

The Computer in Family Practice

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Three years of experience with direct computer application in ambulatory medical care delivery is reviewed. The current setting is a three-man private family practice in rural Maine. Emphasis is placed on multiple use of a time-shared computer access. A review is given of

those applications which seem acceptable to physicians and patients along with comments on those that aren't.

Tables are provided on cost effectiveness which suggest that the time sharing computer may soon be an integral part of small private practices.

What is the computer's place in family medicine today? Is it on the horizon as a threat to the individualized personal medical care characteristic of the family practitioner or will it be an aid to him by which he may increase the quality and satisfaction of his practice? Regardless of the answers to these questions, many persons consider the \$800,000 to \$14,000,000 investment that is commonly referred to as well beyond the overhead of the practicing

physician's office. The purpose of this article is to put these and other questions on computer application into a realistic perspective. It is based on three years of experience with direct computer patient interactions both in the military and in private practice.

Background

Many reports of medical computer applications are based on adaptations of traditional commercial computer systems. The hardware and elaborate data processing equipment originally developed in response to business needs were used as a center for medical systems. Necessary new equipment was then crudely and expensively developed to be compatible with the traditional systems rather than the unique characteristics of the medical demand. The same

was true of the "language" or "programming alphabets" in that medical practice was made to fit business language. The outcome, as might be expected, is the technological nightmare towards which medical literature is oriented.

The computer systems with which this article deals are those which lend themselves to medical application by meeting the following criteria:

1. Relatively low cost,
2. Extensive programming with medically compatible language,
3. Terminal constellations which permit direct non-threatening patient interaction, and
4. No technological expertise required by office personnel.

Initial experience with such systems was obtained while developing the Programmed Patient Care Clinic at the Brunswick Naval Air Station in Brunswick, Maine. A project was begun in 1970 to provide solutions to the problems of medical records, mobile staff, mobile patient populations, and inefficient laboratory and X-ray utilization, by converting a large ambulatory population to the problem oriented record. It soon became apparent that the computer could do consistently what many human hands could also do — but in-consistently. Navy families at that installation have had no paper records maintained for about one year while their medical care has been logically recorded and stored by computer. Cost savings, physician satisfaction, and patient acceptance have been adequately demonstrated and will soon be submitted for publication.

In July 1971, our three-man private family practice began to integrate the computer in office practice. Initial funding for the computer terminal access was provided by the Department of Health and Welfare under the Computer Assistance for the Physician's Office Project (CAPO).

It was our contention from the outset that the computerized integrated medical record was a worthwhile goal. Equally obvious however was the fact that the computerized medical record would not by itself provide enough practice income to balance the increased overhead. The object of our efforts then became to convert as many of the administrative duties as possible to computer techniques as well as develop additional aids to patient care which would

TABLE I

Current Use	Planned Additional Use
1. patient history (physical exam format)	— individualized "take home" patient summary
2. patient education	— insurance history
3. physician education (consultation)	— expanded library
4. paramedic guide of triage and examination	— keyed to patient history
5. office billing	— expanded library
6. diagnostic aids and reference scan	— refinement and remote implementation
	— scheduling

be economically supportive. Table I represents the status of these efforts. "Current Use" denotes daily office access since July 1971.

Patient Histories

An inevitable outcome of mixing physicians and computers is a medical history. Perhaps this is because history taking is an essential but very time consuming part of medical practice; perhaps it is simply an outlet by which a physician-author may express his latent creative talent. Our patient history which was developed after a process of analysis and selection is no better or worse than most of the many other computer adapted medical histories. It is a branching general medical history which requires about 30-45 minutes of unassisted patient time. As have most computer oriented histories, it has been well received by patients and effectively utilized by those physicians who integrate it into their routines.

It has been quite obvious, however, that the patient has received little additional tangible benefit from the use of an automated history. As far as he is concerned, the doctor has always "asked some questions" when he got his "check-up." The patient is hardly motivated to pay a higher fee so that the doctor can have a machine do part of his work. The concept of an *individualized take-home patient summary* arose from the desire to provide the patient more of a return for his time, provide a medical service worthy of an additional fee, and to take greater advantage of the computer's potential.

The patient's summary is generated directly from his responses to a traditional medical question but contains material of individual interest to his health maintenance and for his use. The simplest example may be as follows:

Question to patient: "Do you smoke?" Yes/No

Patient response: "Yes"

Patient print out: "Did you realize that smoking increases your risk of sudden heart attack as well as lung cancer?"

The patient print out becomes more individualized as replies become related to previous questions, i.e.: "Did you realize that at *your* age and weight *your* chances of dying over the next ten years are increased three times by *your* present rate of smoking?"

A simple insurance history has been developed from a compilation of common questions on the many different insurance company forms. Acceptance by the individual companies has not yet been obtained.

Patient Education

This is a time consuming part of medical practice regardless of whether or not the physician is intuitively motivated. Many diseases (diabetes, arthritis, etc.) as well as family medical needs (contraception, well-baby care, etc.) are easily adapted to individualized patient use routines. The programs we are currently using in this area were not created by us but by other participants in the CAPO project.

A series of questions is presented which define a patient's specific problem; for example, the type of contraceptive desired. This is followed by interacting questions with the patient responding to what she already knows and the computer providing information of which she is not aware. At the conclusion, a short summary of the factual material of which she was not aware is presented for her to take home.

Physician Education

Several established routines solely for physician education have been available for our use. One program involves the National Board patient treatment method, whereby a patient is treated progressively according to the physician's judgement and the physician is criticized or commended for the merit of his choice. A second technique uses a short case history presentation followed by a series of treatment options. The patient progresses or fails appropriately, and

the physician is given information as to why his treatment may be inappropriate.

The programs now available and recent attempts to increase the available library have had very low interest and utilization. There are many reasons for this but the most apparent explanation is simply that the *practicing* physician needs (and will use) education programs related to treatment of the patients he is seeing. He is less interested in the academic exercises of treating hypothetical patients.

The most useful approach to computerized physician education appears to be the "consultation" program whereby a physician enters active patient data and receives interpretation and references appropriate to what he had entered.

Paramedic Guides

The computer is uniquely reliable for reproducing accurately whatever has been stored in it. The old saw "garbage in — garbage out" captures this feature of the computer as being completely dependent on the human thought processes that initially told it what to do.

It is exactly this reliability in repetition that is probably the one commonly agreed-upon need in the application of paramedical personnel. Generally it is accepted that a non-physician can do many things which a physician would otherwise spend his time on, but problems arise on the selection and timing of such tasks. If a physician could stand next to his assistant and point out, for example, that when a hypertensive patient who is taking thiazides complains of a sore toe a different procedure might be used than when the same complaint is heard from a diabetic. If this process could be done in several chronic diseases and if the single physician were replaced with a team of specialists in each specific chronic illness, it is quite probable that patients would receive better long term care. The same is true with regards to the identification and treatment of many acute illnesses.

This is exactly the philosophy of computer direction for paramedical personnel involved in patient care which can be most directly applied in private practice. The very well thought out protocols on hypertension, cardiovascular disease, and diabetes developed at Beth Israel Hospital and used in our practice are early prototypes. The format involves a short series of disease-related questions, a medication review and double check on patient's usage, a short directed physical examination, and a guide to indicated laboratory tests. The computer interaction in this case is via the physician's assistant with a one page print out provided for the physician review and concurrence or interruption. The program does provide very consecutive levels of patient referral: i.e., should the patient see a physician immediately, within a few days, or at sometime in the future.

Other protocols have been developed for equally secure consideration of acute illness. In general, these routines do not yet lend themselves to computer programming. The problem encountered here is that the physician, while evaluating a viral sore throat, may be "ruling out" many poten-

tial illnesses of a more serious nature simply by having the patient before him. He will be doing the same thing with the multiple symptoms which the patient will complain of; he is either finding pain in the throat, headaches, and joint pain all consistent with his diagnosis of a viral sore throat or indicative of a need for further evaluation. It has been repeatedly shown that only the rare patient presents with a single complaint and the more questions he is asked the more extensive his symptomatology becomes. If a computerized acute illness screening program for paramedical use is to be of value to private family practice it must contain the following:

1. A highly selective series of screening questions providing a broad but rapidly discriminating patient history.
2. A library of selected, office based testing and physical exam procedures which the paramedic is directed to perform from the "endpoints" above.
3. A brief expenditure of patient and computer time. Several preliminary computer models meet the first two criteria but require the physician's assistant to repeatedly consult the patient and the computer, back and forth until a picture of the patient's illness is provided. This requires an expenditure of time by the patient and the computer which may be satisfactory to the academic institution but is not practical in private family practice.

The acute illness screen we have available for our use takes from three to fifteen minutes depending on the depth of patient's symptoms. The single encounter directs the physician's assistant to perform physical examination procedures or laboratory tests as appropriate to the patient's response. The print-out summarizes the patient's history and the tests which the assistant has been directed to perform. The results of the tests/procedures are manually entered after the patient and assistant have left the computer and before he sees the physician (if he does).

This routine is presently in rather crude form in our practice and reflects the practical demands of a family practice after a busy tourist season. Another summer will hopefully find us providing better medical care to the chronic problems of our regular patients while the use of the computer and medical assistants will help us to more safely evaluate the transient illnesses of seasonal visitors.

Office Billing

Administrative applications of the computer are likely to be the most attractive to practicing physicians. The grinding burden of paperwork which consumes perhaps a third of our time is an area that most physicians would gladly delegate to a machine. It is perhaps ironic that medical administrators have been using computer routines to simplify their duties for some time while those of us who have both administrative and patient care demands neglect such aids. Many obligations, including requests for records from other physicians, insurance and "third-party" forms, and consultation requests (and replies) will be automatic benefits if a computerized fully integrated medical record was now available. Since it is not, individual programs have to be de-

veloped where appropriate and where a direct financial influence on practice overhead can be demonstrated. Physicians should perhaps be a bit more demanding to those third-party carriers who like to deluge us with multiple forms and requests which could, with little effort, be made compatible via a single common form produced by a computer from daily office entries.

Automated billing is the simplest form of administrative computerization which is available to the practicing physician. Currently, a single financial entry for each patient encounter is made by a medical secretary into the computer. The entry is made via the same terminal that is used at other times of the day by patients for purposes described previously. From the single entry is generated a monthly patient bill, a daily bookkeeping log, and an on-going record of the services our practice provides. The latter can be readily correlated to practice overhead and individual service expense.

Diagnostic Aids and Reference Scan

There are commercially available diagnostic programs by which a physician may list the symptoms, laboratory tests, or physical findings his patient may have and receive a list of diagnoses with varying levels of probability, including appropriate references for further study. We have had such a service available to us in our practice for several months and have used it very little. Although the theory justifying such programs seems valid, it is likely that they overlook a basic difference between academic medicine and private practice that has been earlier alluded to. The practicing physician would benefit from step-by-step consultation on the patient care problems presented to him, but is less interested in learning the Syndrome's "proper name" for its own sake. Such diagnostic programs will likely be of more value and greater use to family physicians if they are geared to problem treatment rather than syndrome labeling.

It should also be mentioned here that using a computer in practice requires a change in habit. The change required to use a computer for obtaining a diagnosis seems more difficult than the change required by the routines described earlier. This may explain our low utilization of such programs.

Cost

Computer services in our area utilizing all the programs previously discussed is currently available at about \$1,200-\$1,300/month.

This is broken down as shown in Table II. "Computer Access" means the right to "plug-in" a computer located into a commercial supplier geographically remote from the office itself. The cost of this access generally includes a certain amount of individualized programming, plus a basic group of programs "owned" by the company.

TABLE II

Cost	
Computer Access	\$ 700
Dedicated Telephone Line	\$ 300
Patient Screen Terminal	\$ 130
Printer (Hard Copy) Terminal	\$ 70
Total/Month	\$1,200

The dedicated telephone line in our area represents approximately 160 miles of leased line from a computer in Cambridge, Massachusetts to our office in Damariscotta, Maine. Hardware* terminals come in many different shapes and forms. We have found that realistically the terminals used by the patient makes little difference; he is no more intimidated by a keyboard with 20 keys than he is with four colored buttons, provided he only has to use one of four choices. It is very hard to justify the added expense of light sensitive screens and pen light indicators popular in some areas. Technically there are differences in printer speed that may be summarized by saying that a more rapid speed is useful for hard (paper) copy than is received well by patients. Most printers can be easily adapted for either speed; therefore it is not a cost consideration.

Who Pays the Bill?

Reference to Table III will provide support for the connection that computer services may soon be economically justifiable in private family practice. Office charges may vary around the country, but few can contest the conservative estimates provided.

Our office has completed 60-120 physical examinations per month. If a \$5 charge is made for the preventive medi-

TABLE III

Reimbursement	
Patient History (60/month at \$5)	\$ 300
Patient Education (10/week at \$5)	\$ 200
Paramedic Routines (20/week at \$5)	\$ 400
Office Billing	\$ 300
	\$1,200

cine patient history included as part of this, \$300 would return to practice expenses.

The patient education routines could be reasonably considered the primary area of concern for many patient visits each week. Should the computer be used for ten visits each week at a charge of \$5 per visit, approximately \$200 would be accrued each month. Paramedic routines and their charges may be similarly explained with reference to the text above for the service provided.

A brief discussion of office billing is due with respect to the local experience of our practice. A secretary in our area earns \$100-\$125 per week. While our practice was growing, a single bookkeeper was slowly but steadily falling behind the work generated by two physicians. With the addition of a third physician and computerized accounting, a medical secretary is now able to adequately handle the needs of the practice and will have the flexibility to absorb the work generated by a fourth physician after the first of the year. The \$300 "generated" by the computer is a conservative estimate of the additional salary required had we not had computerized billing.

No reference is made to the physician education, diagnostic aid or other administrative programs which are beneficial to the practice, but cannot be easily credited against overhead expenses.

Patient, Physician and Computer

It should be re-emphasized that the programs described have been applied by regular medical and paramedical personnel with no particular computer training. The acceptance of the computer by the patient has been almost uniformly enthusiastic here or elsewhere. The strange, almost mystical fear of the computer by the physician is very difficult to understand when one becomes accustomed to thinking of it as little more than a very efficient secretary with a phenomenal memory.

The "Big Brother Syndrome" relating the computer to some kind of government surveillance is remotely conceivable only in the context of government involvement we currently see in other medical areas. Where physician initiative is lacking, a federal agency seems ready to fill the gap. The danger with government involvement in medical computer application does not lie with regulation as much as it does with government authorship of programs provided for practicing physician input.

Ongoing problems of computer application in private practice deal primarily with the logistics of scheduling and the continuous need for updating old habit patterns required when a new technology becomes available. When these problems become solved, the computer will become a useful tool in private family practice.

*A lesson in computer terminology. Hardware refers to equipment. Software refers to the "thinking" or programming put into the machine.

