

Epi Info and Epi Map: Current Status and Plans for Epi Info 2000

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In order to deliver public health services, epidemiologists and other public health professionals need low cost and easy-to-use computer software tools to manage data, perform data analysis, and map results. The software must function on laptop computers during field studies as well as in office environments.

*Epi Info*¹ and *Epi Map*² are personal computer (PC) software programs developed since 1985 in response to this need by the Centers for Disease Control and Prevention (CDC) and the World Health Organization (WHO). *Epi Info* provides data entry, data management, graphics, and statistical analysis functions. *Epi Map* displays geographic data from *Epi Info* or dBASE files as color, pattern, or dot-density maps. Both are public domain programs that are available at low or no cost.

This article reviews the features of the DOS-based versions of *Epi Info* and *Epi Map* programs that currently are used by many public health practitioners around the world and describes plans for the next iteration, *Epi Info 2000*, which has not yet been released. In contrast to the DOS-based *Epi Info* and *Epi Map* programs, *Epi Info 2000* will be Windows-based. *Epi Info 2000* also will be designed to facilitate integration (Table 1) with high-end geographic information systems (GIS) programs.

DOS Versions of Epi Info and Epi Map

The DOS versions of *Epi Info* and *Epi Map* have been popular. A study in the summer of 1997 documented the distribution of at least 145,000 copies,

with users in 117 countries and translations of the manual and/or programs into 13 non-English languages.³

The initial DOS version of *Epi Info* was released in 1985 and *Epi Map* was released in 1992. The features of *Epi Info* have been refined by input from epidemiologists worldwide and allow relatively sophisticated analysis of commonly encountered public health issues. Data processing features of *Epi Info* include the ability to create data sets that can be exported in a variety of formats, including dBASE. Because dBASE tables can be imported by all high-end GIS programs, data sets generated by *Epi Info* can be used and displayed by these programs, as well as by *Epi Map*.

Epi Map allows the user to draw or customize map outlines on the screen, thus facilitating its use in disaster situations, hospital infection surveillance, or community public health settings where appropriate digitized maps may not be readily available. Map outlines (boundary files) can be constructed by using a digitizer tablet or by taping a transparency or a map over the monitor screen and tracing the outline in *Epi Map*. Boundaries also can be imported from Atlas, MapInfo, ArcView, and ARC/INFO systems. Version 2 of *Epi Map* for DOS offers a programming language for creating point-and-click information systems with drill down to other maps, text, or hypertext. In *Epi Map*, several maps with different boundaries and data files can be displayed on a single screen, allowing rates and counts to be shown side by side, or presentation of a series of diseases or time periods.

The DOS versions of *Epi Info* and *Epi Map* run on essentially all Intel-compatible PCs, even those with limited computing power. Most epidemiologists can learn the essential concepts for using *Epi Map* in an hour or two; doing simple analysis in *Epi Info* does not require much more.

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Table 1

Characteristics of *Epi Info 2000* compared with those of *Epi Info* and *Epi Map*

Characteristic	<i>Epi Info/Epi Map</i> for DOS	<i>Epi Info 2000</i> (under development, for Windows 95, 98, and NT)
Operating system	DOS-based	Windows 95, 98, NT
Statistical analysis features	Yes (<i>Epi Info</i>)	Yes (<i>Epi Info</i>)
Able to import boundary files	Yes (Atlas, MapInfo, ArcView, ArcInfo)	Yes (ArcView, ArcInfo shape files)
User can draw or edit boundary files	Yes	Yes
Displays data from	<i>Epi Info</i> or dBASE Files	<i>Epi Info</i> , Microsoft Access, dBASE, ODBC, others
Able to display rates or counts in polygons	Yes	Yes
Able to geocode to street address level	No	Possibly
Available free on the Internet	Yes	Yes
Public domain	Yes	Yes
Multiple maps on one screen	Yes	Possibly

Like all DOS programs, *Epi Info* and *Epi Map* have limitations on graphic, printing, and standardized interface features. *Epi Info* and *Epi Map* files have unique formats, although conversion utilities are offered for other common formats. Because *Epi Info* and *Epi Map* are separate programs, data prepared in *Epi Info* must be transferred to *Epi Map* for display. This can be done transparently with the aid of DOS batch file commands and the configurable *Epi Info* menu.

Sample uses of *Epi Info* and *Epi Map* include displaying maps to portray:

- disease counts and rates in a public health surveillance system in which a master data file is processed at intervals and geographic information is displayed in a choropleth map for rates and a dot density map for counts. Figure 1 illustrates typical *Epi Map* output, without enhancement, that can be printed directly from a word processing program. With modern graphics programs, many enhancements are feasible.
- rates and counts for surgical wound infections by operating room, recovery room, and hospital room or floor
- community risk factor rates
- sexually transmitted or other disease rates or counts displayed as a series of maps on the

same screen to show different diseases or time intervals

- injuries by type or place of occurrence
- well water tests and results by area
- refugee camp surveillance for cholera, malnutrition, population, and food supplies
- medical events during activities involving large crowds
- customized schematic maps to display areas representing non-geographic variables

Epi Info 2000 for Windows 95, 98, and NT

Epi Info 2000, an entirely new version of *Epi Info* and *Epi Map*, is being developed for Windows 95, 98, and NT. *Epi Info 2000* will use the same strategy as the DOS versions—preparing data in *Epi Info* and then displaying it in *Epi Map*—but mapping features will be integrated into *Epi Info* through the addition of a Map command in the Analysis program. *Epi Info 2000* is written in Visual Basic and uses Microsoft Access database tables for compatibility with the rest of the information technology world.

Development of mapping functions will be done with *MapObjects* software purchased from Environmental Services Research Institute, Inc., (ESRI), the commercial providers of Arc/Info and ArcView.

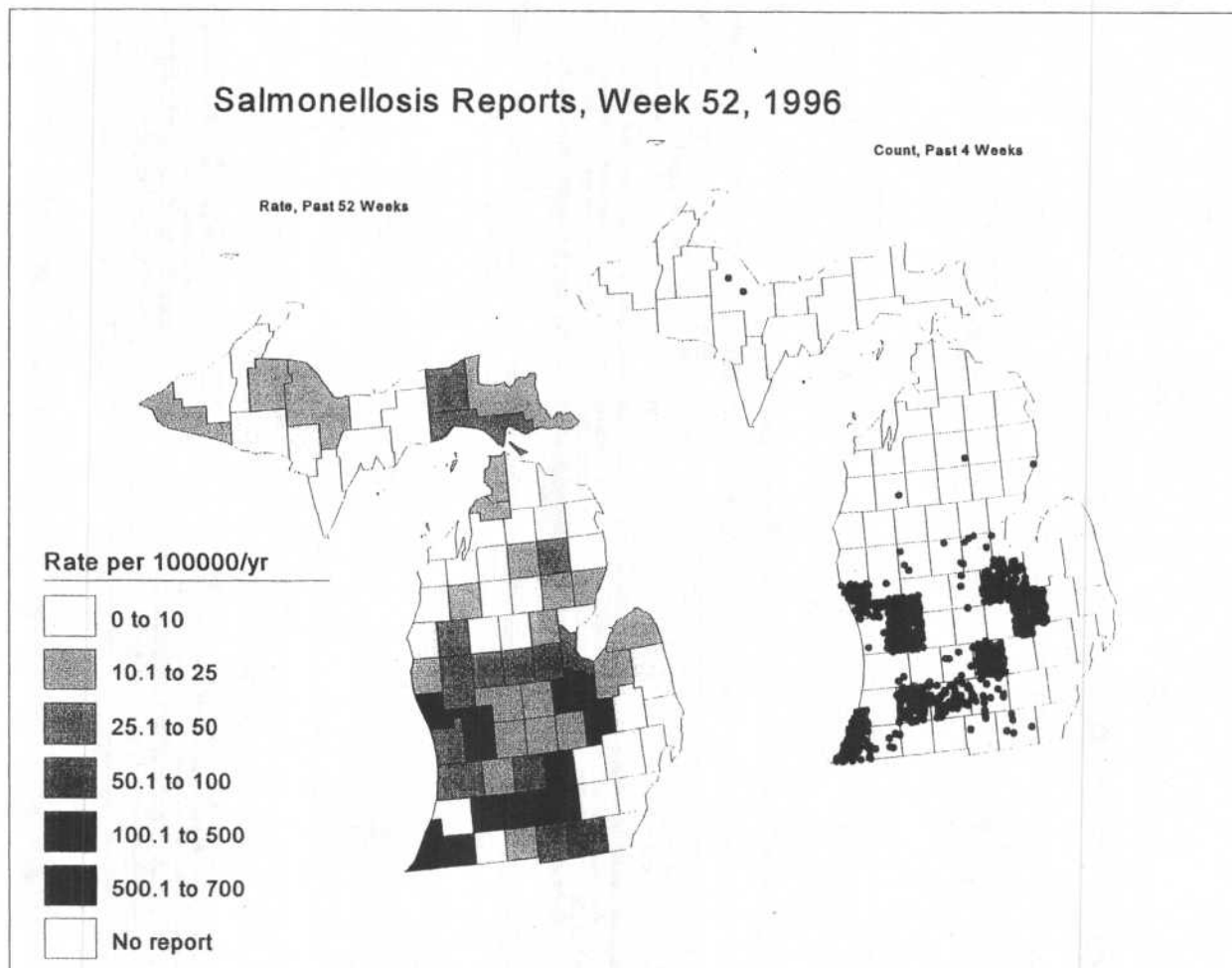


Figure 1. Two maps from the same screen in *Epi Map*, Version 2 for DOS, at Week 52 of observation, based on cumulative (provisional) data in a public health surveillance system: a choropleth map summarizing disease rates for the past 52 weeks; and a dot-density map displaying case counts during the past four weeks, by county.

ESRI has provided a special license for CDC waiving runtime distribution royalties for *Epi Map 2000*. *Epi Map 2000* will offer compatibility with Arc/Info coverages, ESRI shape files and a wide variety of bitmap image formats such as BMP, TIFF, SUN, ERDAS, BIL, BIP, and BSQ.

The mapping functions in *Epi Info 2000* could be used to extend GIS applications and methods in a public health practice setting. For example, a state or national public health agency that provides high-end GIS services could make *Epi Info 2000* and *Epi Map 2000* available to smaller agencies, including map boundaries, data files, and training. Data files could

be sent easily over the Internet to display in *Epi Info 2000* on the user's desktop.

The Windows version of *Epi Map*, like the DOS product, will focus on the display of rates or counts in polygons. Features to facilitate geocoding, drawing or editing maps, and incorporating images are under consideration as development proceeds. Boundary files by ZIP code and census tract are available for the United States, with less detailed files for the rest of the world.

Epi Info and *Epi Map* for DOS can be downloaded from the CDC Internet site at <http://www.cdc.gov>, under the heading, Products and Publications, then

Software and Epi Info/Epi Map. The manuals are included in electronic format but also can be purchased from vendors referenced on the web pages. *Epi Info 2000*, including *Epi Map 2000*, is scheduled for release in 1999 and will be similarly distributed.

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Spatial Analysis and Mapping on the Internet

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In the 21st century, advances in computer technology will enable full Geographic Information Systems (GIS) functionality on the Internet for analysis, management, and display of spatially-referenced public health data.¹⁻² This technology will enable state and local public health practitioners to improve delivery of essential public health services such as monitoring community health problems (essential public health service #1), epidemiologic analysis (essential public health service #2), communication of health issues with the community (essential public health service #3), and linking people with needed services (essential public health service #7).³ Performance of GIS mapping and spatial analysis on the Internet also will help public health agencies establish links with their "customers" (patients and representatives of community groups). In addition, in order to enhance community services and meet the needs of all governmental activities that create or use geographic

data, partnerships will need to be formed between governmental agencies to develop regional Web-based GIS data exchange and repositories (See <http://www.ruis.org>, for information on the San Diego Regional Urban Information System. Also, see <http://baltimore.umbc.edu/bwc> for information on the Baltimore-Washington Regional Collaboratory). These partnerships will alter the way that public health agencies share and exchange information.

The purpose of this article is to provide public health practitioners with an orientation to the rapidly evolving trends in Internet GIS technology. First, the challenges involved in enabling full GIS capabilities on the Web are briefly reviewed. Second, client-server relationships involved in performing GIS on the Web are described. Third, three models for Internet GIS technology are outlined, ranging from the standard configuration most common today

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