A COMPUTER ON MY DESK DO I HAVE A CHOICE?

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Abstract: *The author describes new computer applications currently being implemented in North American hospitals and other psychiatric practice settings, as well as the effects of these new technologies on patients and clinicians.*

"Hey! Who put this computer on my desk?" Are you likely to be saying this in the near future? It's becoming a distinct possibility, if you work in a hospital, clinic, or a group practice setting.

Even though computers have been very slow to be adopted into clinical psychiatry, they do turn up in many other areas in medicine. Slavishly following rules, tireless, accurate, the computer has carved a niche for itself in doing boring, repetitious, and occasionally dirty or dangerous jobs.

How is it likely to happen that you find a computer on your desk? Here are some possible scenarios:

1. The hospital in which you work as a department head buys a new telephone system. Because of your status, you get a fancy "computerphone" which maintains your personal telephone directory, keeps track of calls, reminds you about your appointments, etc. It's hard to say "no" to such a "perk". Besides, you don't want your colleagues to consider you a "dinosaur", do you?
2. Your provincial medical insurance plan is now offering claims processing direct from your computer to theirs, over the telephone lines. Your group practice decides that the money savings in getting claims paid sooner will easily pay for the computer system.
3. The hospital is installing terminals at patients' bedsides and in nursing stations. The nurses refuse to carry your handwritten medication orders anymore, insisting you enter them directly into the computer. Sighing, you order a terminal for office.

Unrealistic, you say. Would never happen where I work. But it is taking place, all over the country. Before I describe some of the systems that you may be dealing with, let me first say a few words about computerisation - its promise and the reality.

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THE PROMISE OF COMPUTERISATION IN PSYCHIATRY

What characteristics of computers make them particularly useful in psychiatry?! First, they follow rules. Second, they do not tire. Finally, they are both faster and more accurate than humans in certain complicated logical and compu-tation tasks.

It was recognized many years ago that all the data being collected on psychiatric patients, if subjected to "large-number" statistics that computers are so good at, would allow for epidemiological studies of, for example, the connection between historical; variables and subsequent mental illness. Other possibilities include the use of the computer in psychophysiological research, where it can monitor data, serve both as stimulus and recorder, analyze data, make logical deci-sions, and provide instant feedback. Computer analysis of EEG data is a case in point.

Computers may soon be treating patients! Closer to actuality is their use in training of residents, medical students, and so on; in amusing patients with computer games, and in their rehabilitation.

THE REALITY: LESS PROGRESS THAN PREDICTED

We should be enjoying a bright, effortless, computerised new age right now, but we're not. Why not? One of the difficulties has to do with the computer itself. Take its obedience in following rules. Because it can only follow a predetermined program, it cannot make ethical-contextual-moral decisions - it lacks intuition. No matter how far off the track, how wildly, impossibly wrong, the computer never has an inkling - it just slavishly follows rules it was programmed with. As they say, "Garbage in, equals garbage out!"

Another reason why computerisation has proceeded much more slowly than expected is a lack of acceptance by clinicians, who are often required to do much of the work in inputting data, while failing to benefit from the outputs. Many systems double the physician's paperwork.

With respect to output, computer reports have all too often been irrelevant, incomplete, or indecipherable. Stereotyped narrative reports fail to allow one patient to be distinguished from another.

Perhaps the biggest problem has been the use to which the data is put. When quality assurance or hospital accreditation is the goal, the clinician may feel that he is being forced to conform. Another hurdle in some systems may be clinician confidentiality.

EXAMPLES OF COMPUTER SYSTEMS

In spite of the difficulties, the promise has been sufficiently attractive to stimulate the design and implementation of many systems. Unfortunately, very few applications can be said to be resounding successes. I will describe some of them.

Word Processing. No one in the business world needs to be convinced of the superiority of word processors over typewriters. Moreover, once the information is in computer form, it can be used for other purposes without re-entering it.

Billing. Because a number of provincial health insurance systems accept claims submitted on magnetic tape, floppy disks, or even over the telephone via modems, it has become worthwhile for individual practitioners as well as groups to invest in billing and accounting systems.

On-line Chart Retrieval. Another application you might encounter is the online retrieval system. In many hospitals, the sheer volume of medical charts is becoming a significant problem, for storage space,

ability to retrieve rapidly, avoiding loss, and so on. Micro-fiche is a poor solution, and unsuitable for active charts.

A solution being adopted by hospitals with big budgets is the scanning of paper charts, X-rays, EKG's, EEG's, and ultrasound pictures, followed by digital storage on optical disks. While storing the exact graphic representation of the typewritten page is much more costly than storing the character codes (typically 25 times more storage) the overall system is much simpler.

High resolution terminals are used to retrieve the documents instantly; if a hardcopy is needed, a laser printer gives excellent quality. The data is stored on optical laser disks, like the CD's (Compact Disks) you use in your home hi-fi. One such disk can store 8,000 megabytes of data, the same as that contained on 4 million double spaced typed sheets.

Centralized Dictation Systems. It may not be immediately obvious that some centralized dictation systems are really sophisticated computers. They store audio information digitally. But why not use much cheaper audio tape? Just as written material can be manipulated by a word processor, speech stored digitally can be changed, or rearranged, various parts can be strung together instantaneously, and so on.

A number of vendors are marketing centralized dictation systems which can be tied into modern telephone systems. If you've forgotten how to use such a system, it will give you verbal prompts. To listen to a discharge summary before it's been typed, simply dial in with the proper authorization code.

Sound quality will not deteriorate over time. It is also possible to slow down or speed up the playback to match a typist's or listener's speed, without any distortion or frequency change.

Online Database Searching. Many hospital and medical school libraries now offer the capability to search databases such as *Index Medicus*, called *MEDLINE* in its computerized version, online. You don't need a library to use them; all that's necessary is a password and a computer terminal equipped with a modem. Besides *MEDLINE*, many other databases can be accessed, including the full text of a number of journals, such as the *American Journal of Psychiatry*.

The latest innovation is to put *MEDLINE* on optical disks for use with personal computers. This avoids hourly connection and usage charges.

Communications. A microcomputer equipped with a modem and telecommunications software permits a psychiatrist to communicate instantly with colleagues. By belonging to an electronic bulletin board system such as *PsyComNet*, one can post private messages in electronic mailboxes; post notices, announce meetings, leave messages for other subscribers, etc. on a series of public bulletin boards devoted to various topics, such as psychopharmacology or forensic psychiatry. It is possible to participate in conferences, or to make manuscripts, bibliographies, and so on available for others to read and comment on.

Whenever a hospital equips its staff with terminals or personal computers which are networked together, they can begin to communicate with each other in ways which reduce frustration, misunderstanding, the "telephone tag" game, and the "paper chase" of endless memos. One example is the *MAILBOX* program available on *MUMPS* systems. In a typical installation, staff can send and read departmental messages; send, read, and save personal messages; sign in and out of the department, and locate other staff. When you sign on, departmental messages of general interest are automatically displayed, and you are notified of any personal messages.

Diagnostic Aids. Sophisticated artificial intelligence systems to aid in making diagnoses and treatment decisions have been researched for years. Examples are *CADUCEUS*, an internal medicine diagnostic program,. and *MYCIN*, which recommends antibiotic therapy for severe systemic infections.

Similar systems are now available for the average clinician. The American Medical Association has a system called *DXplain*, which accepts a list of clinical manifestations and then proposes diagnostic hypotheses and their probability, as well as pointing out sign that could be elicited to help narrow the diagnosis. This system, developed at Massachusetts General Hospital, is available on-line through a telephone hookup.

Lawrence Weed, the developer of *Problem Oriented Medical Record*, is marketing his "Knowledge Coupler", a computer program which runs on your own IBM PC or Apple MacIntosh computer. It asks questions about the problem, and comes up with a list of diagnoses and their probabilities, along with the relevant references.

When these systems start to prove that they are more accurate than unassisted clinical decision-making, then we may face the prospect of legal liability for failing to use them.

Hospital Information Systems. Systems are widely installed in the United States, where administrations were impelled by the need to obtain accurate billing data on patients. Individual departments, such as emergency rooms or clinical laboratories, have been successfully computerized with enormous improvements in efficiency.

INTEGRATED SYSTEMS

It's been harder in the direct patient care area. For example, in manual systems, nurses write vital signs, etc. on pieces of scrap paper, which they stuff in their pockets until they get to the chart. With

the first clinical patient information systems, nurses were still writing on little pieces of paper. The difference was that now they had to line up to log onto a terminal.

The current trend is to systems which provide a terminal at the bedside of every patient. This is because:

1. Computer hardware prices are continually decreasing.
2. If data cannot be entered directly into the system at the point where it is obtained, errors are introduced by intermediate transcription.
3. If there are not enough terminals, individuals waste time waiting.

It becomes impractical to provide separate bedside terminals for laboratory data, patient movements, order entry, and so on. The answer is the integrated system.

Following are some examples.

Beth Israel Hospital.
Starting in 1976, clinicians at Beth Israel Hospital in Boston have been developing and using an integrated clinical computing system to help in the care of 19,000 annual admissions and 160,000 outpatient visits. They adopted the following principles in its design:

1. Information should be captured, not on pieces of paper, but directly at terminals. The person entering the data should get an immediate benefit.
2. Terminals should be the principal means of retrieving information. Data should be available at any terminal as soon as it has to be entered at any other terminal.
3. Rapid response time: delays measured in seconds are often unacceptable.
4. Computer failures must be rare, corrected within minutes, and data must never be lost.

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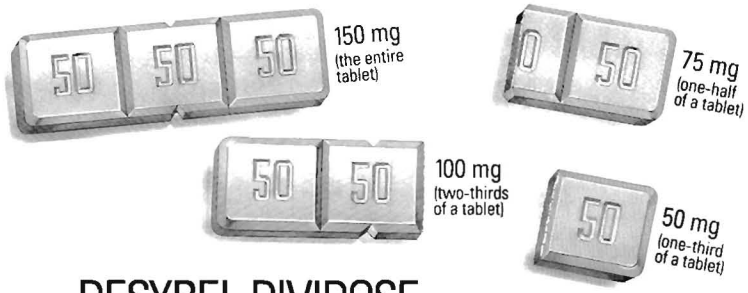

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5. Confidentiality must be protected.
6. Programs must be user-friendly, with no need for user manuals.
7. There should be only one, common, registry for all patients.

Their system runs on a network of Data General minicomputers, and includes 300 terminals, 100 printers, and 12 billion characters of disk storage. It is available 24 hours per day.

In the admitting office, the system is used to register new patients, pre-admit patients, note their arrival, and keep track of transfers. In outpatient departments, visits are scheduled so as to prevent conflicts for both patients and clinicians. In the medical records department, light pens read bar codes on the patient charts as they are signed out or returned.

The clinical laboratories, pathology and radiology departments are all tied in, so that results are immediately available on any terminal. In the pharmacy, the computer prints labels automatically and runs a pill counting machine which dispenses the correct quantity of medications directly into the bottle. Other useful features include an online telephone directory; a program called PaperChase which is used for searching *MEDLINE* and other medical literature databases; consultation programs which offer advice on managing electrolyte and acid-base disorders, on using antibiotics, or new medications in the hospital formulary; and electronic mail.

The system informs attendings when their patients have been admitted or have come to the emergency room.

This integrated system enjoys a high degree of use. As one house officer wrote, "The computer is one of the greatest assets of Beth Israel Hospital!"

Toronto Hospital

At the newly merged Toronto General Hospital and Toronto Western Hospital an $11 million computerized patient care system is being installed over the coming three years. Hardware will include almost 3000 terminals located in patients' rooms, nursing stations, and elsewhere[5]. The hospital hopes that by reducing paperwork, staff will have more time for patient care, so that the system will pay for itself. Security for this system will be based on a magnetically encoded plastic card which authorized users insert into the terminal before entering a "Personal Identification Number".

SYSTEMS IN PSYCHIATRY

While systems such as those described above may affect psychiatrists working in general hospital settings, a greater impact can be expected from systems specific to psychiatric settings.

PDMS-III.

At the Ste-Thérèse de Shawinigan Hospital, a pilot project was begun in 1983, utilizing a bilingual software package called *PDMS-III*[10,11]. There are four subsystems:

1. *BASE* is a system for recording psychiatric evaluations. It includes the psychiatric history, DSM-III diagnosis and criteria.
2. *NOTES*, for progress notes. Severity of the illness, degree of improvement, side effects of medications, and suicidal risk can be quantified and graphed over time.
3. *EMR* (which stands for Examen Mental Régulier) allows assessment of changes in mental status from one examination to another.
4. *LABO* provides for the compilation and management of the lab tests, injections, etc. associated with specialized clinics (such as Lithium or Modecoate clinics).

A patient index system works together with the four subsystems.

Decisionbase.

In Vancouver, a psychiatrist has developed a system, called *Decisionbase*, geared towards the clinician in private practice. In addition to maintaining patient documentation such as notes, clinical status, lab results, prescriptions, and so on, the system includes built-in statistics functions to analyze this data. Running on IBM-compatible personal computers, it will administer questionnaires and psychological tests to patients, and can assist in diagnosing DSM-III disorders.

Lithium Information Center.

This Center[12] in Wisconsin, established in 1975, disseminates information about the medical uses of lithium to psychiatrists, patients, and families. Its computer database includes more than 12,000 articles on lithium; this information can be accessed online.

Drug-Exception Reporting System.

This system is a decision-support system which uses the opinions of clinical experts as its knowledge base[13]. Each drug order is screened by computer against a set of prescribing guidelines which cover dose ranges of psychotropic and anticonvulsant medications, polypharmacy and drug interactions. Reports to individual clinicians about drug orders which are in exception to the guidelines are produced automatically.

A two-year study showed that feedback led to significant decreases in the number of orders written in exception to the guidelines.

The Veterans' Administration Mental Health Package.

This[14] is one module in an extensive automation effort recently begun by the VA at over 200 medical care facilities. The software is being written in the M(UMPS language, which runs on a wide variety of mini-, micro-, and mainframe computers. Since all VA software is in the public domain, it is widely available. In addition to the usual

administrative tasks, the automation project also includes scheduling, pharmacy, and laboratory functions.

The Mental Health Package software is designed to be easy to use. Although menu-driven, experienced users can bypass the menu displays. No attempt is made to replace the paper chart; information in the system can be printed out for insertion into the record.

There are four major clusters of applications in the MHP:

1. General Management cluster.
2. The Vocational-Rehabilitation functions.
3. Patient-Administered Instruments.
4. Clinical Record cluster.

The General Management Cluster includes a waiting-list application to keep track of patients waiting to enter a program or unit. Another application lists and describes the tests and interviews that can be administered to patients or filled out by the staff. The *Vocational Rehabilitation* option includes software to use a job bank, carry out vocational interviews, and, in the future, assist in vocational case management. The *Patient-Administered Tests and Interviews* cluster allows patients to interact directly with the computer. Although one might suspect that many patients would object, the experience at a large number of facilities has been that patients tend to use the computers more eagerly than staff. The *Clinical Record* choice allows information about the patient to be entered or retrieved by the clinician, and permits display of data entered by the patient.

Consultation-liaison psychiatric service

The extremely low cost of microcomputers, compared to minicomputers or mainframes, coupled with the flexibility and accessibility of off-the-shelf software, encourages clinicians to develop their own applications. For example, a psychiatric consultation-liaison service in a teaching hospital developed a system to assist research, teaching and administrative functions[15]. An activity file contains every encounter between consultants and patients, as well as research, supervision, and liaison activities. Chart notes are computer-generated, as are letters to referring physicians.

Computerized interviewing of psychiatric patients

Computerized interviewing of psychiatric patients may help therapists provide better care by eliciting more information, with greater accuracy, than other methods[16]. This has been demonstrated for patients with alcohol-related illnesses, and for those at risk of suicide.

Patients appear to enjoy interacting with a computer, and report feeling less tense after a computer interview than after a personal interview. This may be due to three factors:

1) the patient can set his own pace, taking as much time as necessary to answer each question;

2) barriers between physician and patient such as those created by social class do not come into play;

3) the computer is not judgmental of the patient - it expresses neither approval or disapproval of answers.

Nursing

At the Institute of Living, in Hartford, Connecticut, a project for the automation of psychiatric nursing notes has been underway since the mid 60's[17]. At the end of their shift, psychiatric nurses fill in a checklist to rate patient behaviours. The computer generates both a narrative note for inclusion in the chart, and graphs which show how behaviour changes over time, which is most useful when keyed to medication dosage.

Patient Rehabilitation

Computers show promise in the rehabilitation of patients. Besides the obvious uses of training individuals to use office automation, such as word processors, it has been shown that even severely mentally handicapped patients can improve their communication abilities with specially adapted software and hardware[18].

CHARACTERISTICS OF SUCCESSFUL SYSTEMS

How can we predict whether a proposed computerised system will be successful? We can identify some common factors, such as the techniques and hardware for entering data into the system.

Data Entry Method

Most clinicians are not typists, so the keyboard, while essential for some tasks, must not be the principal data entry device. What can we use instead? If the data has to do with an object, for example, a file folder or a bottle of medication, one solution is bar codes, like the ones printed on supermarket items[19]. However, the mainstay of successful systems remains the on-screen menu, or option list. Many applications let you use cursor control keys or a pointing device, such as a mouse[20] or light pen, to select your choices. Some people like touch-sensitive screens, arguing that the most natural pointing device is you index finger.

The latest wave is the iconic interface, which is a menu consisting of little pictures representing choices. The Apple MacIntosh computer is a highly successful example.

Voice recognition is the most promising of all data input methods, as it eliminates the need for a transcription stage. As the word is spoken, it appears on the screen. Current systems have vocabularies of around a thousand words with 95 per cent recognition rates, making them very satisfactory for areas like admitting, radiology, laboratories, or order entry.

Ease of Use.
Computers don't always reduce work. For example, systems designed by government bureaucrats for use in government-funded facilities to keep closer tabs on how their money is being spent, may require psychiatrists to fill in a form each time they assess a patient, in addition to the note that they already write in the chart.

Other Factors.
Confidentiality of patient and clinician data, security from tampering or inadvertent error, and reliability are other factors influencing whether a system will be successful. Not to be overlooked is the importance of careful design of database structure in applications involving medical records[21] to accomodate the tremendous variation of potential observations to be stored and the wide variety of functions the database must perform.

IMPACT OF COMPUTER SYSTEMS

Computer systems have both positive and negative effects on psychiatrists and their patients. On the positive side, computers can save time for clinicians, improve their accuracy, improve their diagnostic precision, and ensure better followup of their patients.

In a survey of 545 users of the integrated hospital-wide clinical computing system at Beth Israel that I described above[5], it was found 83 per cent of clinical users felt that the terminals enabled them to work faster. Eighty-one per cent of the users also indicated that their work was more accurate.

In Britain, a desktop computer is being used by surgeons to support clinical diagnosis of acute abdominal pain[22]. Over a two-year period, the diagnostic accuracy of the whole surgical team improved, fewer laparotomies were negative, and there were fewer perforated appendices. Copeland and colleagues[23] reported that a computer increased diagnostic accuracy obtained in a psychogeriatric setting.

For patients on medications such as lithium, computers can provide timely reminders of the need for periodic lab tests.

On the negative side, clinicians find that their actions are subject to more scrutiny, especially in systems geared to peer review. A study of attitudes towards a computerized drug review system, carried out in 11 psychiatric facilities[24], showed that prescribing practices improved, in spite of negative attitudes. User acceptance is not necessary to see positive effects; this may convince legislators and administrators to override clinicians' concerns when deciding on new systems.

Systems which waste time may not get the use they might otherwise deserve. For example, a microcomputer was programmed to obtain histories from patients in an abortion clinic[25]. It was successful in that it obtained an average of 42 more items of information, but because the computer interacted with a nurse rather than the patient directly, nursing time increased.

An unfortunate aspect of many systems is lack of flexibility. This can be compounded by administrative decisions. An example is provided by a direct order entry system installed in a tertiary-care university hospital[26]. To encourage use, hospital policy was changed so that the only alternative to direct entry of orders was to hand write them into the patient's chart, following which a pharmacist had to review the order and enter it into the computer system.

What about the impact of these systems on patients? Positive aspects include more personalized contacts, increased confidentiality, better care, and cost savings; however, patients also complain that care is less personal and less confidential. This seeming paradox requires some explanation.

Many patients feel that the information a clinician obtains from reading the report of the computer interview, gives the face-to-face meeting a more personalized aspect. The clinician does not need to spend time obtaining dry historical details, and can concentrate on listening. A properly designed computerized medical records system will provide greater confidentiality than paper charts, because it is less exposed to the eyes of curious individuals[27]. Computers allow clinicians to make more precise diagnoses[22,23] and more thorough followup of patients. In hospitals, lab tests are available more quickly, charts are less likely to get lost, and information is more accurate. Computer systems can improve quality assurance, for example by tracking Continuing Medical Education of physicians[28], or by ensuring that medications are prescribed according to standards[29]. In non-psychiatric settings, computer administered questionnaires can help screen patients who would benefit from psychiatric referral[30].

When physicians receive computer-generated feedback of cost for drugs they prescribe, they tend to reduce prescription costs[31].

Analyses of resource utilization in mental health delivery settings allows greater efficiency in deployment of staff and facilities[32].

In contrast to the above, some patients, just like some physicians, will not feel comfortable with the impersonal, mechanical coldness of computers. On the other hand, patients have been very accepting of technology in other areas of medicine, such as CAT scanners, and flock to hospitals with the most up-to-date equipment.

Comprehensive collections of personal information on individuals, such as medical and particularly psychiatric data, pose a very real threat to citizens' liberty and privacy[33], particularly when the computer makes it possible to "link" records from different sources. Innovative approaches are necessary to make systems acceptable[34].

Are These Changes Desirable?

The computer is almost certain to have an impact on the way we work in the future. We may not all agree on whether the coming changes are desirable, but some of them are inevitable. Neither boundless optimism nor computerphobia will ease the transition. Ideally, you will be open to new ideas, but sceptical of pie-in-the-sky promises. Keeping informed will help ensure that the computer systems you are asked to use will make your work easier and more fun. ■

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PSYCHIATRY

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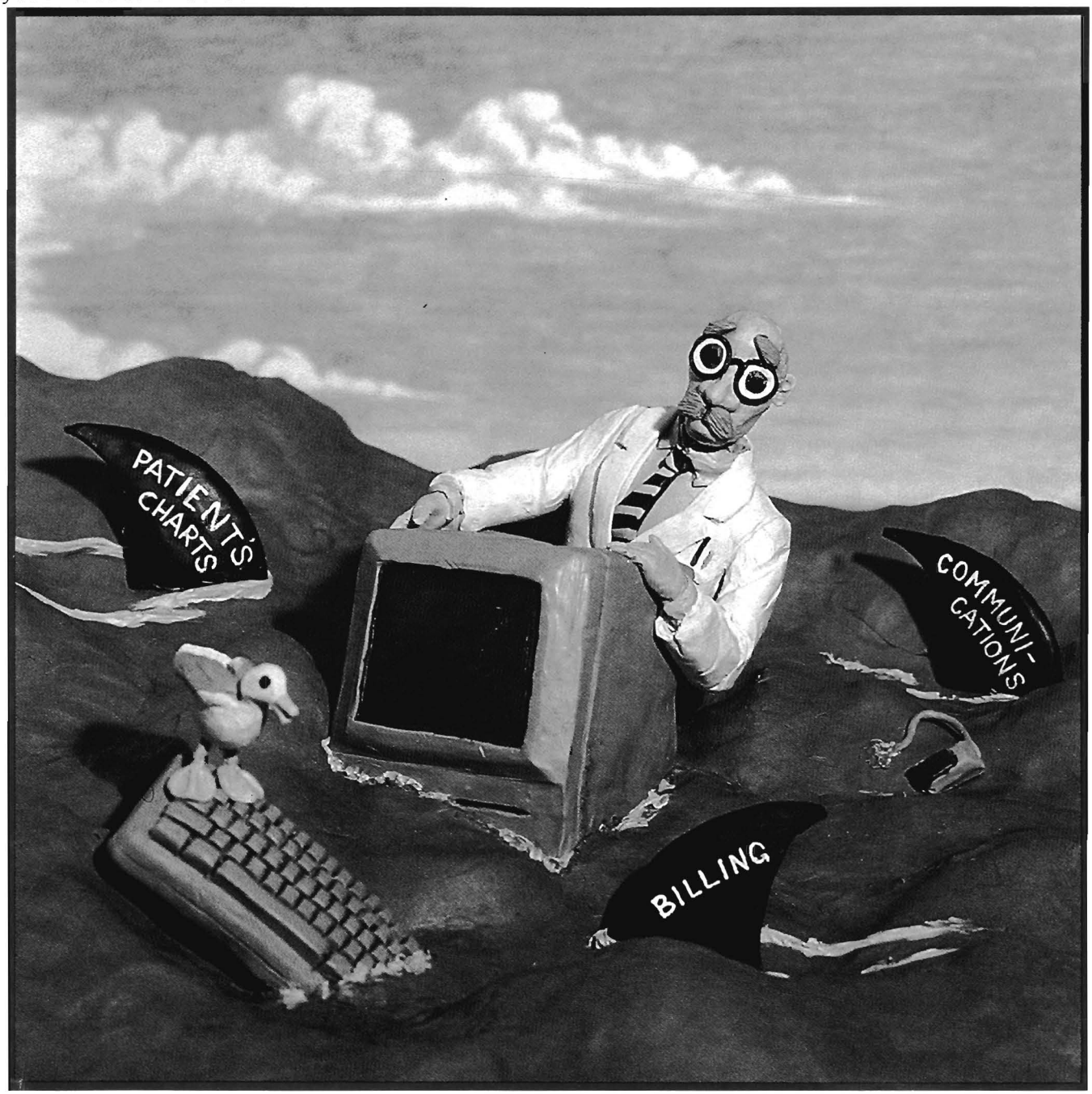

STAYING AFLOAT WITH COMPUTERS

- **A COMPUTER ON MY DESK. DO I HAVE A CHOICE?**
- PSYCHIATRIC ASSESSMENT AND TREATMENT OF DEAF PATIENTS
- STUTTERING: ITS NATURE AND TREATMENT
- SPEECH AND LANGUAGE DEVELOPMENT AND BEHAVIOUR DISORDERS