Editorial

Implementation and Termination of a Computerized Medical Information System

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Be not the first by whom the new are tried, nor yet the last to lay the old aside.

—Alexander Pope
Essay on Criticism, Part 2
1709

Computerization of medical care is widely seen as a boon to the process of delivering care.[1–4] Among the postulated benefits is instant access to patient records, ease of order entry, facilitation of data capture, legibility, and aids to management and quality improvement. Much of this promise has been relegated to the near future because of a lack of sufficient and appropriate technology, especially software.[5] Currently there is intense interest in medical computerization and growth in the number of companies offering products.[6–8]

In May 1995, the Department of Family and Preventive Medicine at the University of Oklahoma put into operation a comprehensive computerized medical information system (CMIS). We used a request-for-proposal approach to solicit vendors. At the time of selection, only one vendor met the rather stringent criteria we specified for a usable system. The "go-live" date was preceded by a prolonged bidding process, followed by 6 months of planning, hardware installation, and collection, refinement, and input of configuration data by a large implementation team with a variety of skills.

After a 3-month period of sole use as a computerized medical information system, the decision was made to abandon the system. This report is a summary of the problems that we faced.

Submitted, revised, January 24, 1996.

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ISSN 0094-3509

The Implementation Process

Selecting a computer system involves examining the goals and objectives of the organization and correlating these with the products available. We determined that we wanted a client-server system with terminals in the patient examination rooms. Critical components of this system were on-line records including dictation and transcription, physician order entry, links to in-house pharmacy, laboratory, and radiology, and a link to the independent scheduling and demographic billing system. Our goal was to facilitate patient care with legible, shared records, to enhance resident education by documenting experience, and to assist the clinician with laboratory and radiology ordering and reporting. Other goals, such as management reports and quality improvement, were also considered. A team consisting of the chair of the department, the head of our information systems, and advisory physicians reviewed the available systems prior to the procurement process.

Funding in any organization is problematic, but because of a one-time opportunity, we were able to arrange for the implementation of a comprehensive CMIS. We contracted with a large vendor with three CMIS sites in operation nationally. Our site was the first with a residency program, the first academic program, and the first with a wide variety of fee-for-service patients. Our vendor assured us that these facets of our operation would not impede a successful implementation, but in the end, they caused serious problems.

There are several steps in the installation of a system. One step involves the hardware, including placement of servers, terminals, printers, and cables. A second task is the collection, organization, and entry of patient data, physician/provider data, consultants, nursing users, pharmaceutical lists, laboratory and radiology tests, and security levels. A third major effort is the training of all system users. The time required to complete this training ranged

from 2 to 16 hours for each of our users, some of whom had no prior computer experience. Training included all aspects of the system, including logging on, finding patients, ordering tests, and reviewing results. In addition to the training, we conducted numerous and extensive "walk-throughs" to identify bottlenecks and potential problem areas.

We chose to use an immersion implementation rather than a gradual phase-in by clinical area. In our initial assessment, we thought it would be too confusing and cumbersome to phase in a system with the number of processes while maintaining a manual system. In retrospect, it might have been better to phase in the system, starting with a small core of enthusiastic users, as changing physician and staff behavior and the culture of a large organization is a difficult task.

Our $500,000 Lesson

In the end, the product we had chosen was neither user-friendly nor intuitive enough for physicians and other users to provide patient care, billing reports, or other useful objectives. We were neither sufficiently critical in our initial evaluations nor persistent enough in our questions of current users, and we failed to recognize the difference between implementation problems and fatal performance flaws.

Based on our experience, we suggest that successful implementation of a CMIS depends on identifying the goals for the system and selecting a system that meets these goals. Doing this requires getting hands-on experience with the system—without the vendor present—by visiting sites that currently use it; talking with people who use the system on a daily basis rather than salespeople and users handpicked by the vendor; talking with clerks and nursing personnel to find out if reports are easy to generate and data are simple to extract.

Our experience, however, demonstrates that effort and diligence does not guarantee success. Future users should consider the following attributes when contemplating a CMIS.

Reliability is the foremost attribute of any medical record system. As with any machine, computer systems are subject to breakdown, but breakdowns should be infrequent. The system should be designed so that on-site technical personnel can quickly locate the source of the problem, correct it, and return the system to proper performance. The unexpected usually occurs. Early in our experience, after a thunderstorm, the campus computer network shut down. Our server, detecting no higher-priority system, attempted to take over the operations of the campus computer. Wresting control from the errant machine proved challenging. This scenario sounds far-fetched, but it actually occurred.

The system must have credibility. It is important that anyone who places information into a record (physician, nurse, transcriptionist) be able to verify the action quickly and accurately. Anyone subsequently viewing the chart should be able to quickly locate desired information and correct erroneous information without the possibility of "doctoring" records. After a needlestick incident involving a 15-year-old girl, a nurse ordered an HIV test, listing "exposure to AIDS" as the diagnosis. Not wanting this "diagnosis" to appear on the girl's chart, we sought to delete this entry. We were ultimately successful, but the process was quite difficult.

The system must be consistent. This aspect refers to the means of interacting with the machine. For example, if a certain function key or icon causes an entry to be erased on one screen, that particular function key or icon should do precisely the same thing on all screens. Interface inconsistency will almost certainly damage the integrity of the system and clinicians' confidence in it.

The user interface needs to be intuitive to clinicians and other users. In the patient encounter, the focus is and should be on the patient rather than the computer. When the clinician looks at the screen to enter information or order a test, the means of doing so should be obvious. The user interface should also accommodate the surprising number of terms that clinicians may use in referring to the same diagnostic test, procedure, or medication. Computerized medical record systems are basically large databases that require standardized terminology in order to be maximally useful for research. The system we used provided "pop-up" menus for the clinician to pick from when ordering tests, procedures, or medications. We quickly found that the list needed to be much larger and more comprehensive. Numerous aliases should be linked to the same CPT or ICD-9 code so that whatever occurs first to the clinicians can be located quickly under that name. For example, a physician should be able to order an exercise tolerance test, a treadmill, a stress test, or an exercise treadmill. It is also desirable to have Soundex searches. Definitions should be readily accessible in case the clinician is unsure that the item selected is actually the one intended.

The user interface should enable the clinician to use the system quickly. Interactions with the computer should be met with a timely response. Clinical information systems necessarily require multiple screens that should appear and disappear quickly on command. There should be no delays in accessing requested patient information and conducting searches through lists of drugs, procedures, and consultants; and there should be no guesswork in figuring out how a particular item is worded

in the computer; and drug interaction software should be easily and immediately accessible. In addition, any useful computerized system should include physician reminders, for example, that a patient is due for a mammogram or is allergic to penicillin.

The office manager needs to be able to determine quickly and accurately which records are incomplete and why, so that corrective action can be taken. Billing personnel need to know that the attending physician who "signed" the encounter is the same physician identified on the billing statement. Any conflict identified during an audit can trigger fines or penalties. We spent enormous amounts of time and effort to ensure this link.

A clinician who is concerned about the efficacy or safety of a given treatment or medication should be able to use the computer system to recall all patients receiving that treatment or medication easily and rapidly. Records should be reviewable across patients as well as within an individual patient record. Using the system, a clinician working with the elderly should be able to determine who has had an influenza shot and who has not.

In all likelihood, any CMIS will need to interface with other computer systems. Our CMIS connection to the scheduling system was unreliable at best. Interfaces to several reference laboratory computers were attempted, but none was completed.

Members of the implementation team need a variety of skills. Among the group should be those with database expertise, networking expertise, operating system expertise, and users of all types, including clinicians, nurses, clerks, and ancillary services. Representatives of both the vendor and purchaser need to work together closely.

Unplugging the Computer

In spite of enormous effort on the part of all clinic staff and physicians and support from the system vendor, we determined after 3 months of daily use that the system was untenable. It was phased out during the fourth month of usage. The primary reason was the perception by a large majority of the users, especially the physicians, that the system was too hard to use and that there was little perceived benefit. An example of this problem is that physicians were required to "associate" a diagnosis with a laboratory order. While this process was neither prompted nor intuitive, it was mandatory for reimbursement. Any physician can justify a given order (for example, a cough justifies a chest radiograph), but the process of linking the order with the justifying diagnosis through a cumbersome computer program proved too daunting. Another problem arose when users attempted shortcuts to improve efficiency. These shortcuts decreased documentation, resulting in the inability to bill for a performed service. For example, injections would be noted in the free-text progress note rather than in the specific order section because the menu system was too difficult to traverse. Hoped-for benefits were not realized because, although promised, it was too difficult to produce reports and extract data from the database.

The cost of the implementation was more than one-half million dollars for the hardware and software. This figure does not include overtime for clinic personnel during installation or personnel who were shifted from primary duties as research assistants or the cost of information systems technicians' ongoing CMIS support activities.

Discussion

Our disappointing experience is not the first to be reported. Dambro et al[9] had a similar experience with a medical record system. Their system was terminated after 4 months because of the expense of added personnel.

Changing how physicians practice is one of the issues related to implementation of computerized medical records.[10] Some of our first-year residents had fewer problems than other users because they had less to "unlearn" about how to practice medicine in an outpatient setting; some felt, however, that they spent too much time learning how to use the computer before learning medicine.

It is possible to increase computer use by physicians, but doing so is limited by the lack of suitable software: programs that are intuitive, easy to use, and anticipatory of the clinician's needs. Software should expedite the process of care, not slow it down. Other factors include ease of generating management reports, ease of use for others, such as nurses, and facilitation rather than hindrance of billing.[11] The CMIS should benefit the physician's office rather than the office having to adjust excessively to the needs of the CMIS.

Patient acceptance of a CMIS has not been an issue. The findings of Solomon and Dechter,[12] which showed no change in patient satisfaction with terminals in the examination room, coincide with our anecdotal experience. Nonetheless, physicians must feel confident enough to use a system in the presence of patients. Physician confidence (or lack thereof) is likely to influence patient acceptance. Confidentiality is a concern,[13] but we had no major problems in this area. The primary requirement for a system to be successful is that it fit with how a physician thinks and practices, with a secondary gain to a variety of groups, including patients, clinicians, and managers.

Our effort to implement a CMIS failed, ultimately because of cumbersome procedures, the risk of "getting lost" in the system, and the inflexibility of the system, all

of which produced user resistance. Perhaps the lessons we learned will be useful to other potential CMIS users. There is no doubt that physicians will be using computers[2,5,14]; the challenge lies in evaluating and selecting the system best suited to a given office.

Our impression from ongoing review is that even though there is currently frenetic development activity by many companies, a stable, comprehensive, intuitive CMIS that accommodates the diverse needs of a large family practice group is several years away.

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