Computers in Family Practice

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The Microcomputer as a Vehicle for Continuing Medical Education

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Continuing medical education remains one of the most troublesome issues in medical education and practice. It is axiomatic that the physician must continue to learn after the completion of formal education in order to maintain skills, incorporate new knowledge, and improve cognitive and clinical abilities. Continuing medical education is mandatory in many states and is a requirement for membership in an increasing number of medical organizations, yet there are pervasive doubts about the efficacy of the traditional forms of continuing medical education.[1] In particular, the most common mode of continuing medical education—the formal course consisting of a series of lectures—has been shown to be of little value in changing physician behavior, the only true test of the impact of continuing medical education.[2] Other methods must be used to ensure the lifelong education of the physician.

Computers may be such a tool; they have been used widely in undergraduate medical education for almost 20 years.[3] Computer-assisted instruction (CAI) has been rapidly adapted to the medical school setting and put to myriad uses. Literally dozens of specific applications have been presented in the literature, and it would be a rare medical school that did not currently use computers in some phase of its curriculum.[4,5]

One of the most effective formats for computerized instruction in the medical arena is the computerized clinical simulation. Clinical simulations replicate actual medical cases, presenting clinical vignettes to the physician and forcing a choice among a series of diagnostic and therapeutic options. In the more sophisticated clinical simulations, the clinical case can unfold in many ways; the student experiences the immediacy of the actual clinical setting and can evaluate the consequences of making different kinds of diagnostic and therapeutic choices without imperiling real patients. The complexity of the simulation is limited only by the skill of the author and the pro-

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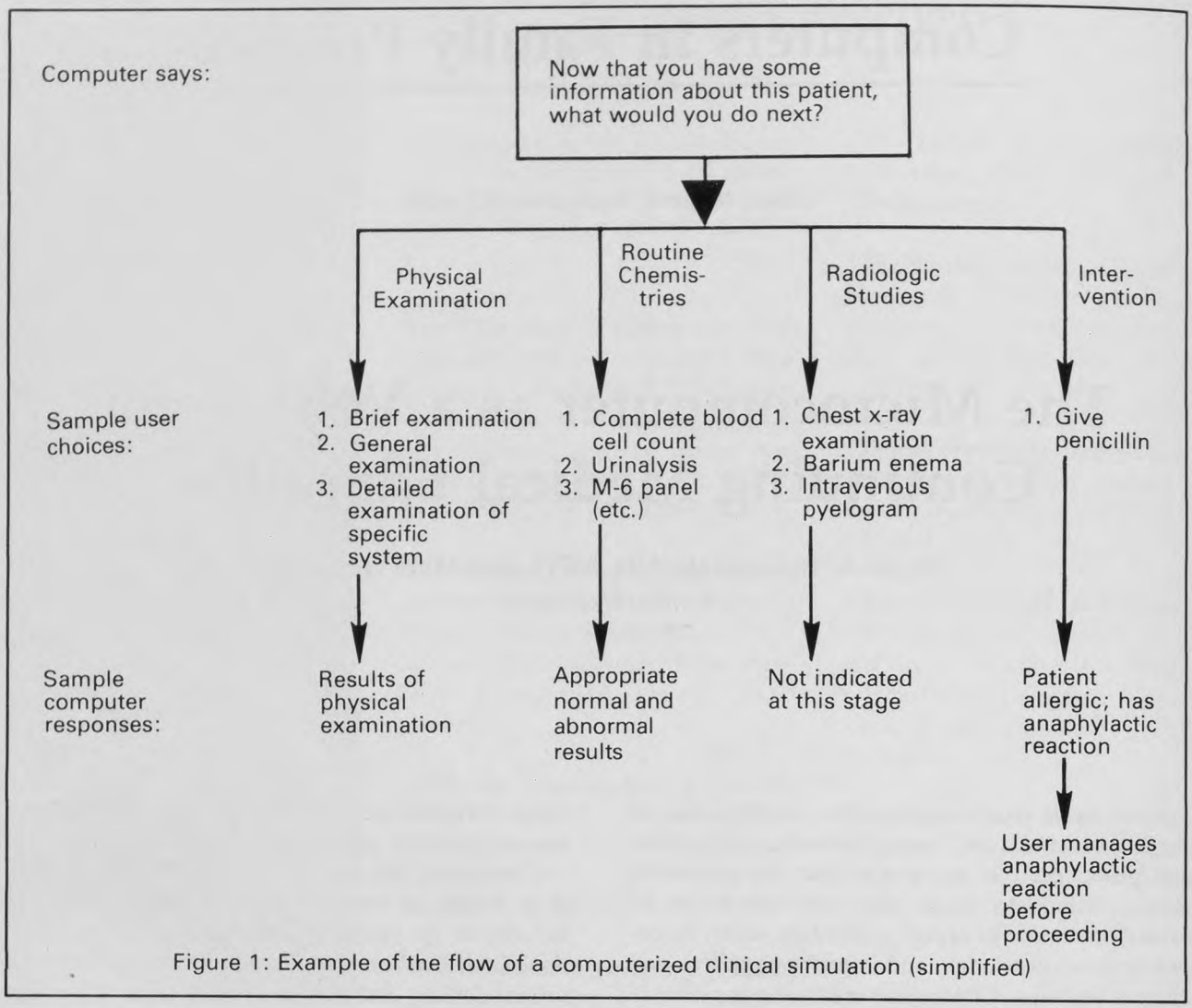

Figure 1: Example of the flow of a computerized clinical simulation (simplified)

grammer, and the simulations can be accompanied by a variety of audiovisual material.[6] An example of the flow of a typical computerized clinical simulation is shown in Figure 1.

The majority of clinical simulations have been used in the formal academic setting, implemented for the most part on large mainframe computers. This paper is a brief description of an ongoing effort to make clinical simulations available to practicing physicians as a major component of their ongoing continuing medical education. This development has been made possible by the recent introduction of powerful, low-cost microcomputers, which for the first time has made it feasible to replicate clinical simulations on computer systems that the average physician can easily buy for his home or office.

Background

The University of Washington Health Sciences Learning Resources Center developed in the late

1970s a series of clinical simulations for medical and nursing students. These case studies were implemented on the DEC-10, a moderate-sized mainframe time-sharing computer. A system was developed by which faculty members could construct the text and logical flow of a clinical simulation using a series of printed structured forms. This textual information was then converted into a program that produced an interactive clinical simulation students could use on one of the many terminals available throughout the medical center. The system was designed so that the faculty author needed little or no knowledge of computers or programming languages. The simulations were incorporated into a number of different courses in both medical and nursing curricula, primarily as a supplement to core teaching material.[7]

In a current study the basic library of approximately 40 programs was reviewed by the authors and a subset that dealt with cases germane to family physicians was selected. The programs were then made available to family practice residents and faculty in the Family Medical Center, the clinical teaching practice of the University of Washington Family Medicine Residency. Instructions on using the terminals were supplied, and residents and faculty experimented with the programs at their convenience. The reactions of the residents and faculty to the programs were assessed using a structured questionnaire and informal interviews.

Results of Pilot Test

This experiment was planned as an exploratory study and a rigorous experimental design was not used; however, participation was sufficient to allow some general assessment of the utility of clinical simulations in the residency setting. Virtually all those who used the clinical simulations enjoyed the experience; they found this particular medium to be challenging, instructive, and fun. The majority of residents and faculty alike indicated that they would favor using such material as a component of their continuing medical education, both within the formal academic setting and in practice.

This brief trial revealed some troublesome flaws with the system designed for medical student use. First, the system was technically exasperating; the use of a remote terminal and a modem proved to be unreliable and somewhat difficult to operate. Second, the format employed in medical student teaching was too rigid for physicians at the resident and faculty level. It was clear that clinicians wanted to have considerable flexibility in the ways in which they "worked up" the patient and chose therapeutic options. Lock-step simulations that forced them to proceed in a linear fashion were seen as frustrating and unrealistic. Finally, this particular audience was relatively intolerant of minor imperfections in the simulations. Programming bugs that had little actual effect on the flow of the program were seen as irritating and unacceptable. The overall response to the concept, however, was highly favorable and encouraged an attempt to adapt this technique to formal continuing medical education programs for practicing physicians.

Modifications and Refinements

In order that the clinical simulations would be suitable for practicing physicians, the programs were designed to be compatible with the most popular microcomputer systems. To do this, a flexible and portable programming language was selected, and a programming system was designed to transfer the entire process to microcomputers.

The author workbooks were also extensively modified to make them flexible and easy to use, even by clinical faculty far from the medical center. A comprehensive curriculum was designed to focus on subject material that lent itself to computer simulations, that dealt with clinical situations of interest to a range of primary care physicians, and in which significant changes in diagnosis or treatment had recently occurred. Authors were then selected from both the full-time and clinical faculty of the University of Washington School of Medicine, and a full-time programmer was employed. An editorial board with responsibility to review and approve all program material was established.

At present, 12 programs have been completed and accepted by the editorial board, and additional authors have been identified and have begun to prepare case material. The simulations have been implemented successfully on the APPLE II series of microcomputers and on the IBM PC. In the near future the cases will be installed on computers that use the MS–DOS and CP/M operating systems. These recent programs are designed for the practicing clinician and are considerably more sophisticated and flexible than those initially prepared for medical and nursing students. The programs run crisply on microcomputers, and virtually all imperfections have been eliminated by an extensive process of review by many clinicians. A scoring system has been added in such a way that the users are evaluated on their diagnostic, therapeutic, and overall performances, and will ultimately be able to compare their own performances with those of their peers.

These programs are now available to physicians as continuing medical education activities accredited by the University of Washington School of Medicine.* At present, several of the programs have been reviewed and accepted by the American Academy of Family Practice.

*For further information, write to Computerized Medical Education, PO Box 85655, University Station, Seattle, WA 98145-1655.

Comment

Effective continuing medical education actively engages the physician, stimulating acquisition of new information and skills and honing decision-making ability. Most formal continuing medical education is passive, consisting of either reading a journal article or listening to a lecture, and may not penetrate very deeply into the consciousness of the participating physician. Clinical simulations, by contrast, are highly participatory. The user must make concrete diagnostic and therapeutic decisions, decisions that have an immediate effect on the simulated patient. Thus simulations combine some of the allure of a game with the immediacy and reality of the clinical case.

Microcomputers have made it possible for physicians to use these educational programs in their homes or offices, without expensive travel to distant courses and without loss of practice or vacation time. Clinical simulations can be precisely scored, and physicians have the luxury of trying a variety of different approaches to the workup and treatment of any single case, evaluating for themselves the consequences of differing strategies. It seems likely that computerized clinical simulations will become an accepted part of the continuing medical education repertoire of many practicing physicians.

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