGRAM. If you add or change data using DBASE III Plus or FoxBASE, the CEIS indexes may not work correctly when you run CEIS. Both the report and the data entry portions may produce invalid results.

Data should be added once a month, as soon as PHC/EPI has received the monthly coverage and cases and deaths reports from the provinces. It should be done over a short period of time, one or two days, if possible. Once the data has been added, the databases should be backed up.

It is wise not to add data over an extended period of time, one or two weeks. Data may be forgotten; the data entry person does not remember what s/he has entered and what s/he hasn't. The database or computer may also be destroyed or lost before all the data has been added and backed up.

It is best to have one person responsible for entering the data every month, with a second person trained to do it if necessary. If the same person does it every month, s/he will get to know CEIS. S/he will know how to enter the data and deal with zero entries, blank entries, etc.. S/he will recognize common reporting errors that can be shown to either Dr. Levent or Dr. Mehmet Ali. S/he will also, hopefully, feel some responsibility for the proper functioning of the CEIS. This person should be carefully trained and monitored for the first couple of months. S/he should then train the backup person to make sure that s/he has understood how CEIS works.

Either Dr. Levent or Dr. Mehmet Ali should check a sample of the data entered every month, 7-10 coverage records and 7-10 cases and deaths records, to make sure that there are not any gross data entry errors. If it turns out that there are a lot of errors, the data should be completely checked. One person can read the data from the forms and a second can check the entries.

A. Notes on CEIS Data Fields

1. All Coverage and Cases and Deaths data fields are character fields. Therefore, the data entry person must be careful to enter only numbers, not letters, in these fields. The data entry person must also be careful when updating data in these fields. If there is data already in the field, the new data must either be typed over the old data, or, if not, the old data must be deleted. If not, then the value of that field is unpredictable. For example, if you have:

	0	1-4
DBT1	<u>0</u>	<u>0</u>

and want to change the DBT1 0 age group to 1, do not leave it as follows:

0	1-4
---	-----

DBT1 1 0 0

you must change it to the following:

DBT1 0 1-4
 1 0

II. Backup of Data and Programs

This is one of the most important, and often neglected, tasks in database management. One person should be given **CLEAR** responsibility for backing up the data every month, perhaps the data entry person. One person should be given **CLEAR** responsibility for backing up the data on a yearly basis, for emptying the database, and for backing up the program and FoxBASE files. If the database is lost, or the computer is destroyed, PHC/EPI should be able to rebuild CEIS within a day or so if the above are done carefully.

The monthly backups can be done on two series of diskettes, preferably 1.44 MB diskettes (3.5 inch high density diskettes), that are alternated from month to month, eg, in January you back up the data on set A, in February you back up the data on set B, and in March you back up the data on set A again. The yearly data backup should be done on new diskettes every year and stored somewhere safe where they will not be lost or used for something else. The program backups should also be done on new diskettes and stored with the yearly backups.

The programs should be backed up every time they change. Only the uncompiled versions need to be backed up. The FoxBASE program diskettes should be backed up with one copy stored with the CEIS programs and yearly datafile diskettes and one copy stored with PHC/EPI's other software.

III. Restoring Data Files

The user can restore data files from the monthly backup via the CEIS program, the Other Programs menu. This program will take all the databases from the backup diskette(s) and replace the databases currently in the CEIS directory with the ones from the diskette(s). **WARNING!!!!** Do not restore the databases from the diskette(s) if there is nothing wrong with the data bases in the CEIS directory. The restore program will then reindex all the data files.

IV. Reports

The CEIS program currently produces five reports for coverage, five reports for cases and deaths and two reports for population. All of these reports are accessed through the CEIS/Turkey report menu (RAPORLAR).

There are two coverage reports available for a single province, one for a single year and one for many years. The one year report shows the provincial figures by month with a cumulative total displayed every month. The many year report shows yearly coverage figures starting with the year that the

user specifies and ending with the current year. Both reports show coverage figures for all the childhood vaccines and the pregnant women vaccines. The user must specify for the childhood vaccines if s/he wants to see coverage for 0-11 months of age or 12-59 months of age. For the childhood vaccines, the denominator used to calculate coverage is survivors. For the pregnant women vaccines, the denominator is newborns.

There are two summary coverage reports available for the entire country, one for a single year and one for many years. The one year report shows the national figures by month with a cumulative total displayed every month. The many year report shows yearly coverage figures starting with the year that the user specifies and ending with the current year. Both reports show coverage figures for all the childhood vaccines and the pregnant women vaccines. The user must specify for the childhood vaccines if s/he wants to see coverage for 0-11 months of age or 12-59 months of age. For the childhood vaccines, the denominator used to calculate coverage is survivors. For the pregnant women vaccines, the denominator is newborns.

There is one coverage report available for all the provinces. It is for all or part of a single year. It shows the cumulative figures up through the month specified (if 12 is specified then it will be for the whole year) for each province for the year the user specifies. The report shows coverage figures for all the childhood vaccines and the pregnant women vaccines. The user must specify for the childhood vaccines if s/he wants to see coverage for 0-11 months of age or 12-59 months of age. For the childhood vaccines, the denominator used to calculate coverage is survivors. For the pregnant women vaccines, the denominator is newborns.

All of the cases and deaths reports are available for a specific disease. There are no reports showing results for more than one disease at a time.

There are two cases and deaths reports available for a single province, a single year report and a many year report. The single year report shows monthly cases and deaths figures by age group and morbidity and mortality rates for the total population. Monthly cumulative figures are also displayed. The many year report shows total yearly cases and deaths figures by age group and morbidity and mortality rates for the total population by year from the year the user specifies through the current year. The total population of the province for the year(s) of the report is used as the denominator to calculate morbidity and mortality and the rates are expressed per 100,000 for both reports.

There are two summary cases and deaths reports available for the entire country, a single year report and a many year report. The single year report shows monthly cases and deaths figures by age group and morbidity and mortality rates for the total population of the country. Monthly cumulative figures are also displayed. The many year report shows total yearly cases and deaths figures by age group and morbidity and mortality rates for the total population by year from the year the user specifies through the current year. The total population of the country for the year(s) of the report is

used as the denominator to calculate morbidity and mortality and the rates are expressed per 100,000 for both reports.

There is one cases and deaths report available for all provinces, a single year report showing cumulative figures for as many months as the user specifies (12 would be for the whole year) for the year the user specifies. The report shows by province the total cases and deaths figures by age group and the morbidity and mortality rates for the total provincial population. Summary national figures are also displayed. The total population of each province for the year of the report is used as the denominator to calculate morbidity and mortality and the rates are expressed per 100,000.

V. Graphs

All of the graphs are accessed through the Graphs menu (GRAFIK). There are five coverage graphs and five cases and deaths graphs available. The graphs are generated and displayed on the screen via LOTUS 1-2-3. The graphs are also saved in LOTUS PIC files in the CEIS directory for printing later on via the LOTUS PRINTGRAPH program. The graphs cannot be printed from within CEIS because there is not enough memory available in the computer. The PIC files are saved with unique names based on the graph that is generated. The names for the PIC files are established based on the following formula:

1st character indicates whether the graph is coverage(A), cases and deaths(V), or morbidity and mortality(H).

2nd and 3rd characters indicate a province (eg, 06), summary (SM), or all provinces (AL) graph.

4th character indicates whether the graph is for one year (B) or many years (D).

5th and 6th characters indicate either the year of the graph if it is for one year or the first year of the graph if it is for many years (eg, 88).

7th and 8th characters indicate a disease code if the graph is for cases and deaths or morbidity and mortality (eg, 12). If it is a coverage graph, the 7th character indicates the vaccine code (B,D,O,M,T) and the 8th indicates whether it is for under ones (0) or one to four year olds (5).

9-12 characters are always .PIC to indicate to the LOTUS PRINTGRAPH program that it is a PIC file that can be printed.

An example would be A34B88D0.PIC. This is a coverage graph (A) for Istanbul (34) for one year (B) for 1988 (88) for DPT (D) for under ones (0).

A second example would be HALB8812.PIC. This is a morbidity and mortality graph (H) for all provinces (AL) for one year (B) for 1988 (88) for measles (12).

There are two coverage graphs available for a single province, one for a single year and a single vaccine (or vaccine group if it is DPT, POLIO or TT) and one for many years and a group of vaccines (either a group of childhood vaccines - BCG, DPT1, DPT3, POL1, POL3, Measles - or a group of pregnant women vaccines - TT1, TT2). The single year graph shows cumulative coverage figures by month for the year and the vaccine chosen. The many year graph shows coverage figures by year from the first year of data in the database to the current year for the group of vaccines selected. If any of the childhood vaccines are selected, the user must specify if the graph is for under ones or for one to four year olds. The denominator for childhood vaccines is survivors and the denominator for TT is newborns.

There are two summary coverage graphs available for the entire country, one for a single year and a single vaccine (or vaccine group if it is DPT, POLIO or TT) and one for many years and a group of vaccines (either a group of childhood vaccines - BCG, DPT1, DPT3, POL1, POL3, Measles - or a group of pregnant women vaccines - TT1, TT2). The single year graph shows cumulative coverage figures by month for the year and the vaccine chosen. The many year graph shows coverage figures by year from the first year of data in the database to the current year for the group of vaccines selected. If any of the childhood vaccines are selected, the user must specify if the graph is for under ones or for one to four year olds. The denominator for childhood vaccines is survivors and the denominator for TT is newborns.

There is one coverage graph available for all provinces, a graph for a single year and a single vaccine. The graph shows total coverage figures by province for the year and the vaccine chosen. If any of the childhood vaccines are selected, the user must specify if the graph is for under ones or for one to four year olds. The denominator for childhood vaccines is survivors and the denominator for TT is newborns.

Appendix 4
System Reference Document

CEIS-Turkey
Technical Reference

I. Data Files

There are seven database files used by the CEIS/Turkey. Five of them are indexed. The following table lists the files, their indexes, and the components of each index. Each index was built as a unique index (by using the "set unique on" command in FoxBASE or DBASE III Plus before indexing the file). This means that for every value of the index, there will only be one record in the index. There should never be more than one record in the database with a given index value.

File	Index	Index Components
SYSTEM	none	
GRAPH	none	
COVERAGE	COVERAGE	YEAR + LOCATION + INTERVAL
C&D	C&D	YEAR + LOCATION + DCODE + INTERVAL
DISEASE	DISEASE	DCODE
POP	POP	YEAR + LOCATION
LOCATION	CODES	CODE

The following table describes briefly the data that each file contains.

File	Contents
SYSTEM	One record containing the country name, the name of the geographic subdivisions within the country (Province, District, etc.), the frequency with which coverage and cases and deaths data is collected (monthly, quarterly, yearly), and the date of the last database backup.
GRAPH	There is no permanent data in the GRAPH database. It is used to store data that is exported to LOTUS 1-2-3 to generate coverage and cases and deaths graphs.
COVERAGE	It contains all the coverage data with one record per province per month for each year. Each record contains data about childhood vaccinations by age group and tetanus vaccinations for pregnant women.
C&D	It contains all the cases and deaths data. There is one record per province per month per disease for each year. Each record contains data by age group. The number of diseases that you can collect data for is unlimited, but the more diseases you collect information about, the larger your database.
DISEASE	It contains one record for each disease with a disease code and a disease name. There must be a disease record

in the database before you can add information to the C&D file about that disease.

POP It contains one record for each province for each year. There must be population records for a given year before you can run reports or plot graphs for that year.

LOCATION It contains one record for each province containing a province code and a province name. A location record must exist for a province before you can enter data in POP, C&D or COVERAGE about that province.

II. Program Files

The FoxBASE programs for the CEIS/Turkey are fairly well modularized, they perform a single function with clearly defined data inputs and outputs. The variables used in each program are defined explicitly in the program or are defined as parameters passed from one program to another. There are a large number of variables defined within the report and graph programs (40 - 100). These are used only within those programs. There are never more than four variables (parameters) passed from program to program and those are always explicitly stated both in the calling program and the called program. Unfortunately, there was not time to either document the code the way it should be done, or write a technical manual. In the absence of doing so, the next person to work with the source code will have to put in a bit of extra work to figure out the logic and the use of the variables. The following hierarchy will at least show how the CEIS/Turkey is set up.

```

                                epi.bat
                                menu.prg
data.prg                        report.prg                        graph.prg                    other.prg
data_pr.prg                    report_p.prg                    graph_pr.prg
coverage.fmt                   covlocp.prg                    cover1g.prg
c&d.fmt                        covsump.prg                    cover3g.prg
location.fmt                   covallp.prg                    cover4g.prg
disease.fmt                    c&dlocp.prg                    cover5g.prg
                                c&dsump.prg                    cover6g.prg
                                c&dallp.prg                    c&d1g.prg
                                popp.prg                      c&d3g.prg
                                c&d4g.prg
                                c&d5g.prg
                                c&d6g.prg
                                graph.bat
```

A brief description of each file and what it does follows:

- covsump.prg** This is the summary coverage report program for the entire country. It takes three parameters: a variable indicating whether the report is for one or many years, a year, and a variable indicating if the coverage is for under ones or one to four year olds. It calculates coverage for either one year or a period of years for each of the EPI vaccines for the given age group and for the two TT vaccines given to pregnant women. The denominator for both under ones and one to fours is survivors and the denominator for pregnant women is newborns. The one year report is displayed by month with cumulative totals. The multiyear report is displayed by year with the first year being the parameter passed from report_p.prg and the last being the current year. When the report terminates, control is returned to report_p.prg.
- covallp.prg** This is the coverage report program for all provinces. It takes three parameters: a year, the month of the year through which the data should be cumulated, and a variable indicating if the coverage is for under ones or one to four year olds. It calculates coverage for either an entire year or a portion of a year, depending on which month is selected, for each of the EPI vaccines for the given age group and for the two TT vaccines given to pregnant women. The denominator for both under ones and one to fours is survivors and the denominator for pregnant women is newborns. The report is always displayed by province. When the report terminates, control is returned to report_prg.
- c&dlocp.prg** This is the cases and deaths report for a single location. It takes four parameters: a province code, a variable indicating whether the report is for one or many years, a year, and a disease code. It calculates the number of cases and deaths by age group and the total morbidity and mortality per 100,000 for a single disease for either a single year or a series of years. The denominator used to calculate morbidity and mortality is the total population for the province for the year(s) of the report. If the report is done for one year the results are shown by month including a monthly cumulative total. For the multiyear report, yearly totals are shown with the first year being the parameter passed from report_p.prg and the last being the current year. When the report terminates, control is returned to report_prg.
- c&dsump.prg** This is the summary cases and deaths report for the entire country. It takes three parameters: a variable indicating whether the report is for one or many years, a year, and a disease code. It calculates the number of cases and deaths by age group and the total morbidity and mortality per 100,000 for a single disease for either a single year

or a series of years. The denominator used to calculate morbidity and mortality is the total population for the country for the year(s) of the report. If the report is done for one year the results are shown by month including a monthly cumulative total. For the multiyear report, yearly totals are shown with the first year being the parameter passed from report_p.prg and the last being the current year. When the report terminates, control is returned to report_prg.

- c&dallp.prg** This is the cases and deaths report for all the provinces. It takes three parameters: a year, a month, and a disease code. It calculates the number of cases and deaths by age group and the total morbidity and mortality per 100,000 for a single disease for either a single year or a portion of a year. The denominator used to calculate morbidity and mortality is the total population for each province for the year of the report. Results are shown by month including a monthly cumulative total. When the report terminates, control is returned to report_prg.
- popp.prg** This procedure produces a report showing population figures for either a single province over a period of years, as many as are in the database, or for each province in the entire country for a single year. It takes two parameters: a province code, which can be set to all provinces, and a year. When the program terminates, control is returned to report_p.prg.
- cover1g.prg** This is a graph routine that produces a coverage graph for one location for a period of years for either a group of childhood vaccines or TT for pregnant women. It takes three parameters: a province code, a variable indicating which group of vaccines should be graphed, and a variable indicating whether the childhood vaccines are for under ones or one to four year olds. It displays yearly coverage totals for as many years of data as there are in the database. The denominator used for the childhood vaccines is survivors. For pregnant women it is newborns. The graph is plotted via LOTUS 1-2-3. The data for the LOTUS macro and graph are exported to a file called GRAPH.PRN which is then imported into LOTUS 1-2-3 by running GRAPH.BAT. A LOTUS PIC file is also produced and saved in the CEIS directory. When the program terminates, control is returned to graph_pr.prg.
- cover3g.prg** This is a graph routine that produces a summary coverage graph for the entire country for a period of years for either a group of childhood vaccines or TT for pregnant women. It takes two parameters: a variable indicating which group of vaccines should be graphed, and a variable indicating whether the childhood vaccines are for under

ones or one to four year olds. It displays yearly coverage totals for as many years of data as there are in the database. The denominator used for the childhood vaccines is survivors. For pregnant women it is newborns. The graph is plotted via LOTUS 1-2-3. The data for the LOTUS macro and graph are exported to a file called GRAPH.PRN which is then imported into LOTUS 1-2-3 by running GRAPH.BAT. A LOTUS PIC file is also produced and saved in the CEIS directory. When the program terminates, control is returned to graph_pr.prg.

cover4g.prg This is a graph routine that produces a coverage graph for one location for one year for a single vaccine (or group of vaccines for DPT, POLIO, and TT). It takes four parameters: a province code, a year, a variable indicating which vaccine should be graphed, and a variable indicating whether the childhood vaccines are for under ones or one to four year olds. It displays cumulative coverage figures for each month of the year being graphed. The denominator used for the childhood vaccines is survivors. For pregnant women it is newborns. The graph is plotted via LOTUS 1-2-3. The data for the LOTUS macro and graph are exported to a file called GRAPH.PRN which is then imported into LOTUS 1-2-3 by running GRAPH.BAT. A LOTUS PIC file is also produced and saved in the CEIS directory. When the program terminates, control is returned to graph_pr.prg.

cover5g.prg This is a graph routine that produces a summary coverage graph for the entire country for one year for a single vaccine (or group of vaccines for DPT, POLIO, and TT). It takes three parameters: a year, a variable indicating which vaccine should be graphed, and a variable indicating whether the childhood vaccines are for under ones or one to four year olds. It displays cumulative coverage figures for each month of the year being graphed. The denominator used for the childhood vaccines is survivors. For pregnant women it is newborns. The graph is plotted via LOTUS 1-2-3. The data for the LOTUS macro and graph are exported to a file called GRAPH.PRN which is then imported into LOTUS 1-2-3 by running GRAPH.BAT. A LOTUS PIC file is also produced and saved in the CEIS directory. When the program terminates, control is returned to graph_pr.prg.

cover6g.prg This is a graph routine that produces a coverage graph for all provinces for one year for a single vaccine (or group of vaccines for DPT, POLIO, and TT). It takes three parameters: a year, a variable indicating which vaccine should be graphed, and a variable indicating whether the childhood vaccines are for under ones or one to four year olds. It displays total coverage figures for each

province for the year being graphed. The denominator used for the childhood vaccines is survivors. For pregnant women it is newborns. The graph is plotted via LOTUS 1-2-3. The data for the LOTUS macro and graph are exported to a file called GRAPH.PRN which is then imported into LOTUS 1-2-3 by running GRAPH.BAT. A LOTUS PIC file is also produced and saved in the CEIS directory. When the program terminates, control is returned to graph_pr.prg.

c&d1g.prg

This is a graph routine that produces either a cases and deaths or morbidity and mortality graph for one location for a period of years for a single disease. It takes three parameters: a province code, a variable indicating whether cases and deaths or morbidity and mortality should be graphed, and a disease code. It displays total figures for as many years of data as there are in the database. The denominator used for morbidity and mortality is the total population of the province for the year being graphed. The morbidity and mortality rates are per 100,000. The graph is plotted via LOTUS 1-2-3. The data for the LOTUS macro and graph are exported to a file called GRAPH.PRN which is then imported into LOTUS 1-2-3 by running GRAPH.BAT. A LOTUS PIC file is also produced and saved in the CEIS directory. When the program terminates, control is returned to graph_pr.prg.

c&d3g.prg

This is a graph routine that produces a summary graph for the entire country for either cases and deaths or morbidity and mortality for a period of years for a single disease. It takes two parameters: a variable indicating whether cases and deaths or morbidity and mortality should be graphed, and a disease code. It displays total figures for as many years of data as there are in the database. The denominator used for morbidity and mortality is the total population of the country for each year being graphed. The morbidity and mortality rates are per 100,000. The graph is plotted via LOTUS 1-2-3. The data for the LOTUS macro and graph are exported to a file called GRAPH.PRN which is then imported into LOTUS 1-2-3 by running GRAPH.BAT. A LOTUS PIC file is also produced and saved in the CEIS directory. When the program terminates, control is returned to graph_pr.prg.

c&d4g.prg

This is a graph routine that produces either a cases and deaths or morbidity and mortality graph for one location for one year for a single disease. It takes four parameters: a province code, a year, a variable indicating whether cases and deaths or morbidity and mortality should be graphed, and a disease code. It displays monthly totals for the year being graphed. The denominator used for morbidity and mortality is the total population of the province for the year being graphed. The morbidity and

mortality rates are per 100,000. The graph is plotted via LOTUS 1-2-3. The data for the LOTUS macro and graph are exported to a file called GRAPH.PRN which is then imported into LOTUS 1-2-3 by running GRAPH.BAT. A LOTUS PIC file is also produced and saved in the CEIS directory. When the program terminates, control is returned to graph_pr.prg.

c&d5g.prg

This is a graph routine that produces a summary graph for the entire country for either cases and deaths or morbidity and mortality for a single year for a single disease. It takes three parameters: a year, a variable indicating whether cases and deaths or morbidity and mortality should be graphed, and a disease code. It displays monthly figures for the year being graphed. The denominator used for morbidity and mortality is the total population of the country for the year being graphed. The morbidity and mortality rates are per 100,000. The graph is plotted via LOTUS 1-2-3. The data for the LOTUS macro and graph are exported to a file called GRAPH.PRN which is then imported into LOTUS 1-2-3 by running GRAPH.BAT. A LOTUS PIC file is also produced and saved in the CEIS directory. When the program terminates, control is returned to graph_pr.prg.

c&d6g.prg

This is a graph routine that produces either a cases and deaths or morbidity and mortality graph for all provinces for one year for a single disease. It takes three parameters: a year, a variable indicating whether cases and deaths or morbidity and mortality should be graphed, and a disease code. It displays a yearly total for each province on a bar graph. The denominator used for morbidity and mortality is the total population of each province for the year being graphed. The morbidity and mortality rates are per 100,000. The graph is plotted via LOTUS 1-2-3. The data for the LOTUS macro and graph are exported to a file called GRAPH.PRN which is then imported into LOTUS 1-2-3 by running GRAPH.BAT. A LOTUS PIC file is also produced and saved in the CEIS directory. When the program terminates, control is returned to graph_pr.prg.

graph.bat

This is a DOS batch file that is called by all of the graph programs. It copies two files to the LOTUS 1-2-3 directory, EPIGRAPH.WK1 and GRAPH.PRN, renames EPIGRAPH.WK1 as AUTO123.WK1, and starts LOTUS. The AUTO123.WK1 file is a file that is automatically loaded when LOTUS starts. It then loads the data from GRAPH.PRN and executes the graphic macro contained in GRAPH.PRN. The graph is displayed on the screen and saved as a LOTUS 1-2-3 PIC file called EPIGRAPH.PIC. Upon termination, the AUTO123.WK1 and GRAPH.PRN files are deleted from the LOTUS

1-2-3 directory and the user is returned to CEIS.

File	Description
epi.bat	This is a DOS batch file. It starts CEIS. It changes the user to the correct directory and calls FoxBASE and the main menu program for CEIS, menu.prg.
menu.prg	It sets all the database environment variables(talk, bell, echo, status, etc.) to the correct value, presents the main menu, queries the user for a choice, and calls one of the four major program routines: data.prg, report.prg, graph.prg, or other.prg. It returns control to the operating system when terminated.
data.prg	It presents the data entry menu, queries the user for a selection, and then calls a procedure contained in the data_pr.prg file to execute the desired data entry routine. It returns control to menu.prg when terminated.
data_pr.prg	It contains the four data entry procedures that are called from data.prg. Covcdfile is for both COVERAGE and C&D. Locfile is for LOCATION. Popfile is for POP. Disfile is for DISEASE. They all query the user for data, either locate or create the correct record to edit and then edit it. None of these procedures call any others, but they do use the FMT files associated with the file they edit. The only exception is POP because there is a calculation performed that can not be done through a FMT file. The FMT files are a handy way of dissociating the programs from the language or format of the data entry screens. When one of the procedures terminates, control is returned to data.prg.
report.prg	It presents the reports menu and queries the user for a selection. Based on that selection a procedure in report_p.prg is called with 0-1 parameters. When report.prg terminates, it returns control to menu.prg.
report_p.prg	It contains three report procedures. Covdrep for both COVERAGE and C&D reports. Poprep for POP reports and locrep for LOCATION reports. Locrep is the least polished of the three. It calls no procedure and passes no parameters. Covdrep and poprep both query the user for data about the report to run and then call the correct report procedure, passing it 2-4 parameters. When the report procedure terminates, control is returned to report_p.prg. When a report_p.prg procedure terminates, control is returned to report.prg.
graph.prg	It presents the graphs menu, queries the user for a selection and calls the correct procedure in graph_pr.prg

- 37 -

passing 0-1 parameters. When graph.prg terminates, control is returned to menu.prg.

- graph_pr.prg It contains one procedure, covcdgph, for COVERAGE and C&D graphs. The procedure queries the user for data and then calls the correct graph program passing 2-4 parameters. When the procedure terminates, control is returned to graph.prg.
- other.prg It contains three program utilities. The user is requested to choose among the utilities and then the program executes the utility requested. Currently, the utilities include database backup and restore as well as the copying of database files to ASCII text files with each field delimited by a blank. This allows LOTUS 1-2-3 to read the fields as numbers, even though they are character fields in FoxBASE. When the program terminates control is returned to menu.prg. This program should include, but does not currently, two other utilities: one for backing up a specific year's data from any of the data files and deleting that data from the database, and one for restoring a year's worth of data to the database from a backup.
- location.fmt It contains the screen format used to edit or add a record to the LOCATION file.
- coverage.fmt It contains the screen format used to edit or add a record to the COVERAGE file.
- c&d.fmt It contains the screen format used to edit or add a record to the C&D file.
- disease.fmt It contains the screen format used to edit or add a record to the DISEASE file.
- covlocp.prg This is the coverage report program for one location. It takes four parameters: a province code, a variable indicating whether the report is for one or many years, a year, and a variable indicating if the coverage is for under ones or one to four year olds. It calculates coverage for either one year or a period of years for each of the EPI vaccines for the given age group and for the two TT vaccines given to pregnant women. The denominator for both under ones and one to fours is survivors and the denominator for pregnant women is newborns. The one year report is displayed by month with cumulative totals. The multiyear report is displayed by year with the first year being the parameter passed from report_p.prg and the last being the current year. When the report terminates, control is returned to report_p.prg.

Appendix 5
Contact List

29'

Contact List

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40