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In-house microcomputer software package for management of histopathology reports

YC LIM DMLT and SK CHEONG MBBS, FRCP

Department of Pathology, Faculty of Medicine, Universiti Kebangsaan Malaysia, Kuala Lumpur

Abstract

A system for computerising histopathology records developed in-house using dBASE IV on IBM-compatible microcomputers in a local area network is described. The software package uses a horizontal main menu bar with associated pull-down submenus as interface between the machine and the user. It is very easy to use. The package provides options for selecting databases by years, entering/editing records, browsing data, making multi-characteristics searches/retrievals, printing data, and maintaining databases that includes backing-up and repairing corrupted databases.

Key words: Microcomputer, software, histopathology, dbase, database programme, records.

INTRODUCTION

In our histopathology unit, patients' particulars and their histopathology reports have always been processed in duplicate with one copy forwarded to the clinician in-charge and the other retained and filed for future reference. The reports are stored in hard-cover files in order of their laboratory numbers. As such it is almost impossible to locate a report without prior knowledge of its laboratory number. It is also difficult to determine whether a particular patient has had previous reports.

Clinical research is often dependent on the analysis and processing of a large number of cases involving the examination of multiple variables. With a manual system, data search/retrieval is exceedingly laborious as one has to delve into many files to trace the records.

Since 1986, reports have been kept in electronic computer files or database files using dBASE III, a separate database file for each year. However, these databases are accessed in their gross form with all requests issued through the dot prompt of dBASE III. This has not made data search/retrieval any easier as any minor discrepancy in the command line will not be accepted. Besides, entry of data is not validated and this results in inaccuracy of data stored.

Hence, we saw a need for a user-friendly programme that uses a menu system which will not frustrate even the most inexperienced user. Between April and May 1990, an in-house programme written in dBASE IV, a commercial database management software with programming facilities, was designed and developed to manage these databases.

The Histopathology database manager, or *Histomgr* in short, is an application programme generated by the dBASE IV Application Generator. This programme comprises a menu system that allows easy access to databases, selection of databases, entry/editing of records, browsing of records, multi-characteristics searches / retrievals, printing data and upkeeping of the databases. Validation of data entered is an important feature incorporated and is transparent to the user.

Various programmes have been described in the literature for the same purpose.[1,2,3] In these programmes, which are also menu-driven, the submenus that are invoked by pressing selected keys will replace the main menu on-screen. Our menu system uses the more advanced horizontal main menu bar system which activates the pull-down submenus without replacing the main menu bar as illustrated in Fig 1. Selection is by moving the highlight (operated by arrow keys) across the main menu bar. Pressing the <Enter> key selects the currently highlighted option and the submenu will be displayed. Selection from the submenu is by moving the highlight up and down the submenu to the required options.

In this report, we describe our experience in developing and using this programme in a local area network environment.

METHOD

Designing the application - Histomgr

Before the actual development of Histomgr took place, the goals of the application were defined. Based on these definitions, database structures,

Address for correspondence and reprint requests: Assoc. Prof. S.K. Cheong. Department of Pathology, Universiti Kebangsaan Malaysia, P.O.Box 12418, 50778 Kuala Lumpur, Malaysia.

screen formats, and printout formats were designed and created, followed by entry of trial data and testing of operation.

1. Database creation

The databases are created and named according to the year. For 1991, the database is named SNOMED91.DBF. The .DBF extension indicates a dBASE IV file and is generated by the system itself. Each record consists of 12 items. These include laboratory number (LABNO), registration number (RNO), identity card number (ICNO), name (NAME), sex (SEX), age (AGE), ethnic group (RACE), site of origin of the specimen (SITE), pathological diagnosis (DIAGNOSIS), T code (TCODE), M code (MCODE), and comment (MISC). The T and M codes are based on that of Systematized Nomenclature of Medicine (SNOMED).[4] The labels in brackets are used to name the fields or items of the records.

2. Use of database

When the programme is activated, a banner is displayed. This banner displays the authors, the version and the year created. The horizontal main bar menu will then appear. The main menu displays 5 options : Database, Update, Enquiry, Utilities, and Exit. The 'Database' option allows the user to choose the desired database.

3. Input and viewing data

The 'Update' option consists of a pull-down submenu which offers 3 different actions. The first and third actions make use of a designed screen format for entry of new patients data or to modify existing patient records (Fig. 2). Certain entries like race and sex are presented as a multiple choice function with pre-defined choices such as M/F (Male/Female) for sex and M/C/I/O (Malay/Chinese/Indian/Others) for different races. The second action provides a browse screen that is useful for a quick overall view of all the records of the database selected (Fig. 3). It does not allow any editing.

4. Search/Retrieval

The 'Enquiry' option is an important function of the Histomgr. On selection of this option, the system offers a screen displaying multiple items for enquiry to obtain 'processed' information from the database or to trace all the records available for a particular patient (Fig. 4). This function is highly versatile and searches can be made for a single or for a combination of up to 9 different variables including an age range. A record must match all the criteria set before it is retrieved and dispayed.

Retrieved data output can either be printed or displayed on the monitor screen. The user is also given a choice of a complete record output or one of selected items, by typing in the item names (must be similar to the field names of the programme) when prompted.

Built-in messages warn the user while the search is in progress and also when no matching record is found. At the end of each search, the user may either proceed to the next one or terminate the procedure with the <Esc> key.

5. Database maintenance

The 'Utilities' option offers 2 different actions. There is the 'Backup' action that copies all the databases to floppy diskettes. The 'Repair

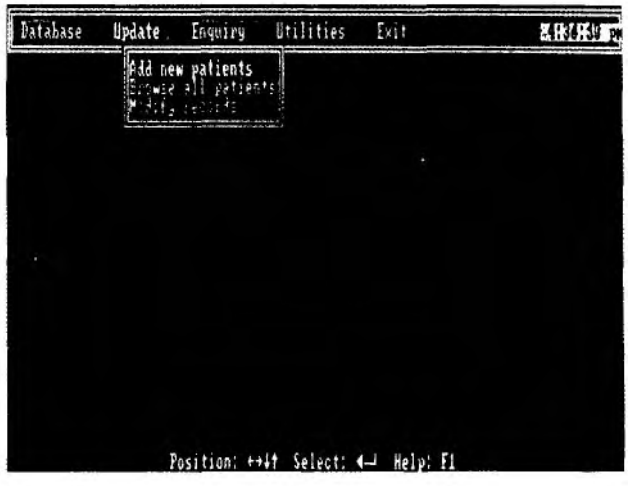

FIG. 1: The main menu bar with its attached pull-down submenu.

FIG. 2: Screen format for entry/edit patient information.

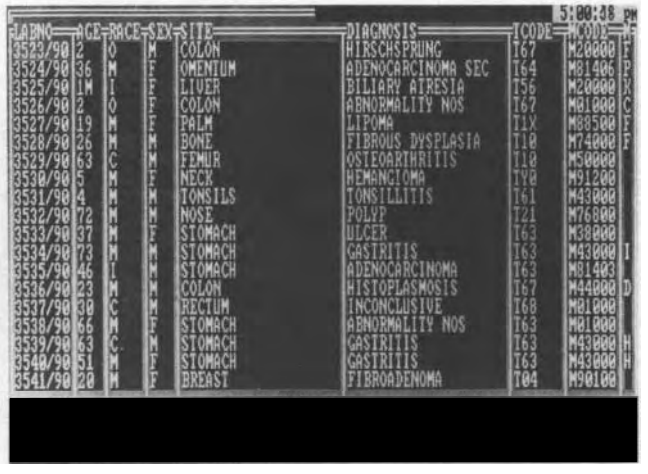

FIG. 3: Browse screen for quick view of the database.

FIG.4: Screen display to enter items for enquiry used in data search/retrieval.

corrupted index' action, as its name suggests, allows the possibility of carrying out the reindex command to repair a corrupted database.

6. Exit from the Programme

Lastly, the 'Exit' option when selected allows the user to close all database files and exit from the programme.

Developing the application - Histomgr

Development of Histomgr was done with the dBASE Application Generator. This involved a series of steps that included giving a name to the application, defining the default settings or conditions of operation, creating a signed-on banner, making the main menu bar and attaching the pull-down submenus to each option in the main menu bar. After all the above definitions were set, the Application Generator was then used to translate them to programme codes. However, some subprogrammes require complex codes that cannot be handled by the Application Generator such as the subprogramme for the enquiry option. The "Enquiry" subprogramme was therefore written separately and the Appication Generator used to generate programme codes to use it.

Automatic compilation

To maximize processing speed, dBASE IV automatically compiles all programme codes to machine codes. These codes would be executed by the machine when used. If any modification is made to the programme codes later, dBASE IV will automatically compile the programme code again to machine codes. Machine codes are in general handled faster by the computer.

Installation

The compiled machine codes of Histomgr can operate under the main dBASE environment or the abridged dBASE programme called runtime module. This runtime module can be distributed independently of the main dBASE package. Users of this module do not need to be licensed for use. We have installed the runtime module under the Department's local area network environment using Novell 386 Netware (Novell Incorporated, USA). As many as 18 users can access Histomgrsimultaneously. Only authorized personnel can access the programme. This runtime module with Histomgr can also be installed in any microcomputer possessing 640 KB RAM and a fixed disk, preferrably with 20 MB storage space.

DISCUSSION

The main question raised with the installation of any new system is whether it has improved the efficiency of the function which it is required to perform. The main aim of developing Historngris to provide a fast and easy searchtretrieval means to trace histopathology records. We believe that we have achieved this objective.

Being a fully menu-driven programme, a user of Histomgr is not required to learn any dBASE commands in order to operate the system. All that the user needs to know is how to move through the menus and select the desired options/actions. This is what computer enthusiasts call "user-friendliness."

As a searchtretrieval tool, Histomgr has proven to be highly versatile. Various combinations of searches are entertained and the results are available in seconds depending on the types of terminal used. A faster microcomputer will give results faster.

Histomgr also has flexibility in the choice of data output. Data retrieved can either be displayed on-screen or printed or both. Providing the user with achoice of any combinationof variables or items of information to be displayed or printed fulfills the varied needs of different users.

When comparing the speed of searchtretrieval of Histomgr with that of direct manipulation through dBASE dot prompt, it was found that Histomgr takes a longer time to start off the actual searchtretrieval as it has to first carry out preliminary functions. If the database is small (hundreds of records), the slower speed is noticeable. However, when it involves a larger database (thousands of records), the difference in speed is no longer noticeable. Moreover, when the enquiry is complicated, such when as a combination of variables is required e.g. the occurrence of a disease with relation to age, sex andethnic groups, the advantage of Histomgr becomes apparent. It is easier to perform and the time taken is shorter.

Considerable time has been saved from locating cases for research purpose. The search/retrieval option allows the researcher to trace cases of interest for further study. It is equally true in the preparation of slides for practical/demonstration. Suitable cases can be readily identified and the paraffin blocks subsequently traced.

Histomgr is a multiuser programme that currently allows up to 18 users to use the same database simultaneously through different computer terminals. Security to avoid clashes of operation is by a record locking system. Whenever an attempt is made to modify an existing record,

the programme will automatically lock all users out of that record! The "engaged" user will then have to press the <space> bar to claim exclusive right to the record in order to be allowed to modify it. This security system has proven to be quite an inconvenience as a user who has a number of records to modify will find himself locked out each time he attempts to change a record and have to repeat the procedure all over again.

Histomgr was designed with the hope that it will meet with all the different possibilities of tracing records. However, since laboratory number has been left out as a filter during thedesigning stage, the programme is not able to accommodate individuals who wish to locate a case by its laboratory number! The more adventurous users may also feel restricted by the menu system. These deficienciescan be overcomed by accessing the respective database directly through the dot prompt.

Future plans for the programme include the possibilities of using laboratory number as a time period filter and the designing of a standardized report form format. Histopathologists can then directly enter their findings into the database file and then initiate the programme to print out the appropriate report that is to be despatched to the respective clinician in-charge.

Another useful modification is to provide an automatic data search whenever a new record is added, to locate and inform the user of any previous reports for that particular patient based on his name and identity card number. The user will then know whether the current pathology is new or whether other pathologic lesions have been diagnosed.

Together with the Novell operating system, Histomgr can also be modified to locate corresponding Haematology and Cytology or Chemical Pathology reports to construct a complete patient profile for a particular patient who has had different specimen samples sent to the different divisions of the Department. This we hope will be beneficial in cases that are difficult to diagnose and hence help to provide better patient care.

The computer is aproductivity tool. One of the reasons for introducing a computer with friendly software is to increase research activity in the Department. That this objective has been fulfilled is evidenced by the number of new projects undertaken and publications produced by the staff.

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