The Advanced Clinical Information System: Physician-Focused

Daniel Davis MD*
Gail Tiwanak RN*
Lani Rauscher*

The U.S. health care system is being forced to change because of intense demands for better quality, decreased cost, and better service. These demands are driving the implementation of health-oriented computer technologies that will fundamentally change the practice of medicine. These technologies will enable physicians to find new opportunities to improve quality and reduce cost.

Seventy-five percent of health care costs are generated by physician decisions and half of all health care dollars are spent in the hospital.[1] Errors in the management of hospitalized patients occur frequently. Maki and others reported a 35% error rate in the choice of empiric antibiotics.[2] Castle et al noted a similar error rate in antibiotic use at a university hospital.[3] An advanced computerized clinical information system with physician-order entry can reduce errors and improve the quality of patient care.

This paper describes the rationale for physician use of a computerized clinical information system and our initial efforts at The Queen's Medical Center to select and design a physician-focused order-entry and results-reporting system.

Major improvement in the quality of medical care will occur when physicians use computerized decision-support tools as part of their day-to-day patient care. Decision-support will be most effective if applied at the time the physician analyzes patient data and then orders diagnostic tests and therapies. Order-entry and results-reporting (OE/RR) is the term used for the computerized process of reporting patient test results, for the ordering by computer of diagnostic and therapeutic measures, and for a system of on-line medical knowledge designed to improve clinical decision making.

OE/RR is the cornerstone of an advanced clinical information system (ACIS) that physicians can incorporate into their daily practice. In the near future, physicians, nurses and other health-care providers at The Queen's Medical Center will begin using ACIS and OE/RR in their day-to-day care of patients. The advanced clinical information system will become as important to the good clinician as the stethoscope.

Rationale for Physician Order Entry

The rationale for direct physician use of OE/RR is that the best opportunity to improve patient care occurs when effective decision-support tools are placed in the hands of physicians. Specific reasons for direct use by physicians of ACIS are summarized in Table 1.

The goals of ACIS are to improve clinical care through improved decision making and to improve the efficiency of the physician's hospital practice through automation of time-consuming activities. The purpose of ACIS is not to automate patient care for the sake of automation, but rather to add value to the health care process by improving quality and efficiency.

Quality-improvement experts use a matrix (Table 2) to emphasize the relationship between making the right decisions—that is, doing the right thing—and performing the work correctly—or, doing the thing right. The best opportunity for improving medical care—doing the right thing right—is to enable the physician to make the best clinical decision at the time the decision is being made. This enabling process requires accurate, timely and complete patient-specific data and extensive support for the decision, neither of which is possible without modern information technologies. Old methods of managing information, such as the paper chart, are inadequate in today's demanding health care environment. Medical charts on paper are often inaccessible, illegible or incomplete.

Tufo and Spiedel noted that in a traditional paper medical-record system, physicians were lacking important clinical information in up to 20% of patients' charts.[4] Clinicians are then forced either to operate with incomplete information, guess about clinical data, or order duplicate tests. The accuracy of handwritten records has been questioned. Hsia reported that 20% of dis-

TABLE 1: Reasons for Physicians Order Entry and Results Recording.

• Manual order entry is unefficient and error prone.
• OE/RR can improve the quality of patient care.
• OE/RR can improve efficiency of care and decrease costs.
• OE/RR can improve communication among care givers.
• Access to clinical information can be increased while security and confidentialty.

TABLE 2: The Quality Matrix

Do the right thing right	Do the wrong thing right
Do the right thing wrong	Do the wrong thing wrong

TABLE 3: Tabular Form of Bayles' Rule.

A	B	C	D	E
Disease State	Pre-test Probability	Test Characteristics	Column B x C	Post-test Probability D / sum
present	.85	(sensitivity) .15	.13	.67
absent	.15	(1-spec) .41	.06	
		Sum =	.189	

TABLE 4: Physicians Defined Critical Success Factors for OE/RR:

• Ease of use.
• Availability of work stations.
• Fast response time.
• Efficiency and time savings.
• Clincally valuable information.
• Security
• Minimal down time

* From The Queen's Medical Center
1301 Punchbowl Street
Honolulu Hawaii 96813

charge DRG codes were incorrect.[5] Even when information about the patient is accessible and correct, the physician's decisions can be improved using the computer as support for making decisions.

Pestotnik et al noted that a computerized, therapeutic, antibiotic alert system identified 420 instances of inappropriate antibiotic therapy in 1,632 patients. Physicians were previously unaware of relevant susceptibility-testing in 49% of these alerts. Physicians apparently responded to automated alerts by changing antibiotics in 30% of such instances.[6]

Tierney reported that use of a computerized order-entry system for physicians significantly lowered charges to patients and also lowered hospital costs; the projected savings were $3 million annually.[7]

TABLE 5: Sources of Efficiency in ACIS:

- All clinical data should be available at a single geographic point.
- All clinical data should be made available to the clinician as soon as it is processed by the ancilliary service.
- Clinical data should be available at locations other than the patient's floor.
- Clinical data should be available to remote sites.
- Phone time should be decreased.
- Order sets should speed order entry and promote standardization.
- Simple decision support will promote the choice of formulary products and eliminate phone calls to clinicians from pharmacists.

TABLE 6: Cinical Data Elements for ACIS:

- Demographic data.
- Historical data- previous surgeries, major medical diagnoses, family history, social history.
- Allergies.
- Problem lists.
- Discharge diagnosis.
- Current medications.
- Laboratory data–chemistry, hematology, micro, etc.
- Imaging data–imaging reports and images.
- Path reports.
- Cardiology results—EKG, ambulatory EKG, echocardiogram, cath reports, etc.
- Collaborative care plans.
- Code status and advanced directives.

TABLE 7: Steps in OE/RR Development at QMC:

- Alignment of OE/RR goals with institutional strategy.
- Defining the current environment of manual order entry.
- "Best of Breed" site visits.
- Extensive definition of user functional requirements.
- Detailed definition of user functional requirements.
- Requesting proposals from vendors.
- RFP analysis and selection of two finalist vendors.
- Site visits for the two finalists.
- Demonstrations by the finalists for QMC staff.
- Selection of a final vendor.
- Implementation.
- Ongoing CQI.

TABLE 8: Future ACIS Challenges:

- Automated discharge summaries.
- Cinical expert systems.
- Outpatient prescription writing.
- Resident procedure tracking systems.
- Resident sign out process.
- Complete long-term computer patient record.
- Community wide clinical data base.
- Telemedicine.

ACIS should decrease the incidence of common medical errors. Consider a case in which the physician "does the right thing" by deciding to heparinize a patient with pulmonary embolism, but who "does it wrong" by failing to give an adequate loading dose of heparin. Improper performance of the right task resulted in avoidable risk to the insufficiently anticoagulated patient. Failure to achieve adequate anticoagulation within 24 hours of heparinizing patients is a common physician error. ACIS should decrease such errors by prompting the physician with an appropriate method of administering heparin at the time it is ordered.

Another example illustrates how ACIS might prevent a physician from "doing the wrong thing right": The physician correctly diagnosed mild enterocolitis due to *Clostridium difficile* and ordered oral Vancomycin in a proper dose. However, by not realizing that oral metronidazole is almost as effective as Vancomycin but costs substantially less, the physician missed an opportunity to make a better decision.[8] Doing the wrong thing, even artfully, can be costly and harmful. Such decision-making errors can be decreased by computerized clinical information systems. Gardner et al reported a reduction in erroneous orders for antibiotics because of a computerized therapeutic antibiotic-monitoring program.[9]

Another example of clinical decision-support by ACIS is the provision of a tabular form of Bayes' rule for use in the analysis of tests analysis (Table 3). Such support might help prevent a physician from "doing the wrong thing". For example, a physician strongly suspected pulmonary embolism but the V/Q scan was read as low-probability for pulmonary embolism. The physician erroneously assumed that pulmonary embolism was not present. However, using a simple tabular form of Bayes' rule, data from the PIOPED study[10], and the physician's estimate of pre-test probability, ACIS could have calculated the post-test probability of pulmonary embolism and communicated this probability to the physician, who then might have considered further testing or using anticoagulation empirically. QED, direct order-entry by the physician, based on ACIS would have improved the quality of care for this patient.

Barriers to Physician Order Entry

There are potential barriers to successful order entry by physicians.[11,12] Physician-generated barriers include:

- The ABDF syndrome—"If it ain't broke, don't fix it";
- The "I'm in charge" syndrome;
- The fallacy that computers are illiterate;
- Computer-phobia and computer-mania.

The first barrier is the ABDF syndrome—"If it ain't broke, don't fix it". The U.S. does not have the best health care in the world; rather, the U.S. has the best tertiary care in the world for some.

Recently in our hospital the care of a critically ill and dying elderly patient cost almost $500,000; at the same time, a young single mother developed *status asthmaticus* and was hospitalized because she had been unable to obtain a $10 medication. Rational prioritization of the need for medical care demands high quality information regarding the clinical determinants of costs and outcomes. This clinical information will be obtainable and affordable only through the use of advanced clinical information systems. Through the direct use of ACIS and OE/RR, physicians will be able to contribute to the development of data on outcomes and the use of ACIS as a tool to improve quality.

A second medical staff barrier is the "I'm in charge syndrome" in which physicians declare that others are responsible for both inefficiency and high cost in health care, and that others should change their tactics in order to fix the system. Previously cited examples of medical decision-making errors clearly indicate the importance of the role of the medical staff in improving the quality of care. Quality is everybody's business. If physicians, nurses, ancillaries and administrators are not working together as a

(Continued) ➤

(Continued from page 343)

team to implement the ACIS, the risk of things going wrong is high.[13]

The argument against direct physician use of OE/RR and ACIS is that physicians should continue to write orders by hand because handwritten orders have worked in the past, are convenient for the physician and don't require physicians to change their ways. However, there are several problems with handwritten orders:

- Handwritten orders are all too often illegible.
- Clerks can misinterpret medical orders.
- Handwritten orders can be lost.
- Handwritten orders take too much time to complete.
- Physicians make errors in writing orders.

Illegible orders can lead to harmful misinterpretations and represent a legal liability. Bates et al reported that 28% of drug-ordering errors were generated by clerk, nurse, or ancillary personnel.[14] Physician errors accounted for 72% of adverse drug incidents. In addition, such orders take too much time to write and to be interpreted; it was estimated that a typical medication order takes more than 4 hours to process.[15] A study of stat intravenous antibiotic orders revealed that in such an order-entry system, 20% of stat intravenous antibiotics were not administered within the next 4 hours in the cases of suspected sepsis.[16]

Information-service (IS) personnel can generate barriers to physician order-entry by developing a sense of ownership of ACIS and by viewing ACIS as primarily an information technology rather than as a clinical tool. Failure of IS planners to include physicians early in the selection and design of clinical information systems is a common error that might stem from a sense of ownership of ACIS.[17]

The hospital administration might erect barriers to physician order-entry, which could be founded on the mistaken beliefs that:

- Physician involvement in ACIS is too expensive;
- Physician needs are incompatible with hospital needs;
- Physicians are too difficult to work with.

Bria describes reasons why an administrator might think that physician involvement in ACIS is unaffordable.[18] One is that physicians might demand more remuneration for extra time and effort in using ACIS as a clinical tool. A second reason is that the administration might not trust the medical staff to work in the best interest of the hospital. The idea that physicians are difficult to work with is based on the observation that physicians often have unalterable opinions and are demanding with regard to quality-of care-issues.

What Physicians Should Do

Our physician-user groups and physicians from other hospitals have defined several critical factors for ACIS and OE/RR to be successful (Table 4).

Ease of use was the most important interface factor. Physicians asked for a windows-type, graphical-user interface: A pointing device such as a mouse, track ball, or light pen, and they also asked for on-line help.

The availability of workstations, fast response time and minimal downtime were defined as critical requirements for the system. Clinicians perceive downtime as any time that the system is unavailable for their use, regardless of the cause. If workstations are not available because they are placed in the wrong locations, or are too few in number, or do not function properly, physicians will view this as downtime.

We discovered a variety of approaches to the issue of availability during our site visits. These approaches include placing one workstation in the hall for every 4 beds in a functional unit called a pod.[19] Advantages of the pod arrangement are decreased cost of hardware and less temptation by patients and families to play with the computer in the patient's room.

The pod configuration has several disadvantages however. Both doctors and nurses wait for the same workstation in the pod. When one care-giver is called away from the workstation for an emergency or a phone call, another person might begin working at the same workstation, not realizing that he or she was logging in on the wrong patient or is logged on to the computer with another's identification. When the pod's workstation goes down, access to a workstation in another pod could be difficult.

Other institutions have placed multiple workstations at the nurses' station, typically one workstation for 4 acute beds. Some have placed a workstation in each patients' room or just outside the patient's door.[20] LDS Hospital in Salt Lake City, Utah, a 550-bed tertiary care hospital, uses 1,200 workstations, one in every patients' room.

Some institutions are experimenting with portable wireless terminals in the form of small notebook computers, pen-top computers, palm-top computers, and personal digital assistants such as the Apple Newton.[21,22,23] At the March 1993 Healthcare Information and Management Systems Society meeting, 13% of surveyed institutions indicated that they had for the most part implemented a wireless, local-area network.[24]

Physicians identified fast-system response as a critical factor for success. This requires the workstation screen to respond to user-input in less than one second, so called "sub-second response time". Sub-second response time might be difficult to achieve if the clinician's workstation must frequently generate access to a clinical data base or a behind-the-scenes decision-support system. To achieve sub-second response time in a complex network tied in to the lab, imaging and pathology computer systems, great demands are placed on network architecture and software interfaces. Each gateway, router, and bridge among networks adds a small increment of time to the data-access process, the total of which can cause a response time of several seconds in a complex or poorly designed ACIS. Thus, system architecture plays an important role in satisfying the physicians' functional demands.

Physicians also require that ACIS improve the efficiency of their work process. Time is money to clinicians, regardless of the payment system in which they work. Physicians identified several sources of efficiency that they expect from ACIS (Table 5).

One aspect of efficiency is having all relevant patient data available at one workstation so the clinician can avoid searching multiple locations to obtain clinical data. In our current paper medical-record system, the clinician often must go to one location for the chart, to another location for current labs, to another site to obtain vital signs that have not yet been recorded, and still elsewhere to locate the place where the administration of medications have been recorded. Often one of these key sources of data cannot be located.

Turn-around time for laboratory results can be decreased as a result of increased efficiency of computer order-processing. The clinician should have all lab results made available through OE/RR as soon as they are obtained by the laboratory, thus eliminating most telephone calls to obtain these results.

Another item of efficiency can come from being able to have access to clinical information from sites other than the patient's location. Thus, better and faster clinical decisions can be made from remote places within the hospital and from locations outside the hospital such as the physician's office and home.

Personal order-sets will promote efficiency by allowing customization of a physician's orders for frequently repeated procedures. Physicians should be able to customize their own orders, screens and user-areas without approval or help from IS. Department order-sets will promote adherence to more effective and efficient standards of care. The OE/RR should promote an easy method for the physician to automatically document the causes and medical necessity of variations in care and thus reduce unwanted calls from utilization reviewers and managed-care workers.

OE/RR will promote large increases in efficiency through the use of decision-support by physicians during order-entry. For example, formulary contents with default dosages should be immediately available, thereby eliminating the need to locate a drug reference book, which often is not available or is out of date. The antibiotic alert programs and Bayesian analy-

sis described above are examples of more sophisticated decision-support.

Another critical success-factor defined by our physicians was that the information contained in ACIS must be clinically valuable. Clinical value comes from having as much of the relevant clinical data as possible on-line. Examples of clinically relevant data that the clinicians expect to use in ACIS are listed in Table 6. Examples of value added to the clinical process are ordering guidelines, clinical alerts, cost information, medication-administration data, and knowledge-base information.

Physicians perceive ordering guidelines from OE/RR to be of value. For example, unnecessary duplicate orders and tests can be detected quickly, such as the concurrent prescription of Lasix by one physician and furosemide by another. Alerting the ordering physician to potential drug-interactions is another value added by the system. Drug-allergy interactions and drug-lab test interactions are common unwanted events that can be decreased by ACIS.

Another critical success-factor defined by our physicians is in ensuring the security of patient information, referring to data integrity and patient confidentiality.

Integrity of data refers to maintaining the validity of the information within ACIS. This includes such issues as the frequency, method, and reliability of backup data, whether duplicate data bases are to be maintained, and which data base is the official record.

Confidentiality refers to the process by which privacy of patient data is maintained. Confidentiality issues for ACIS are basically the same as the confidentiality issues for the traditional paper chart, for which the medical staff currently has policy. Remote access through a modem raises special problems of confidentiality. Control of a legally binding electronic signature for clinicians is related to the data integrity issue.

Previous Failures of Clinical Information Systems

Given the volume of clinical information, the large number of users of this information, the movement of patients among multiple services within and between health care institutions, and the complexity of the information infrastructure, it is not surprising that some clinical information systems have been plagued with problems. It is essential for those planning to install ACIS to analyze the failures and problems of other systems.

Interviews with physicians at several hospitals, clinics, vertically integrated health care organizations, and a review of the literature revealed failures common to several advanced clinical information systems. The most common problem is the failure to involve the clinical staff in the selection and design of the system from the beginning. Another common problem is the failure to include important clinical constituents, such as resident physicians, in the design and implementation process. Most institutions report that only a small fraction, typically 15% to 30%, of their physicians use the clinical information systems. In contrast, some hospitals report very high usage among physicians. At El Camino Hospital, a medium-sized nonteaching hospital in San Jose, California, almost all orders are entered by the physician directly into the OE/RR computer system. El Camino attributes their remarkable efficiency to the clinical information system.[25]

The QMC Response-Vision, Strategy, Structure, Staff

The QMC vision for the Order-Entry/Result-Reporting project is to create an efficient and effective computerized process which will enable QMC health care providers to manage orders and receive results efficiently in order to achieve the best possible patient care and to promote continuous improvement of quality.

Our process for developing the OE/RR project is composed of discrete steps (Table 7). These steps focus on analysis of the current manual order-entry environment, definition of user needs, determination of IS requirements, and alignment of the OE/RR project goals with institutional strategy.

The OE/RR Steering Committee is composed of members from major clinical and ancillary staffs and from hospital administration. The OE/RR Project Team consists of representatives from the medical staff, nursing staff, ancillary departments, management, engineering and IS. User groups are organized to represent user constituencies. Personal invitations were extended to 140 active medical staff members to participate in the Physician User Groups (PUGs). About 70 physicians have been actively involved in the OE/RR process. Similar user groups have been organized among the nursing staff, ancillary staffs, and among the nonclinical departments.

It is anticipated that the OE/RR organizational structure will resemble the structure of other institutions that have implemented advanced clinical information systems.[26] A multidisciplinary Clinical Informatics Committee will be needed to set policy for ACIS and OE/RR and develop quality clinical initiatives for the medical center. The Clinical Informatics Committee should report regularly to the Medical Executive Committee and the administration. Implementation of clinical initiatives and the initial system design will require a Physicians Clinical Informatics Group (PCIG), which will consist of 6 to 8 physicians with special interest in the application of OE/RR for solving clinical problems. The PCIG members will serve on the Clinical Informatics Committee and they will be responsible for the day-to-day screen development and for ensuring rapid response on the part of the OE/RR Project Team to clinical needs. The PCIG will collaborate with the Nursing Clinical Informatics Group (NCIG), ancillary services, IS, and the OE/RR vendor.

A larger number of physicians will be recruited to participate informally as "friends of ACIS" who will serve as testers of additions and modifications of the ACIS. The physician, nursing and ancillary user groups will function as educational and advisory bodies to the PCIG and NCIG.

Future Challenges for Advanced Clinical Information Systems

Future challenges to the QMC ACIS will depend on the extent of health care reform and on how rapidly clinicians learn to use OE/RR. Possible future challenges for clinical information systems are listed in Table 8.

Advanced clinical information systems and direct physician order-entry are powerful clinical tools that will dramatically change clinical medicine. Physicians should lead the application of these technologies to day-to-day clinical practice in order to improve the quality and efficiency of patient care. Through careful planning, learning from others, and involvement of clinicians from the earliest stage, QMC will use these powerful new clinical tools to meet the demands of our rapidly changing health care environment.

References

1. Eisenberg JM, Williams SV. Cost containment and changing physicians' practice behavior: Can the fox learn to guard the chicken coop? *JAMA*. 1981;246:2195-2201.
2. Maki DG, Schuna AA. A study of antimicrobial misuse in a university hospital. *Am J Med Sci*. 1978;275:217-282.
3. Castle M, Wilfert CM, et al. Antibiotic use at Duke University Medical Center. *JAMA*. 1977;237:2819-2822.
4. Tufo HM, Speidel JJ. Problems with medical records. *Medical Care*. 1971;9:509-517.
5. Hsia DC, Krushat AB, et al. Accuracy of diagnostic coding for Medicare patients under the prospective-payment system. *NEJM*. 1988;318:352-255.
6. Pestotnik SL, Evans RS, Burke JP, et al. Therapeutic antibiotic monitoring: Surveillance using a computerized expert system. *The Amer Journ Med*. 1990;88:43.
7. Tierney WM, Miller ME, et al. Physician inpatient order writing on microcomputer workstations. *JAMA*. 1993;269:379-383.
8. Fekety R, Shah AB. Diagnosis and treatment of *Clostridium difficile* colitis. *JAMA*. 1993;269:71-5.
9. Pestotnik, op cit.
10. The PIOPED Investigators. Value of ventilation/perfusion scan in acute pulmonary embolism: Results of the Prospective Investigation of Pulmonary Embolism Diagnosis (PIOPED). *JAMA*. 1990;263:2753-2759.
11. Bria WF, Rydell RL. *The Physician-Computer Connection*. American Hospital Publishing, Inc. 1992.
12. Stuttsman H. The Physician-Computer Connection Conference. Coeur d'Alene,

(Continued on page 354) ➤

COMPUTERS IN MEDICINE

(Continued from page 312)

Robert Flowers MD, is well-known to Hawaii physicians and residents. Having lived in Hawaii for more than 25 years, Flowers is an acknowledged world authority on periorbital aesthetic surgery and facial implants. Poetry by Flowers has appeared in many issues of the *Journal*, and we look forward to more. His associate, **Gregory Caputy MD** served his general surgery residency at Mayo Clinic and his plastic surgery in Halifax, Nova Scotia. Caputy and Flowers present a very honest review of computer imaging. This is an interesting paper that complements the "Virtual Reality" paper by Camara.

This issue wouldn't be complete without an article about library searches by computer, the most common use of computers in medicine today. Hawaii Medical Library has written a comprehensive "how-to" for physicians.

We'd like to extend an invitation to physicians to attend a Computer Exposition here in Hawaii at the Blaisdell Exhibition hall on January 26 and January 27, 1994. This is a must for both the abacus-using physician and physicians who now are using computers.

See you there and
Happy Computing!
Norman Goldstein MD
Special Issue Editor

THE ADVANCED CLINICAL

(Continued from page 345)

Idaho. 1993.
13. McGee, Michael. The Physician-Computer Conference. Coeur d'Alene. 1993.
14. Bates DW, Leap LL, Petrycki S. Incidence and preventability of adverse drug events in hospitalized adults. *J Gen Intern Med.* 1993;8:289-94.
15. Tiwanak G, Davis D, Rauscher L. Unpublished data. 1992.
16. Davis D. Unpublished data. 1992.
17. Massaro TA. Introducing Physician Order Entry at a Major Academic Medical Center: I. Impact on Organizational Culture and Behavior. *Academic Medicine.* 1993;68:20-25.
18. Bria WF, Rydell R. *The Physician-Computer Connection.* American Hospital Publishing, Inc. 1993.
19. Gardner R. personal communication. LDS Hospital, Salt Lake City, Utah. 1993.
20. Glaser J. personal communication. Brigham and Women's Hospital. Boston, Mass. 1993.
21. Wormuth DW. SCUT: clinical data orgainzation for physicians using pen computers. PROC Annu Symp Comput Appl Med Care 1992:845-6.
22. Lussier YA, Maksud M, Desruisseaux, Yale PP, St-Arneault R. PureMD: a computerized patient record software for direct data entry by physicians using a keyboard-free pen-based portable computer. Proc Annu Symp Comput Appl Med Care. 1992:261-4.
23. Bria WF. personal communication. 1993.
24. Hospitals put wireless terminals to the test. *Modern Healthcare.* April 5, 1993;38.
25. Eisenstadt S, personal communication. El Camino Hospital, San Jose, California, 1993.
26. Glaser J. The Physician-Computer Connection Conference. Coeur d'Alene, Idaho. 1993.

EMERGENCY ROOM

(Continued from page 354)

of limited space.

A fax/modem communications capability would speed up sending reports to mental health clinics after a patient gives written consent. In the future it also might allow access to other patient data bases. When the QMC order entry system is online in 1995, ER and admission orders will be entered conjointly.

Currently we have identified our needs and the specifications or our desired data base. An IBM model 56 computer with a 486 CPU, 8 megabytes of RAM and two 212-megabyte hard drives have been purchased. The psychiatry office has been wired to connect the QMC network. A new pushbutton combination lock has been placed on the door to prevent theft of the computer.

A problem we are still working on, however, involves standardization with other patient data bases within the Medical School. By the time this article is published the data base problems will be worked out, the software will be installed, and the users will be trained. When the system is installed, using the computer will probably be slower than the old system. As the users become familiar with the new system, processing evaluations will become faster, more efficient, and will produce better outcomes.