Computerization of family practice

Tom Elmslie,*† MD, MSc, CCFP
Walter W. Rosser,* MD, CCFP, FCFP

The primary focus of computer systems for family practice is on patient billing. Primary care physicians should be aware of the many other benefits that can and should be considered when planning a system for their practice. This article describes the type and extent of information that can be stored in a family practice data base and explores some of the applications in areas of practice and patient management, prevention and research.

En médecine familiale, l'ordinateur sert surtout à la comptabilité. L'omnipraticien qui songe à en acquérir un devrait considérer les autres services qu'il peut en attendre. On décrit ici le genre et l'étendue des données qu'on peut confier à l'ordinateur en médecine familiale et comment on peut le faire servir à l'administration d'une clientèle, au traitement des malades, à la prévention et à la recherche.

Now that some provincial health insurance systems accept claims on 5¼-in diskettes the family physician can use inexpensive microcomputers for billing and accounting. By extending the application of computerization beyond simple billing systems the family physician will have a powerful tool that could significantly change both patient and practice management.

Most computer systems designed for family practice store the information that is now being entered in the patient's chart in two separate data files, one containing registration information and the other containing encounter data (information on each patient visit). This article describes the type and extent of information that can be stored in these two data files and explores their potential applications in family practice, especially for prevention and research.

From the departments of *Family Medicine and †Epidemiology and Community Medicine, University of Ottawa

Reprint requests to: Dr. Tom Elmslie, Family Medicine Centre, 75 Bruyère St., Ottawa, Ont. K1N 5C8

Patient registry file

This file usually includes basic demographic information, such as the patient's name, sex, date of birth, telephone number, address, provincial health insurance plan number and some indication of family relationships. The information is stored in a separate file because it is basically "stable" and requires only occasional updating. Once this information is correctly entered it can be retrieved with 100% accuracy for billing, which offers an advantage over manual processing.

Since this file contains a record for each patient, it counts the number of "active" patients and provides the denominator for incidence or prevalence rates of specific conditions within a practice. Unfortunately, in areas where patients are very mobile the registry information may rapidly become outdated. Although the data for patients listed in the registry who have not visited the physician during a specified period will not disrupt billing, which is driven by the encounter data, they pose a problem by inflating the denominator. Much has been written about this problem.[1,2] One solution is to have a computer program identify those who have not visited during a specified period; a letter can then be sent to determine if they are still active patients of the practice. The registry information can be used for printing address labels for these letters and other mailings to patients.

Patient encounter data

Every time a physician sees a patient an "encounter" takes place, which the physician records in the patient's chart. Few computer systems eliminate the patient chart entirely, since it contains the only complete and detailed record of the encounter. The only information that is needed for billing is the patient's name (or identifying information to link the encounter information with the patient registry), the diagnosis or procedure and the physician's billing number. Simple programs combine this information in a format that allows

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billing cards to be printed or diskettes to be produced; either can be mailed to the provincial health insurance plan.

Most commercial computer systems provide little more than this basic system, and with this system a simple classification of general diagnoses is adequate for billing. However, if the encounter information is to accurately reflect the patient's visit, then a more detailed classification system is required; one that other family physicians are using is preferred so that interpractice comparisons will be possible. The International Classification of Health Problems in Primary Care,[3] which includes many symptoms and general conditions seen in family practice, is the system most commonly used, although modifications may be necessary to adequately describe all encounter situations. The more specific the classification of diagnoses the more useful it will be in clinical or research applications, and specific diagnoses can always be grouped into broad categories later.

Another problem with encounter data is recording the diagnosis. There may be space left on the encounter form for the physician to record whatever diagnosis best describes the encounter. A coding clerk not only has to interpret what was written (an illegibly written "duodenal ulcer" may be coded as "decubitus ulcer") but also must decide which of the classification diagnoses best agrees with the physician's diagnosis. Errors resulting from illegibility and misinterpretation can be avoided if commonly used diagnoses in the classification system are printed on the encounter form; then the physician simply has to circle the applicable diagnosis. A space can be provided for recording less commonly used diagnoses. An alternative is to have available a list of commonly used diagnoses in the classification system for the physician to refer to before completing the encounter form. Again the physician must make the coding choice that best reflects the clinical situation, and there is space on the form for other pertinent information. In a system in which a profile of previous problems is printed out before the patient's next encounter, placing a mark beside the diagnosis that applies at the current visit would be a simple recording method.

Other problems in coding diagnoses include differentiating the main diagnosis from secondary ones, differentiating old and ongoing conditions from new ones, and linking the initial diagnosis, which often tends to be vague, with the definitive diagnosis, made at a follow-up visit.

Information about what is prescribed for the patient at each encounter is useful for the encounter data base. A tear-off prescription form that duplicates the prescription on the encounter form provides for simple and accurate recording and avoids the physician's having to rewrite the information.[4] The problems in coding prescription information include classifying the prescriptions, differentiating new from continuing medications and linking the prescribed drugs to the appropriate diagnosis. Different data-base systems use different ways of linking the various types of information within a data file and between files. Computer software that can handle these problems will provide a useful patient-encounter data base.

When several terminals are connected to the central data base a patient's profile can be immediately accessed. This is most useful when a pharmacist telephones for a prescription refill: the patient's current drug profile and the expiry date of the last prescription can be immediately checked. If a prescription is given, the information can then be directly added to the data base. One of the programs that alert the physician to the possibility of a drug interaction may be used when a drug is to be added to the patient's regimen.

The linking of computers by modem allows rapid transmission of clinical data between laboratories or radiologic facilities and the family physician's office, as well as between the consultant and the family physician. (In addition, some medical journals and continuing medical education programs are available through telecommunications.)

Scheduling of appointments can be allocated to the computer and, through a specially designed program, can easily fit the physician's particular needs. Once an appointment has been scheduled an updated cumulative profile of the patient can be printed and added to the chart.[4,5]

Practice profiles

Studies have indicated that physicians have difficulty predicting their patterns of practice. By identifying these perception–practice gaps an effective method of continuing medical education may be provided.[4] The computer should be able to produce a practice profile stratified by age, sex, diagnosis, medication or any combination of these. It should also have the flexibility to identify specific patients or subgroups of patients. This can be done in an interactive way: the computer system prompts the physician to select the various identifiers (e.g., patient's age, less than 60; sex, male; diagnosis, COPD). This information should be available in various forms to suit the specific requirements of the physician.

Screening, vaccination and lifestyle modification

The greatest impact of computerization on primary care may lie in the area of prevention. At present there is a gap between the knowledge of screening programs that are effective in medical practice and our ability to deliver medical care to patients at risk. For example, task forces on hypertension[6] and cancer of the cervix[7] have identified the family practitioner as playing an important role in screening for these conditions. Reminders to the physician about screening, vaccination and lifestyle modification can either be added to the

cumulative profile of patients who have booked appointments or accessed directly on the computer terminal during the patient's visit.[8] Computer-generated reminder letters to patients can stimulate return visits for needed health maintenance procedures.[9] In one practice the proportion of children vaccinated increased from 79% to 94% with one computer-generated letter to parents of children whose vaccination history was inadequate.[10] Computerized methods for recalling patients are presently under study in several countries.[4,9]

These strategies to improve the delivery of efficacious prevention measures could improve the health of all Canadians. Unfortunately, provincial licensing bodies have reservations about the ethics of recalling patients. In fact, not only should the colleges encourage this process, but the government should offer financial incentives to general practitioners who can report the percentages of their patients screened for important conditions. This step would increase the amount of preventive screening carried out in each province and would also improve the ability of health departments to monitor the health status of their communities and direct programs at specific high-risk groups.

Research data

A family practice that has been computerized can help in patient and practice management, and an expanded data base can help busy practitioners carry out research in primary care. The type of research can range from simple descriptive retrospective studies to intricate randomized clinical trials.

The development of a clearly defined research question forms the foundation of a good study, and often little time is devoted to this difficult task. The computerized data base can be particularly useful in allowing the physician to easily examine various aspects of a practice in order to identify potential research questions (generate hypotheses) or refine existing ones. The distinction between this phase of research and the creation of practice profiles becomes somewhat blurred. The latter exercise can best be described as practice awareness and part of the physician's continuing medical education, although it may be the starting point for identifying a research idea that can then be investigated.

When the research objective has been clearly identified a carefully planned research study can be designed to test the hypotheses. At this stage consultation with a clinical epidemiologist or biostatistician is important. The physician needs to determine what information will be necessary to answer the research question. This will dictate, to a large extent, the appropriate study design. A retrospective study might seem to be the likely design for a computerized family practice since the physician has easy access to a large patient-encounter data base. This type of study is quick and inexpensive. Unfortunately, it is dependent on the quality and extent of the information in the data base. One of the problems with a computerized data base is that the physician may want to use existing information to answer the research question and therefore may either attempt to use data that are less than ideal or, worse yet, change the question to fit the data. He or she may also want to browse through the data and present interesting findings as if they were based on an *a priori* hypothesis. Although it would be convenient for the physician to carry out a study entirely from the existing data base, this is usually not possible since the information needed to answer the research question has not been routinely collected.

If information that might be useful in future studies can be identified and recorded routinely the quality of the data base for retrospective studies will improve. Many retrospective studies in family medicine look for an association between some exposure and an outcome but are unable to control for important confounding variables. For example, in a study looking at the association between the use of hydrochlorothiazide and adverse cardiac outcomes it would be important to control for smoking status. Also, lifestyle factors are identified as important confounders in many studies; data on them could be routinely collected.

Although the information that is needed may not be contained in the data base, it is often available from the patient's chart. Probably the most important use of the data base for research lies in its ability to identify specific patients. Of the patients registered in the practice it may only be those for whom hydrochlorothiazide was prescribed that are of interest; this subgroup can be identified quickly and used as a sampling frame, from which an appropriate number of patients can be selected for detailed chart abstraction.[11]

When the information necessary to answer the research question is contained neither in the existing data base nor in the chart, then it must be gathered prospectively. The computer can be used to determine if the number of potential subjects meets the sample size requirements and can identify the eligible patients. The questions to be answered for each patient can be added to the encounter form for the study period so that the information can be entered into the data base as it is collected.

Some analysis of the data is usually required, but most descriptive and analytic surveys do not need sophisticated analyses. A basic statistical package that provides descriptive statistics and performs simple group comparisons may be included with the computer system. Several commercial packages are available that also include multivariate analyses. If the data file is large and sophisticated analyses are required, then a link with a mainframe computer (for example, at a nearby university) may be necessary.

The report may be written by means of word processing. This approach can be extremely useful,

since many drafts will usually be necessary both before and after submission for publication. Editors of journals such as *CMAJ* are encouraging the use of word processing to increase the efficiency of both writing and editing. In the future, reports may be transmitted to journals by modem. Telecommunications can also be used to access electronic sources of medical information, which will facilitate literature searches.

Computerization of family practices may facilitate studies for which a single practice could not supply the required number of subjects. Multipractice studies would also allow family physicians who have little research training or little time for research to be involved in a study. An added benefit would be that family medicine research, which is often done in university family practice centres, could then be done in community practices, and this would broaden the applicability of the results.

Conclusion

The type of computer system we have described is more sophisticated than a strictly dedicated billing system and offers physicians a means of not only improving office management and their awareness of practice profiles but also, and more importantly, making changes in areas of screening, vaccination and lifestyle modification. Computerization can also provide the tools that will enable them to become more involved in primary care research. Although computerization of family practices will continue, and at an increasing rate, it remains to be seen whether family physicians will receive the benefits of sophisticated systems. Only if such systems are demanded will the marketplace respond.

References

1. Bass M: Approaches to the denominator problem in primary care. *J Fam Pract* 1976; 3: 193-195
2. Anderson J: Primary care denominator problem. *Can Fam Physician* 1985; 31: 59-62
3. *International Classification of Health Problems in Primary Care*, 2nd ed, Am Hosp Assoc, Chicago, 1975
4. Rosser WW, Flucker G: Software for family practice: a decade of development. *Can Family Physician* 1984; 30: 2567-2571
5. Demanel F, Hines RM, Walter JR: Cumulative patient profile in family practice. *Can Fam Physician* 1977; 23: 819-822
6. Sackett DL: Hypertension: II. Finding hypertensives and linking them to clinical care. *Can J Public Health* 1979; 70: 386-387
7. Cervical cancer screening programs: summary of the 1982 Canadian task force report. *Can Med Assoc J* 1982; 127: 581-589
8. Pringle M, Robins S, Brown G: Computer assisted screening: effect on the patient and his consultation. *Br Med J [Clin Res]* 1985; 290: 1709-1712
9. Grene JD, Henderson JM: Automated recall in general practice. *J R Coll Gen Pract* 1971; 21: 352-355
10. Reid S: Computerized recall for child immunization. Presented at the Fourth Royal Australian College of General Practitioners Computer Conference, Melbourne, May 10, 1984
11. Elmslie TJ, Rosser WW, Sollars SJ et al: Is cimetidine being prescribed indiscriminately? An analytic survey of patients who present with symptoms of peptic ulcer disease. *Can Med Assoc J* 1984; 131: 443-447

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