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Media Reviews and Reports

DoEpi

Computer-Assisted Instruction in Epidemiology and Computing and a Framework for Creating New Exercises

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ABSTRACT: DoEpi is a series of computer exercises and a framework for making new exercises based on the Epi Info™ programs for epidemiologic computing. The system contains three outbreak investigations, a research survey, four exercises in advanced Epi Info programming, and four exercises in public health surveillance.

The exercises are available via the Internet (*www.cdc.gov*, under "Publications, Products, and Software") with provision for CME and CEU credit from the Centers for Disease Control and Prevention. They can serve as a useful adjunct to lectures and textbooks in teaching epidemiology or epidemiologic computing.

A new DoEpi exercise with hypertext, low-resolution photographs, questions, answers, and an examination can be constructed in hours rather than weeks or months using an Exercise Development "wizard" provided as part of the instructor's module. Epi Info™ exercises with data files and customized programs require more work to construct but can be added by those with the necessary skills.

DoEpi exercises can be used in a variety of ways for different curricula and students of different background levels, including those with English as a second language. Translation of DoEpi exercises into other languages is facilitated by the instructor's module, and construction of new exercises with locally suitable materials is encouraged.

DoEpi is based on DOS programs to allow the widest use. The format lends itself to conversion to hypertext programs in the Microsoft Windows and Internet formats at a future date.

Medical Subject Headings (MeSH): DoEpi, epidemiologic computing, computer-assisted instruction (Am J Prev Med 1998;14:367–371)

Over the past decade, computer-assisted instruction (CAI) has advanced beyond the stage of experimentation to play a central role in medical education.[1] CAI provides opportunities for simulation, distance learning, and evaluation that are especially appropriate for public health teaching.[2] Problem-based exercises on paper, such as those used at the Centers for Disease Control and Prevention (CDC) to train public health professionals in surveillance methods, outbreak investigations, and computerized data analysis, are well suited to conversion to CAI.

A problem in development of CAI materials has been the large amount of effort needed for their development. A 1994 study found that it takes an average of 228 hours of development to produce 1 hour of courseware, at a cost of more than $20,000.[3] The first educational outbreak simulation program produced by CDC, "Pharyngitis in Louisiana,"[4] took 10-person months to develop about 6 hours of instructional material.

DoEpi is a series of interactive epidemiologic and computing exercises built around Epi Info™,* CDC's public-domain software for public health professionals. DoEpi was developed with the primary objective of reducing the effort necessary to develop new exercises, and with the following additional objectives:

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- To develop a public-domain vehicle for interactive teaching on microcomputers
- To provide a series of exercises in outbreak investigation, public health surveillance, and epidemiologic computing
- To integrate the teaching of epidemiologic computing with the teaching of epidemiology
- To provide a framework for others to contribute additional exercises, or to translate current exercises into other languages with a minimum of effort

In DoEpi, interactive computer exercises in epidemiology have been combined with the teaching of Epi Info™, CDC's public domain software system for epidemiologic computing. DoEpi exercises contain text explanations of epidemiologic problems, supplementary images, questions to prompt student participation, and embedded computer tasks. The first release of DoEpi contains three outbreaks, a research study, four lessons in advanced Epi Info™ programming, and four surveillance exercises. An instructor's module provides tools for producing additional exercises.

System Overview

Epi Info™ was chosen as the basic development tool for DoEpi because it is in the public domain, provides menuing and hypertext functions, and can be used to enter and process most types of epidemiologic data. Because both DoEpi and Epi Info™ are DOS programs, they can be used in any DOS compatible computer, from Intel 286 computers to powerful systems running Microsoft Windows 95™ or NT™, or on a local area network.

DoEpi consists of 12 exercises and an instructor's module for creating new exercises. Each exercise includes a set of learning objectives, automated computer tasks, a series of questions and answers about each case study, and pictures (in a low-resolution format) that illustrate the problem or setting of the exercise. Students scroll through the exercise either by clicking on hypertext links with a mouse or by pressing ⟨ENTER⟩ on the highlighted links. All computer functions, including navigating through the exercises, are clearly described throughout the system. Students with little or no computer experience can easily perform the tasks required.

An evaluation screen and an examination consisting of 10 questions are at the end of each exercise. Students can choose to complete the examination and return it to CDC to earn CEUs or CME credit. The amount of credit awarded differs from exercise to exercise; successful completion of all exercises in the system is worth 42 CME credits or 4.2 CEUs.

In addition to the exercise modules, the system includes Help files, general information on epidemiology resources, and an instructor's module. Other features of DoEpi include print-ready files for some exercises, a slide show and overview of Epi Info™, and links from the main DoEpi menu to core Epi Info™ programs.

The installation program offers five options with varying numbers and combinations of the 12 exercises. Depending on the type of installation chosen, DoEpi requires a total of 4.2 to 12.4 megabytes of disk space. Epi Info™, version 6.04 or later, also must be installed.

DoEpi Functions

Hypertext blocks. Exercises are organized into topics, arranged in screen-sized text blocks. Text items highlighted in yellow on each screen serve as links to other topics or examples that present information relevant to the exercise problem, or ask a question linked to a "Hint" block. Most topics have links to the "Previous," "Next," "Hint," and "Table of Contents" blocks.

Hints. Further information and/or correct answers to questions in a given exercise are provided in "Hint" blocks, which students are encouraged to visit after discussing or writing down their own conclusions.

Images. Photographs in the form of .PCX files can be inserted into exercises. Images used in DoEpi are low-resolution to accommodate older computers and to minimize the size of the completed exercise for distribution over the Internet. Images can be scanned from a variety of sources or sent to a photo processor for digitization and then reduced in resolution by readily available graphics software.

Exercise core format. Each exercise contains a "Table of Contents" screen, an "Instructions for Moving Around" screen, and a list of learning objectives. The "Table of Contents" screen contains a list of all topics in the exercise and provides a comprehensive set of hyper links to all text blocks and computer tasks. "Instructions for Moving Around" is a one-screen, step-by-step guide to navigating the exercise and may be particularly useful for users who have little or no experience with hypertext. A list of Learning Objectives highlights important concepts in the module.

At the end of each exercise are evaluations and examinations. Examinations consist of 10 multiple-choice questions each. Completed evaluation and examination forms may be submitted to CDC for CEU or CME credit. (Details are included in DoEpi's main Help file.)

Computer tasks. Most exercises also contain computer tasks reached by links from relevant text blocks. Computer tasks may explain a computing problem and how to solve it and then allow the user to exit to use Epi Info™, returning automatically to the exercise when through. Printed instructions may be prepared by the

instructor from documents provided with DoEpi. Another type of computer task runs a tutorial program in Epi Info™'s ANALYSIS that interacts with the student and guides the analysis of a data set.

Exercise Modules

Investigations

Postoperative Rhodococcus. An investigation of an outbreak of rhodococcal infection following open-heart surgery in a 900-bed tertiary care center.

Epidemiology: Both descriptive and case control studies are conducted using hospital records. Microbiologic simulation studies are used to test the hypothesis.

Computing: Creating and then revising a questionnaire, making a simple check file, entering data for 7 cases, univariate and case-control analysis, and writing a report.

Oswego church supper. A foodborne outbreak following a church supper.

Epidemiology: A cross-sectional study of illness and risk factors in persons who attended the supper.

Computing: Producing a line listing, calculating, and graphing incubation periods and an epidemic curve in Epi Info™, and producing cross-tabulations of illness and food consumption with odds ratios, chi square, Fisher exact tests, and Mantel-Haenszel stratified analysis.

Toxic shellfish poisoning. Paralytic shellfish poisoning is suspected as 120 people develop paralysis and other neurologic symptoms, with 26 deaths.

Epidemiology: Students are prompted to consider the logistics of conducting an investigation as well as the etiology of the outbreak and appropriate outbreak-control measures.

Computing: Analyzing data from a case control study, including analysis of *P* values, odds ratios, and their confidence limits, and of tradeoffs between managing complexity through programming versus summarizing the data manually before data entry.

Research Study

Oral contraceptive use and ovarian cancer. Using more than 3,000 records from the Cancer and Steroid Hormone (CASH) Study, the student investigates whether oral contraceptive use increases or decreases the risk for ovarian cancer.

Epidemiology: Focus topics include the definition and differentiation of epidemiologic bias and a review of basic biostatistical analytic tools (chi squares, *P* values, and odds ratios) and confounding. Stratified analysis is used to deal with confounding.

Computing: Computer tasks cover cross-tabulation, understanding summary odds ratios, Mantel-Haenszel stratified analysis, and effect modification.

Advanced Epi Info™ Programming

Planning a program or system. An introduction to programming permanent applications in Epi Info™ or other computer systems. Students can either review planning methods by following an outline of a sample computer system or use the outline provided to plan their own computer application.

Problem: Students are guided to think about a number of issues necessary in planning a computer system.

Computing: A list of topics useful in planning any computer system is provided.

Programming the Epi Info™ menu. Describes the inner workings of the Epi Info™ menu and methods by which it can be customized to serve as a model for other computer systems.

Problem: A list of needs for the system includes outputs (e.g., maps of reports by disease), inputs (e.g., morbidity and mortality data), and requirements for data transmission and downloads.

Computing: To meet these needs, students learn to use and modify system menus in Epi Info™.

Programming data input. Covers in detail the creation of questionnaires and data files and programming of the data input process through .CHK files.

Problem: Addresses a number of commonly encountered data-entry problems and offers working examples of solutions.

Computing: Managing dates, times, colors, and lines in questionnaires; performing calculations and providing user feedback or dialogs on data entry; and understanding and implementing relational file structures for data entry.

Programming data output. Presents advanced programming and analytic functions in the ANALYSIS program.

Problem: A number of short problems in analysis of data are used to illustrate useful techniques.

Computing: The exercise focuses on the subtleties of Epi Info™ programming such as defining and using standard, cumulative, and global variables; missing data, relational file systems; and subroutines.

Public Health Surveillance

Paralytic illness in Ababo. An exercise in poliomyelitis surveillance in an African country.

Epidemiology: The students develop a polio surveillance system for one of Ababo's largest districts. Concepts covered include incidence, prevalence, case fatality rates, sensitivity, and the choice of data sources.

Computing: Processing of summary data in a table is taught using the ANALYSIS program.

Surveillance request. The student provides consultation on computerization of an existing public health surveillance system.

Problem: Students deal with questions regarding data integrity and confidentiality; summary versus individual case records; estimating the volume of data; and considerations for staffing, equipping, and running a national surveillance system.

Refugee camp nutrition. In a disaster situation, students derive rates, ratios, and anthropometric information.

Epidemiology: This exercise requires the calculation and use of mortality and morbidity data, as well as data in nutritional

status, to prioritize health problems in the population and to plan interventions accordingly. Sampling concepts are introduced.

Computing: Tasks include computation of rates, rate ratios, and nutritional anthropometric information using Epi Info™ tools and standard epidemiologic statistical techniques.

U.S. state surveillance. Examines in detail the programs used by most U.S. state health departments for reporting via the National Electronic Telecommunications System for Surveillance (NETSS).

Epidemiologic computing: The module demonstrates (1) how to use the Epi Info™ menu system to produce an integrated surveillance system from separate programs; (2) error checking; and (3) how to format data from customized systems to a single standard for transmission.

Computing: Students are given a tour of the inside of NETSS program files, and invited to make technical modifications to the system for specified surveillance requirements.

Instructor's Module

The Instructor's Module provides a "wizard" for constructing a new exercise that performs much of the labor of inserting file names, topic headings, and hypertext controls. Using the DoEpi Instructor's Module, a new DoEpi exercise can be developed in a few days. The setup process is mostly one of deciding what topics are to be presented and entering these into a form. The "wizard" (actually an ANALYSIS program) then constructs the necessary hypertext files so that the author can add text, computer exercises, graphics, examination questions, and optional refinements.

Customizing a new exercise may require knowledge of DOS batch file commands and of Epi Info programming, although this is not necessary for all types of exercises. Materials for graphics scanning can be sent to a photo store for conversion to the Kodak CD-ROM format. This method for slide conversion is available to anyone at minimal cost.

The DoEpi framework is available so that teachers of epidemiology can produce exercises based on their own materials. Exercises in the framework could form the core of a problem-based curriculum in epidemiology for many different audiences. DoEpi has been designed as a toolbox for teachers of epidemiology worldwide.

Advantages and Limitations

DoEpi is a low-technology CAI tool. It runs in DOS, relies more on text than on graphics, and does not attempt to interpret free-text input from the student. This approach works well with professionals who are used to working with written materials, and drastically reduces the amount of effort required to produce a new exercise. DoEpi also allows for flexibility in using the materials, as the exercises are not strictly tied to a game plot, and can be used in a variety of ways, perhaps more analogous to a slide show or workbook rather than a fully developed movie.

Several of the DoEpi exercises are based on interactive printed exercises developed for the Epidemic Intelligence Service (EIS) Officers and long used at CDC for introducing the Officers to epidemiologic concepts. The exercises entitled "Oswego," "Oral Contraceptive Use and Ovarian Cancer," "Paralytic Illness in Ababo," and "Refugee Camp Surveillance" use the same questions, text, and data sets found to be successful over the years in the annual EIS course, with the addition of instruction in accomplishing the necessary tasks in Epi Info. (The printed exercises are available from the Association of Teachers of Preventive Medicine as "Applied Epidemiology Case Studies," from the Division of Applied Public Health Training, Epidemiology Program Office, CDC.)

DoEpi is part of a growing trend toward self-directed CME/CEU courses that are used or distributed on the Internet. An advantage of this teaching method is that users can learn at their own pace.[5] In a 1993 study that compared the use of a self-directed, problem-based curriculum with a traditional curriculum in undergraduates studying hypertension, those who used the self-directed curriculum were more current in their knowledge of disease management.[6] Distributing DoEpi on the Internet has the advantage of providing up-to-date material, without the platform, version, or cost-associated problems that may accompany floppy-disk based packages.[5]

DoEpi has been tested in a number of classroom situations. The audiences have included infection control nurses, master's degree candidates at a school of public health, CDC's Epidemic Intelligence Service (EIS) officers, and a class of public health professionals in Italy. The curriculum has used introductory lectures and the DoEpi exercises in varying proportion, usually in a computer laboratory setting, but occasionally with the instructor presenting the material from the front of the room with a projector. Evaluations have included the question, "Do you prefer DoEpi or more traditional methods?" Generally, in the United States, classes strongly prefer DoEpi. In the 1995 EIS Class of 80 students, for example, 80% preferred DoEpi to traditional methods.

DoEpi is a valuable asset in teaching courses where language barriers exist. In recent courses in Italy and Mexico, for example, the instructor spoke in English, with varying degrees of translation into Italian or Spanish. Since most students had some acquaintance with textbooks in English, DoEpi facilitated understanding by reinforcing the spoken material, and allowing students to proceed at their own pace. The exercises also allowed instructional assistants to prepare for

the classes and to provide over-the-shoulder assistance in the local language after reviewing the exercises.

Although the exercises are designed for use in individual or computer-laboratory instruction, parts of the DoEpi modules are suitable as illustrations for lectures or instructor-led discussions. Students can use DoEpi individually as part of class assignments, for continuing education credit, or simply for instruction in a given epidemiologic subject or technique. DoEpi exercises would also be suitable for distance learning curricula distributed either on diskettes, CD-ROM, or via the Internet.

Epi Info™[7,8] was chosen as the development tool for DoEpi because it is in the public domain, has been widely distributed in a number of languages, and provides tools for general use in epidemiologic and statistical computing. The computing techniques learned through DoEpi can be used by the students for real work, since they can return home with the complete set of computing programs used in the classroom at minimal cost.

Epi Info™ has been used in other CAI programs, including the *Meningitis Hypertext Case Study*, a learning module developed by the Liverpool Epidemiology Programme[9] and CDC's *Pharyngitis in Louisiana*.[4] Like DoEpi, these two programs allow users to link to Epi Info™ programs for data analysis.

DoEpi is in the public domain and may be freely distributed or translated. It is available without charge on the World Wide Web at http://www.cdc.gov/epo/epi/epiinfo.htm under "Download Software," and can also be reached through a series of links from the CDC home page at http://www.cdc.gov/. All of the text files used to compile the current exercises are part of the distribution package so that they can be translated into other languages or adapted to local preferences.

In future versions of DoEpi, we hope to add additional exercises that have been created by others using the instructor's module. Work is beginning on a version of DoEpi that will be compatible with an upcoming version of Epi Info™ for Microsoft Windows 95 and Windows NT platforms (EpiInfo™ 2000.) The Windows version of DoEpi will use Hypertext Markup Language (HTML) and conversion programs to facilitate the conversion of DOS DoEpi exercises to Internet format.

References

1. Hardin L. Computer applications in U.S. and Canadian medical schools: an overview. J Med Educ Technol 1995; 6(1):8–30.
2. Paulsen MF. From bulletin boards to electronic universities: distance education, computer mediated communication, and online education. University Park, Pennsylvania. American Center for the Study of Distance Education Research Monograph, Number 7; 1992.
3. Reinhardt A. New ways to learn. Byte Magazine 1995;20(3): 50.
4. Centers for Disease Control and Prevention, Office of Epidemiology Programs and Public Health Practices Program Office. Investigating an outbreak: pharyngitis in Louisiana. Atlanta, Georgia; 1994.
5. Zelingher J. Get your CME credits from the Net. MD Comput 1996;13(1):7–8.
6. Shin JH, Haynes RB, Johnston ME. Effect of problem-based, self directed undergraduate education on life-long learning. Can Med Assoc J 1993;148(6):969–76.
7. Dean AG, Dean JA, Burton AH, Dicker RC. Epi Info: a general purpose microcomputer program for health information systems. Am J Prev Med 1991;7:178–82.
8. Dean AG, Dean JA, Coulombier D, Brendel KA, Smith DC, Burton AH, et al. Epi Info Version 6: a word processing, database, and statistics program for public health on IBM-compatible microcomputers. Centers for Disease Control and Prevention. Atlanta, Georgia; 1995.
9. Cuevas LE, Moody JB, MacFarlane SB, Rada R, Ghaoui C. The use of hypertext: demonstration of the methods for investigating an epidemic of meningitis. Med Educ 1993; 27(1):91–6.

Improving Health in the Community A Role for Performance Monitoring

Jane S. Durch, Linda A. Bailey, Michael A. Stoto, for the Committee on Using Performance Monitoring to Improve Community Health of the Institute of Medicine

The Institute of Medicine (IOM) launched a discussion of how to improve the community's health with publication of its landmark volume, *The Future of Public Health*, in 1988. That document focused on the government public health system, its functions, and its problems. In 1996, the IOM recognized the rapid changes occurring in the relationship of public health agencies within their communities by issuing *Healthy Communities: New Partnerships for the Future of Public Health.* Public health practitioners were encouraged to forge partnerships, particularly with managed care organizations, to accomplish their mission. Now the IOM has carried this theme further with a book that presents ways to use these partnerships to improve the community's health. The specific focus of this new book is how to monitor the contributions and responsibilities of community health partners.

Improving Health in the Community: A Role for Performance Monitoring presents a broad view of health and its determinants and outlines a community health improvement process. The process is one with which most readers will be familiar: identifying and prioritizing problems, developing and implementing strategies, and monitoring outcomes. What sets this book apart are the recommendations concerning shared responsibilities and accountability for strategies undertaken to improve the community's health. Performance of all partners, such as health departments, social service agencies, private health providers, schools, insurers, and businesses, would be monitored to determine success in meeting assigned objectives. This focus on accountability parallels what is happening within individual organizations and provider groups but has not, heretofore, been applied to a group of partners who may be working together to improve the health of an entire community.

The discussion on performance monitoring and accountability prepares the reader for the other chief contribution of this publication: proposed indicators for a community health profile and indicator sets for performance monitoring of specific health issues. The "community health profile" is another name for the community health report card, which many health agencies have used to describe their assessment of the community's health status and needs. The IOM authoring committee recommends a basic set of 25 indicators for the profile and suggests data sources for each indicator. Because this book assumes a broad definition of health determinants, the indicators cover measurements not usually seen in community report cards. The "ratio of the number of students graduating from high school to the number of students who entered 9th grade three years previously" measures the social environment and behaviors in the community; data would be available from the school system. "The proportion of persons satisfied with the quality of life in the community" is an indicator for which information would not be readily available; the authors recommend a community survey to obtain such data. Readers who are more comfortable with rates of immunization and smoking prevalence will also find those among the indicators.

This book includes only 150 pages of text discussion. The bulk of the volume, 180 pages, is devoted to nine examples of indicator sets for monitoring performance on specific health issues. The sample health issues were selected to represent a diverse group of problems in a community: breast and cervical cancer, depression, elder health, environmental lead exposure, health care resource allocation, infant health, tobacco use, vaccine-preventable diseases, and violence. Besides presenting measurable indicators for each health issue, the authors outline suggested data sources and stakeholders. The stakeholders include entities that could be held accountable through the performance monitoring process for an agreed-upon strategy. These nine indicator sets are very well developed and could serve as a pattern for anyone launching an effort to improve some parameter of a community's health.

Michael Stoto, of the IOM staff, has added a very useful appendix that discusses methodologic issues in developing community health profiles and performance indicator sets. At the end of his chapter, as well as elsewhere in the book, there are numerous references to assist the user in exploring each subject in more detail. A 19-page executive summary covers the major recommendations and models used in the book but does not include the nine sample indicator sets.

For anyone involved in assessing or planning strate-

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