Data Base Management in Radiology: A Simplified Approach

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The increasing availability of personal and departmental computers in radiology departments has led to increasing interest in data management. Data base management software must be system compatible, simple, and flexible to insure its acceptance and constant use. Once in place, such a system streamlines the daily documentation of interesting cases for conference, follow-up, research, and quality assurance. The authors have developed such a data base program for tracking computed body tomography cases in their department, which can be run as a portable computer to maximize ease of access and therefore usage.

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KEY WORDS: data base management, computers, computed tomography.

THE COMPUTER now plays an active role in nearly all facets of academic life. Recent articles have described the uses of computer programs for applications ranging from designing scientific exhibits,¹ to planning resident rotation schedules,² to radiologic teaching tools.³ As computers become more commonplace in our working environment they can provide a means of enhancing our performance by maintaining and organizing records and information.

One of the most widely used tools on the personal computer is a data base management program.^{4,5} There are a variety of excellent data base products available. In addition, data bases running on personal computers can be linked to larger main frame computers, allowing connection to the hospital data base. The introduction of portable lap-top computers provides another advance in terms of ease of use and availability.

MATERIALS AND METHODS

System Hardware

The computer chosen for this project was an Apple Macintosh Portable (Apple, Inc, Cupertino, CA) with 2 Mbyte random access memory and a 40 Mbyte internal hard disk. The portable runs all standard Macintosh software but is easy to transport as it is in a flat case and weighs about 16 pounds.

System Software

The data base management software chosen was Fourth Dimension (Acius, Inc, Cupertino, CA). This data base software supports relational data bases with an easy to use data base developmental tool for creating custom data bases. Data can be retrieved easily by using sophisticated graphical user interface search tools.

Fourth Dimension is one of a series of data bases available for the Macintosh, which include FileMaker II (Claris, Inc, Cupertino, CA), and FoxBase+ (Fox Software). Fourth Dimension was chosen based on our prior use of it for data base management on the Macintosh II and IIfx. The program is very easy to learn for even the most computer-shy.

The data base is first created with a user designated entry form. The form is constructed by placing fields (each field represents a category of information such as name, disease, diagnosis, etc) onto the form (Fig 1). Each field can be formatted to contain free text, defined text choices, number, date, or other more esoteric choices. Any number of fields can be created. Specific responses or entries (lists of choices) can be defined for a field (Fig 2). Once the form of a data base is defined, screen layouts of the form can be made. Each field can be moved around the screen to create a visually pleasing display. Separate and multiple screen layouts can be defined for data entry (input) and data reporting (output). Template screen layouts are supplied to give a basic layout to work from. The output layouts allow for the rearrangement of the order and extent of data input and output depending on the information needed. The input and output layouts can be changed at any time without affecting the integrity of the data base.

Retrieval of entered data can be done through any of the fields defined in the initial data base. A number of defined search commands are available and include equal to, greater than, less than, and contain. Free text searches can also be done with multiple defined entries possible (eg, all males over 50 with liver masses). Searches of over 2,000 patients takes less than 5 seconds.

DISCUSSION

Successful clinical implementation of a data base requires attention to pragmatic operating factors. These include (1) Ease of use—the data entry form must be simple, with a minimum amount of typing needed. Preferably all the information needed should fit on one screen; (2) Ease of information retrieval—searching of the data base must be easily accomplished. Data must be retrieved in the form needed; (3) Ready physical availability—the computer used must be intimately positioned in the physician's

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0897-1889/91/0402-0002\$03.00/0*

Fig 1. Sample form using Fourth Dimension for constructing a data base. In this case a simulated data base for computed tomography is being constructed.

work space (eg, near computed tomography (CT) scanner, reading board, or work area). If the user must travel any distance to enter data, it probably will not get done; (4) Streamlined data base expansion—the data base should be expandable without any need for reentering data. If a new category of data needs to be entered, the data base must accommodate this information without any reconstruction of the initial data base.

In the ideal world the radiologist would have

at his or her disposal an array of assistants to enter information about patient studies and interesting cases. The radiologist then might not need to be concerned over such mundane issues as ease of use, availability, and portability. Unfortunately, in this era of financial accountability and disease-related groups we are faced with ever-scarcer resources. If a data base is to be constructed and maintained, it is the radiologist in most cases who will be responsible for it.

Fig 2. The ability to define specific responses or entries can be chosen through this decision tree.

File Edit Patients Search Print

4th DIMENSION

Last Name: _____ First Name: _____ Age: _____

History Number: _____ Sex: ☐ Male ☒ Female Date: 5/1/90

Diagnosis: 1. Follow Up
2. _____
3. _____

Organs Involved: ☐ Adrenal ☐ Bladder ☐ Bone ☐ Chest Wall ☐ Colon ☐ Kidney
☐ Liver ☐ Lymphnode ☐ Mediastinum ☐ Muscle ☐ Pancreas ☐ Lung Parenchyma
☐ Prostate ☐ Small Bowel ☐ Soft Tissue ☐ Spleen ☐ Other _____

Scan Area: ☐ Chest ☐ Abdomen ☐ Musculoskeletal

Study Type: CT Category: ☐ Infectious ☐ Neoplastic ☐ Other

Correlative Studies: 1. N/A 2. N/A 3. N/A

CT Findings: _____

Comments: _____

Next Previous Record # 1 of 89 Ok Cancel

Fig 3. This is a copy of the full screen used for our data base. The data base is customized for CT.

With increasing clinical, research and teaching demands, the radiologist may have little time for data keeping. Yet, maintaining data on patient studies has become increasingly important in obtaining follow-ups, maintaining quality assurance standards, or producing academic publications.

Running a data base on a portable computer overcomes the problem of availability. With its small footprint it can fit on the console next to the dictaphone. While dictating, one can enter any information necessary. The portability of the system also helps keep the number of systems needed to a minimum.

The system is currently in use in the section of Computed Body Tomography and has been for the past 8 months. Cases are entered daily and are chosen for either their teaching value, uniqueness (eg, potential publication value) or for collecting cases for follow-up. The latter application is especially valuable for maintaining a quality assurance program in the CT section. At the present time, between 2 and 10

cases are entered daily by one of the radiologists. The program has proven easy to use with the average case taking well under a minute to enter.

The most common reasons for searching the data base have been (1) retrieval of interesting cases for daily conferences; (2) identifying cases requiring follow-up. As such, follow-up (eg, pathology or bacteriology reports) is obtained. This information is then entered into the data base; (3) collecting cases for potential publication.

The screen used in this data base (Fig 3) was customized for use in computed tomography. However, it can be modified for any subspecialty in radiology with little difficulty. A copy of the entry form can be obtained at no cost (please send floppy disk) from the authors.

ADDENDUM

The list price for the hardware and software used in this paper: Apple Macintosh Portable Computer \$4,350, Fourth Dimension Software \$795. Substantial academic and developer discounts are available on the hardware and software.

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