Computerized Medical Care: The HELP System at LDS Hospital

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Want to look into the future of health information management? Then a trip to Salt Lake City might be in order.

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Introduction

The traditional medical record has several limitations. It may be poorly organized and inflexibly formatted. It addition it may be illegible, physically inaccessible, and not current. Having a unified record is essential for physicians if they are to make prompt and appropriate treatment decisions for hospitalized patients. Integrating data from as many as 25 sources may be necessary to appropriately care for a critically ill patient. A computerized medical record can be the principal instrument for assuring the continuity of patient care. The current paper medical record is a document that we are obliged to computerize.[1,2] Recently the Institute of Medicine (IOM) declared that a computer-based patient record was an essential technology for healthcare.[3,4] Information in the medical record should be easily retrievable and reviewable in a temporal relationship to other associated data. Records having these characteristics would facilitate the routine processing of data required for medical decisions.[5,6] Traditional manual medical records lack these attributes. At LDS Hospital in Salt Lake City, UT, we have automated much of the data acquisition and computerized the patient medical record using the clinically oriented Health Evaluation through Logical Processing (HELP) computer system.[7,8]

System Description

LDS Hospital has implemented the HELP Patient Care System as a powerful tool in its Continuous Quality Improvement (CQI) process. LDS Hospital utilizes the following HELP system patient care applications:

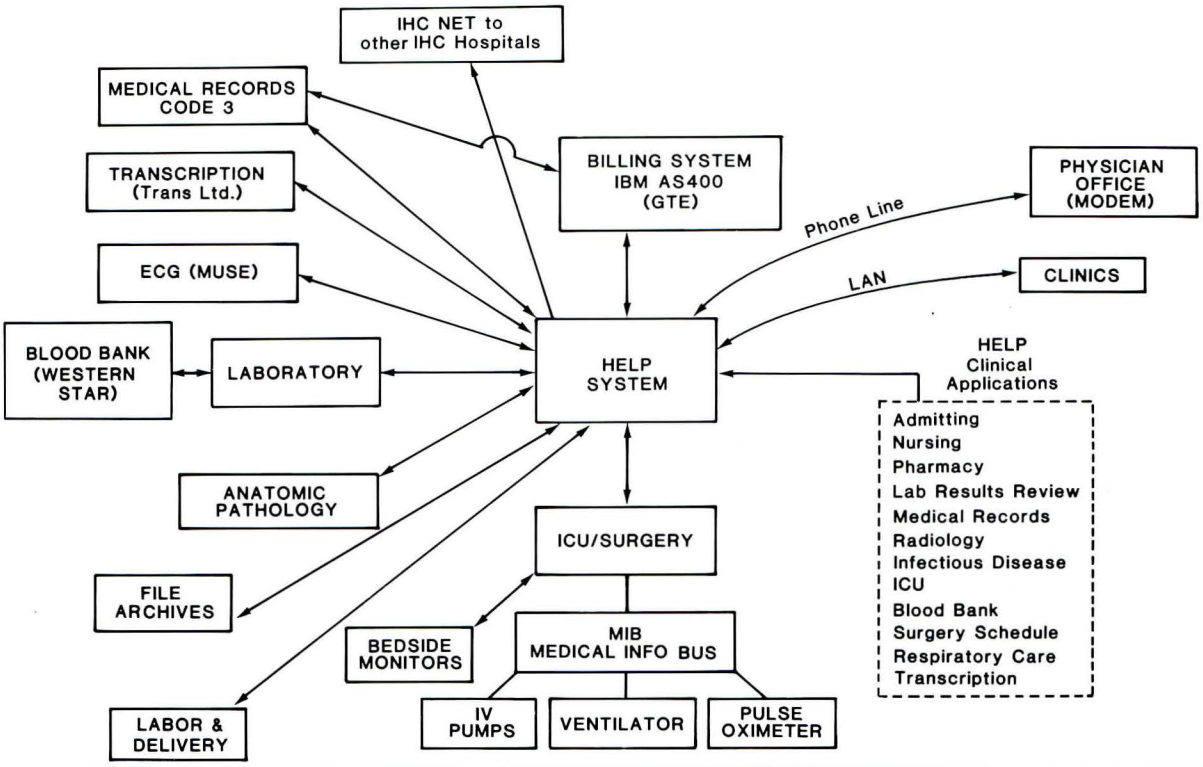
- admitting
- nursing
- pharmacy
- laboratory results review
- medical records
- radiology
- infectious disease
- intensive care unit
- blood bank
- surgery scheduling
- respiratory care
- labor and delivery
- archival files
- transcription and natural language processing

Increased efficiency and effectiveness of patient care have resulted from these applications. However, the most important clinical quality improvement benefits have resulted from using the HELP system's expert system technology component. Expert system technology is a software technology that makes the HELP system more than a simple data communication package like many other patient care systems. The combination of traditional patient care applications and expert system technology enables the HELP system to use its integrated database for clinical decision support. This clinical decision support has become an interactive partner supporting many aspects of patient care at LDS Hospital. It is routinely used by physicians, nurses, pharmacists, respiratory therapists, clerks, and administrators.

Patient-specific data are collected from different departments in the system into an integrated database. Much of the data is collected automatically through instruments and interfaces. Figure 1 is a simplified block diagram of the HELP system. The system consists of more than 50 computers networked and integrated with a central nonstop TANDEM system that is the database server and decision-support expert system. The expert system technology of the HELP system analyzes these data as they are collected and provides

Figure 1

Block diagram of the HELP System showing that it interconnects a multitude of computer data sources and has a large number of internal clinical application programs. Interconnection of all these systems allows us to capture a rich database of timely and accurate clinical data. For example, as soon as data are processed by the instruments in the clinical laboratory they are electronically transmitted to the laboratory computer system, then within seconds to the HELP System where they are available for physician or nurse review. In addition the HELP System's decision-support capability generates "alerts" if there are life-threatening findings.



many types of feedback to clinicians. Figure 2 illustrates how the expert part of computerized medical decision-making part of the HELP system operates.

The HELP Hospital Information System (HIS) has been under development at LDS Hospital in Salt Lake City for the past 20 years.[7,8] LDS Hospital is a 520-bed, private, tertiary care hospital and a major teaching center for the University of Utah School of Medicine. There are more than 1100 terminals and 200 printers connected to the HELP system. Each bedside has a computer terminal. More than 100 physicians have access to the HELP system via dial-up modems from their offices or homes.

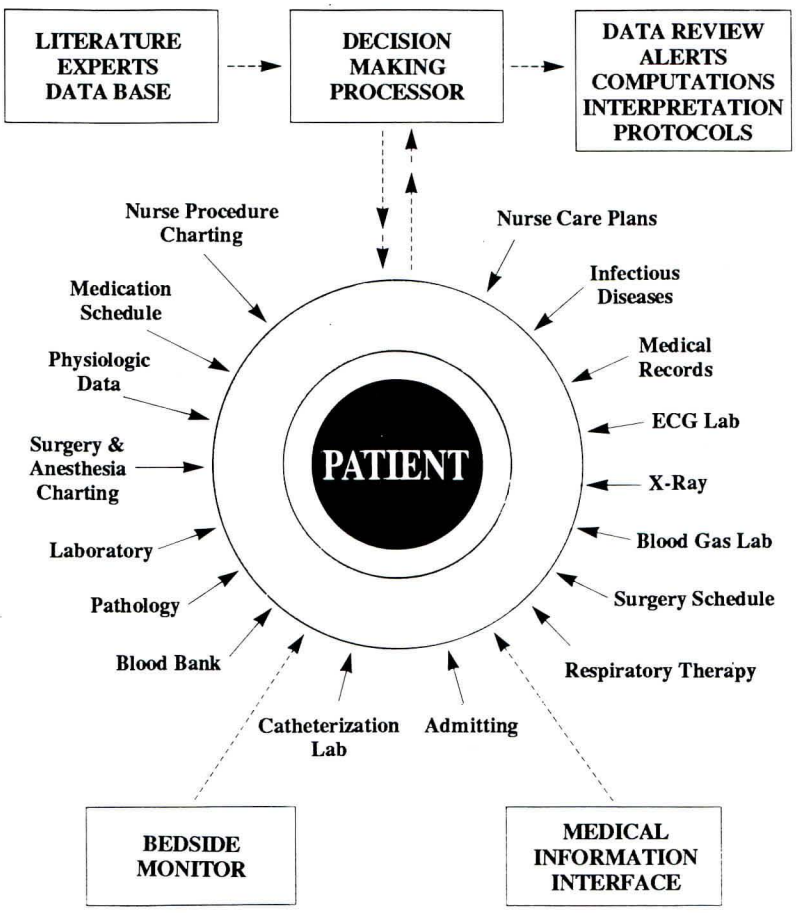
Daily clinical operation of the hospital is now dependent on the HELP computer system. A key feature of the HELP system is its computerized medical record that contains patient information from the clinical areas noted above and that is integrated into one electronic medical record.

Medical decision making has traditionally been considered a scientific, as well as intuitive, process. In recent years, however, formal methods for decision making have been applied to medical problem solving and computer-assisted medical decision making has gained wider acceptance. For example, computers can be used to interpret ventilatory status based on blood gas reports. In addition, computers can be used to alert physicians, nurses, or pharmacists when a medication may be contraindicated. Computers can also be used to provide physicians guidance using patient treatment protocols. A brief description follows of several computerized activities, using the HELP computer system, that have resulted in improvement of patient care.

Admitting

Positive identification of patients is a crucial step for all hospital information systems. The HELP system is used to schedule patients for elec-

Figure 2
Flow chart showing how data from multiple locations flows into the HELP System database. As the data are stored, medical decision-making criteria derived from medical experts and analysis of our own database are applied to the data. Laboratory alerts, drug-laboratory interaction flags, computer-directed care protocols, and a variety of other expert system applications operate in this mode.



tive admissions and to record demographic, insurance, and clinical information.[8] This module of the HELP system is known as the Admit-Discharge-Transfer (ADT) module and is kept current by the admitting offices located at various entrances to the hospital. It is also updated by surgery, emergency room, ICUs, and nursing divisions throughout the hospital as patients are moved. The ADT system communicates with other computers in the HELP system network to keep them updated. For example, when a patient is transferred the information is sent to the entire network of computers such as the billing, medical records, and laboratory computers. Thus the location of a patient can be ascertained at any time from any of the 1100 terminals within the hospital or via physician dial-up access from outside the hospital. Accurate and timely access to this data is not only valuable for tracking patients, but provides data essential for charge capture and utilization review.

Nursing

The Nursing Information System (NIS) at LDS Hospital makes extensive use of the hospital-wide integration capabilities of the HELP system. Patient data charted by the nurse are immediately accessible by other members of the healthcare team through the extensive network of computer terminals. Point of care, real-time data entry, and availability is supported by the use of bedside terminals. Research at LDS Hospital has shown that data entry at the bedside improves the timeliness, completeness, and accuracy of the clinical record because information is neither forgotten nor inaccurately transcribed into the paper record.[8,9,10]

The integration of the system also eliminates the need for duplicate recording of patient data, which is often necessary with a paper system. For example, the nurse measures the patient's blood glucose value, and enters it in the computer just once. The information is immediately stored in the central patient data file and may then be retrieved for the physician's diabetic report, the pharmacy alert program, the dietician's summary, and on the nursing end-of-shift report.

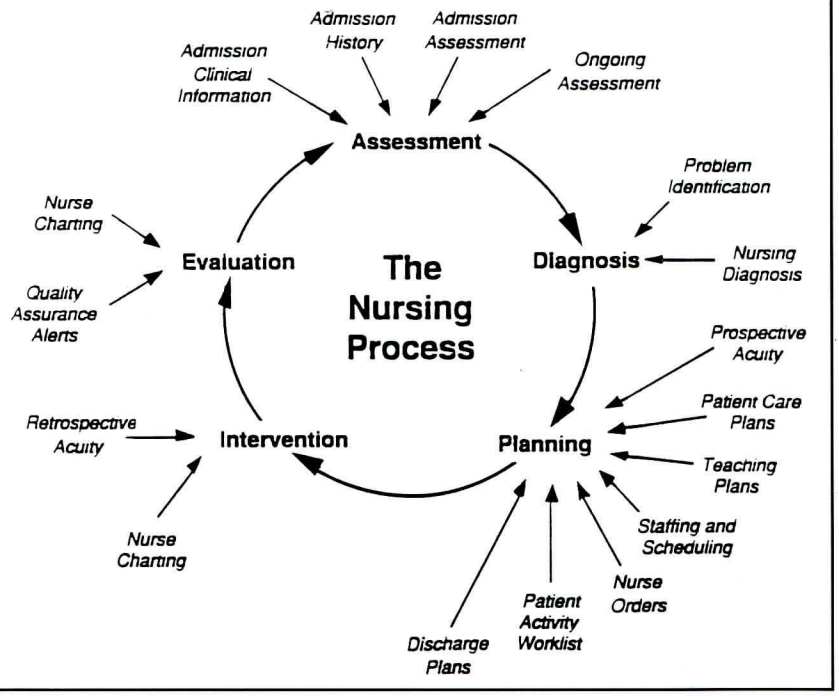
In addition to providing a mechanism for accurate and timely recording of data, the design of the NIS and individual nursing modules supports each step of the nursing process. The scientific nursing process of assessment, diagnosis, planning, intervention, and evaluation is facilitated by use of the HELP system decision-making technology and database integration, as illustrated in Figure 3.

A summary of the NIS modules that are currently installed at LDS Hospital are outlined below:

Physical Assessment

The physical assessment component of the NIS allows the nurse to

Figure 3
Block diagram of the nursing care system used at LDS Hospital. Provided courtesy of the 3M Health Information Systems Division, Salt Lake City, UT.



document the patient's current physical status, including level of consciousness, breath sounds, and cardiac status. The program assists the nurse in following the patient's status by displaying the last charted assessment for each physiological category selected. The nurse can then readily identify changes in the patient's condition based on the current assessment.

The program also facilitates documentation by allowing the nurse to quickly verify and update any assessment information that has not changed since the previous assessment. Thus, detailed charting is limited to items indicating a change in the patient's condition.

Patient Care Plan

The care plan module assists the nurse in developing the plan of care based on problems identified in the clinical nursing history, from the admission assessment, or from problem documentation in nurse charting. The nursing care plan format utilizes nursing diagnoses, as established by the North American Nursing Diagnosis Association (NANDA).[11] Following the selection of the appropriate diagnosis, a series of screens allows the nurse to select the related factors, expected outcomes, and interventions that will be performed by the nurse to achieve the desired outcomes. Further individualization of the care plan is done by establishing goal dates for each outcome and detailing patient-specific actions for each of the general interventions. In addition to the nursing diagnosis component, the patient plan of care may include collaborative problems, nursing orders, a particular unit's standards of care, and protocols.

A hard copy of the patient care plan is kept at the bedside for use by nursing staff, physicians, and case managers during routine rounds and is updated as needed. A permanent medical record copy of the patient care plan history, including all elements of the patient plan with dates and times of initiation, is printed on discharge.

Nurse Charting

This module allows the nurse to enter quantitative patient data, such as vital signs, intake/output measurements, narrative of nursing care actions, and patient problems with evaluation of the patient's response to treatment.

The data entry is accomplished through a series of simple, menu-driven screens that prompt the nurse to chart completely. In some cases, the screens require completion of a particular field before proceeding, thus assuring compliance with documentation standards. The most common care items, problems, and characteristics are available on the charting menus; however, unusual circumstances may also be entered through free text, type-in fields. Editing functions are also available within the program.

A permanent hard copy of the nursing records in the form of a nursing comments (physical assessment/narrative) report and a shift report (consisting of a graphic display of vital signs, intake and output, medications, and laboratory data) are generated and placed in the medical record every 12 hours. Although printed reports are generated only once every 12 hours, clinical patient data from the nurse charting or assessment may be reviewed on the computer screen at any time in a variety of formats.

Computer-charted data is more legible and consistent than traditional nursing records in that the same information is always recorded in the same place on the record, each entry is automatically dated and timed, and individual hand-writing variations are eliminated.[12] One of the longstanding concerns about computerized nurse

charting has been that there would be a decrease in the time nurses spent providing direct patient care. Studies performed in the LDS Hospital ICUs showed there was no measurable difference in the proportion of time spent in 10 different nursing activities. Likewise, there was not a decrease in time spent on charting.[13] However, we believe that timesaving benefits from computerized charting systems can be realized if the data entered by nurses are used to facilitate communications between nurses and physicians.

Pharmacy

The HELP system provides expert clinical evaluation during the medication and blood ordering process. Inappropriateness, adverse circumstance, and excessive costs are identified and modified—before the care is actually delivered. Medications are a good example. The HELP system evaluates pharmacy orders for several types of adverse interactions:

Drug—Laboratory Value
Drug—Drug
Drug—Laboratory Test Ordered
Drug—Allergy
Drug—Dose
Drug—Route

Internal studies have shown that five percent of all LDS Hospital patients have medications ordered that will produce an adverse interaction in one of the above areas. These same orders will produce a life threatening condition in 1.8 percent of all patients. The HELP system alerts clinicians to these adverse interactions. The HELP alerts are followed by physicians more than 99 percent of the time maintaining a high quality of healthcare and eliminating unnecessary costs.[14,15]

In a recently reported study of Adverse Drug Events (ADE) conducted by our clinical epidemiology and pharmacy departments, the HELP computer with its integrated database was used as the primary detector.[16,17] For an 18-month period, nearly 37,000 hospitalized patients were monitored. During that time, nine ADEs were reported by traditional detection methods. During the same time interval, 731 verified ADEs were identified in 648 patients—an 80-fold increase.[17] The automated detection scheme was not only more effective, but also identified the events in a timely manner that allowed early cessation of the causative agent and has the potential to prevent more serious ADE manifestations.

Results Review and Alerts

Physicians, nurses, therapists, clerks, and other hospital staff can have on-line and real-time access to the patient's clinical and demographic data with the integrated data structure of the HELP system.[8] For example, reports are available for reviewing laboratory data, vital signs information, and medications ordered and given. Shift reports of nursing activities and vital signs are generated during each shift. Reports that span several days for each patient are also generated. Since the radiology, history and physical, and other dictated reports are transmitted to the HELP system, these "free-text" dictated reports are also available for review at any bedside. There are a multiplicity of specialized reports that format data from a wide variety of locations and present them in "summary" format that are very convenient for physicians to use. In the ICUs for example, physicians use computer "rounds" reports for their morning patient rounds. These laser printer reports never become part of the "official" patient paper record, but are invaluable for the physician users.

Laboratory alerts are generated by the HELP system as it continuously monitors, evaluates, and analyzes patient laboratory test values, vital signs, medications, and diagnoses. This continuous monitoring spots problems and difficulties long before manual evaluation would identify them. The early warning capability of the HELP system enables care givers at LDS Hospital to react quickly and decisively for the benefit of the patient. Take the life threatening condition of metabolic acidosis for example. Through early identification and intervention, time spent in this condition by patients was decreased from 44.3 hours to 26.5 hours. And the total length of stay decreased from 356.9 hours to 269.4 hours, or a 3.6 day decrease.[18,19]

Medical Records

The patient medical record at LDS Hospital is the traditional paper-based medical record. Patient data maintained on the HELP system complement, rather than replace, the traditional record. Certain routine medical reports (laboratory data, blood gas data, respiratory care, charting, and radiology reports) consist of data contained entirely within the HELP database and are printed by HELP for inclusion in the permanent medical record.[8]

The Medical Record Committee and a subcommittee (including nursing, physicians, coders, ancillary services, and health information specialists) are currently working on methodology for the gradual elimination of unnecessary paper reports as a permanent part of the record.

The HELP system medical record programs which assist in work management in the Health Information Services are traditional programs for:

1. chart location;
2. deficiency tracking and delinquency reporting and automatic physician notifications;
3. diagnostic related grouping (DRG) and attestation tracking;
4. admission, discharge, and transfers (ADT);
5. room trace and current patient list;
6. surgery schedule;
7. correspondence log;
8. pathology and microscopy reports;

9. radiology reports; and
10. emergency log.

The abstracting and coding functions were recently moved to the Code 3 system, a 3M Health Care Computer Systems product that is interfaced with the HELP system and the IBM AS400 Financial System.[8]

Progress Notes

A 24-hour computerized progress note has recently been developed which combines results and handwritten physician notes. It is currently used for Medicine and Surgery and will be customized for other services as needed.

Tumor Registry

The Tumor Registry uses a personal computer-based independent module using the Rocky Mountain Cancer Data System software. Plans are in progress to integrate the Tumor Registry data with the HELP system. LDS Hospital's Tumor Registry is the oldest and largest registry in Utah and contains data on 31,000 cancer cases.

It is interesting to note that even though the HELP system has been in use for several years, a study done in 1990 showed that only an average of 25 percent of the medical record (as determined by page count in the paper record) is computerized.[20] However, it is clear that for certain areas of the LDS Hospital, such as ICU, the majority of the record is computerized. We were surprised that such a small part of the paper record was computer generated. However, viewed historically, a "paperless" system was not one of our objectives. Our initial strategy was to have the HELP system collect patient data that would be useful for making diagnostic and treatment decisions. Since the 1990 study, it is estimated that an additional 15-20 percent of the medical record is computerized. Now that we have used the computerized record to accomplish many of our computerized decision-making goals, we are confident that we will be able to have much less paper in the chart.

Radiology

The Radiology Department at LDS Hospital has implemented a computerized method for managing patient radiology exam reports. The dictated reports are stored in the HELP system and may be reviewed, validated, and electronically signed from any terminal connected to the computer system.[21,22] At the time an exam is electronically signed by the dictating physician, a copy is printed for the inpatient chart and also at the nursing station closest to the patient's room. This dictation subsystem is being expanded to include additional textual reports such as discharge summaries and history and physical examinations.

Infectious Diseases

Since 1983, clinical applications on the HELP system have been developed to improve the use of antibiotics and reduce hospital infections.[23] These applications have been shown to improve the quality of patient care by performing tasks that are not feasible by manual methods that would require managing enormous amounts of information. Monitoring each patient's laboratory test results and memorizing results of all antibiotic-susceptibility tests at the LDS Hospital are examples of functions better performed by a computer than by people.[23]

Assessing postoperative wound infections is an application that has proven beneficial. Through computer monitoring and suggestions for preoperative antibiotics, the infection rate has consistently dropped during the last six years.[24-29]

Year	Infections	Infection Rate
1985	59	1.8%
1986	31	0.9%

Nosocomial infections are an indicator of clinical quality. But the reduction in infections also equates to a significant reduction in the cost of healthcare. It has been estimated that a wound infection can cost $14,000. The reduction of 28 infections from 1985 to 1986 equated to an annual savings of $392,000.

In a study recently published by the *New England Journal of Medicine*, our infectious disease division used the archival HELP computer database to evaluate the occurrence of surgical wound infections in 2847 patients undergoing elective surgical procedures.[30] They found considerable variation in the timing of prophylactic antibiotic administration and that giving the prophylactic antibiotic in the two-hour "window" before surgery minimized the risk of wound infection. As a result of these studies, the computer now prompts physicians and nurses to give antibiotics during the optimal time "window." Such quality of care enhancements are only possible because of the integrated nature of the HELP database. This application of the computer system uses data from pharmacy, surgery schedule, admit/discharge/transfer module, and the infectious disease section of the clinical laboratory.

Intensive Care Units (ICU)

In addition to the problems of the traditional handwritten paper records noted earlier, the intensive care unit (ICU) presents additional problems.[31-37] ICU bedside monitors, ventilators, IV pumps, and other bedside devices generate large amounts of time-critical and important information that in most ICUs must be summarized and transcribed by hand. Such logging is time-consuming and inefficient. The data are frequently neither timely nor representative for the time period and are error prone. Retrieval of data from manually recorded ICU records for quality control and research purposes is time-consuming, cumbersome, and expensive. As a result, the application of computers and

computerized medical decision making offers a unique opportunity in the care of the critically ill.

There are many advantages to computerization of the ICU record:

1. data are available for review promptly;
2. documentation is legible;
3. there is a minimum of duplicate charting and transcription;
4. the computer can remind nurses, therapists, and physicians to chart important data;
5. a patient with multiple medical problems can be followed more easily;
6. recognition of important patient trends is enhanced;
7. time spent making calculations is eliminated;
8. there is better shift-to-shift nursing care continuity;
9. quality assurance can be online, continuous, and automated;
10. alerts for life-threatening events can be automated;
11. patient acuity (such as apache) scores can be automatically generated; and
12. computerized protocols that direct patient care can enhance the care process and improve patient outcomes.[36,37]

At LDS Hospital there are 60 adult ICU beds where all patient data recording is computerized. One of the most important problems in an ICU is gathering timely and accurate data. Inaccurate data can result in compromises to patient care and loss of confidence in the system. The best way to acquire quality data in the ICU is to constantly use it. The more computerized data are used by the healthcare team, the greater the likelihood errors will be found and corrected. For optimal use of computers in the ICU, there must be a harmonious collaboration among medical informatics professionals, physicians, nurses, therapists, and administrators.

Blood Bank

There is a growing concern among the public and physicians about the safety of blood transfusions.[38] Blood is also a scarce resource. For these reasons, five years ago we implemented a computer-assisted blood ordering program. Blood must be ordered by a physician or nurse and the reason for the order specified. Each order is then critiqued by the computer to make certain that it is justified. For example, if a physician ordered packed red blood cells for anemia and the patient's hematocrit was 35, a message would appear on the computer terminal screen indicating that the order was inappropriate. If the physician needs to give an "over-ride" reason to the computer rule, it is easily accomplished with a free text entry. Physicians directly enter more than 50 percent of the blood orders. Since implementing the computerized system, we have gone from 30 percent of the orders having a justification indicated to 100 percent with a justification and 99.63 percent of the orders that meet very strict blood ordering criteria.[39-42] In addition, patients who get blood transfusions, on average, have a hematocrit of 26.5, down from 28.3 four years ago.

Surgery Schedule

Surgical procedure times for patients are scheduled using the HELP system.[8] The scheduling program collects patient data from the ADT module and combines that with the surgeon, anesthesiologist, procedure to be performed, and the choice of operating room to be used. From this information, the computer determines which one of 3700 predefined case carts should be assembled for each case. By 2 p.m. each day, the surgery schedule for the next day is available from any terminal and can also be printed from any terminal. The surgery schedule is important not only to assist in patient preparation for surgery, but also serves some very important clinical functions. For example, identification of patients who will benefit from the use of prophylactic antibiotics is activated by the surgery schedule. In addition, blood components are automatically ordered based on the surgical procedure (such as open heart surgery or total hip replacement), patient clinical characteristics, and surgeon.

Respiratory Care

Since 1984 respiratory therapists have charted ventilator observations into bedside terminals.[8,43,44] Blood gas data are entered into the HELP system automatically from instruments in the blood gas laboratory. The once tedious and time-consuming process of chart review has now been replaced by computer programs accessing the integrated HELP database. All charting, report generation, and billing is accomplished through a single entry into the system. From the database thus generated, concurrent quality assurance monitors are easily and effectively implemented.[44] For example, a medical director's alert report is generated each day indicating potentially dangerous events in the conditions of individual patients. This report also shows low oxygen levels in arterial blood. These events are analogous to sentinel event indicators and come as a byproduct to the bedside charting.[44]

There are many apparent advantages to computer-assisted quality assurance with the respiratory care system because of time saved and efficiency gained. When compared to manual quality assurance approaches, the HELP system offers consistent and reproducible data collection, and monitoring of all procedures rather than a selected sample. The integrated database from a variety of sources allows a broader, more accurate, and more comprehensive review of respiratory care. Policies and

procedure reviews offer the medical director the capability of measuring the quality of patient care.

Labor and Delivery

There are few places where timely and accurate data are more essential than in the labor and delivery suite of a hospital. The obstetrical record is now totally computerized and includes integrated physician, midwife, and nurse data.[45] This record includes the fetal monitoring which has now been moved from the traditional fetal monitor strips to a narrative printout on a personal computer-based system backed up by optical disk storage. The computerized fetal monitor system has replaced the need for retention of the cumbersome fetal monitor strips in either their original form or on microfilm. It has also eliminated the physician check-off discharge form and handwritten notes by physicians, midwives, and nurses.

Fetal monitoring data, such as maternal contractions and fetal heart rate, are automatically acquired with a bedside workstation. All of this data is stored on disk on a network. Nurses and physicians enter charting data through the workstation using a keyboard and mouse. Since timely and accurate data are required, free text entry is discouraged. Instead, comprehensive menus allow entry with a minimum number of key strokes or mouse movements. These menus are so complete that less than one percent of the data is charted as free text.

Five separate records are generated:

1. admission and initial assessment,
2. intrapartum,
3. delivery,
4. recovery, and
5. postpartum.

Data from these records are easily accessed on computer screens so that specific time intervals can be reviewed. In addition, users can "zoom in" and "zoom out" to see more or less detail of the record. Printed reports can be generated on a laser printer.

Data integrity and reliability are assured with "mirrored" magnetic disks as well as long-term storage on optical disks. With the optical disk it is possible to access up to two years' worth of deliveries without having to change optical disks. At the moment we still keep paper copies of the charted data, but have eliminated microfilming of the fetal monitoring strips. Our goal is to eliminate the paper record entirely and keep the records on optical disks which have at least a 20-year lifetime.

Archival Files

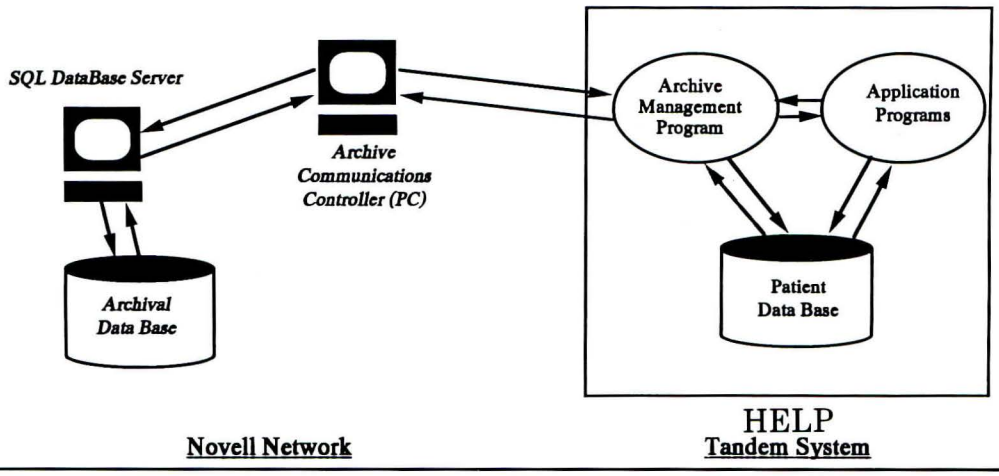
As the phenomenon of the electronic patient record becomes a reality at LDS Hospital, the rapid growth, changing needs, and advanced technological accomplishments of the clinical database on the HELP system created an urgent need to review and resolve the short and long-term archival needs for the computer system. Systems for storing actual text of transcribed reports from Radiology and Medical Records added further urgency for additional disk space.

The computer is the vital link to more effective medical practice, nursing practice, and quality patient care management, as well as for severity programs and outcome management. Plans are in progress for an Ambulatory Services longitudinal electronic patient record system.

The network-based archival system was recently developed for the HELP system (see Figure 4). This system has seven giga-bytes of magnetic disk memory and is expandable as required. The goals of this system are to reduce long-term storage costs and at the same time provide efficient on-line access to clinical data.

Figure 4

Block diagram of the Patient Data Archive system showing how data are archived onto the Novell Network-based Personal Computer (PC) system. The archive system currently has seven giga-bytes of storage and contains the computerized records of patients admitted at LDS Hospital since 1983.



The archival system enables existing application programs on the HELP system to access the archival database in a manner that is "transparent" to the user by using virtual database techniques. The TANDEM-based HELP computer communicates with the remote archival database through a high-speed ethernet network. The archival database utilizes the commercially available Oracle database management system. This system stores historical data from 1983 to the present. It accumulates additional data each day as patients are discharged from the hospital. There are currently more than 750,000 inpatient and outpatient data sets in the archival database.

Transcription/Natural Language Reports

An important step in computerizing the patient record is to provide access to the transcribed narrative text of the history and physical examinations, discharge summaries, consultations, operative records, and any other physician-dictated reports. LDS Hospital's physicians have stated that the most important data/reports they reference at the readmission of a patient are the history and physical examination, discharge summary, laboratory, radiology, and electrocardiogram (ECG) results.

These are also the reports most frequently accessed by nurses, quality managers, coders, and other authorized hospital personnel when reviewing charts for patient care, Professional Review Organization retrospective reviews, quality, reimbursement, and research projects. These data would also play a major role in the electronic data transfer to other healthcare providers on the Intermountain Health Care Network (IHC-NET) (see Figure 1).

Traditionally transcribed narrative reports are dictated by the clinician, transcribed using a word processor, and then printed. It is the printed copy which the clinician reviews and which becomes part of the patient's medical record. On the HELP system, a program transfers the textual report from the word processor to the HELP database. This information can then be accessed, reviewed, and edited electronically.

The advantages of maintaining textual reports electronically as part of the HELP system are:

1. Completeness: The report is part of the patient's electronic medical record.
2. Access: The report is available for review on more than 1100 terminals in the hospital, plus physicians can assess the data from their offices/clinics or from their homes via dial-up modem access.
3. Long-Term Availability: The coded electronic part of the patient's medical record is available for review back to 1983.
4. Research: Making the textual reports part of an integrated computerized database facilitates using the reports as a research tool.
5. Economy: Since the report can be reviewed, edited, signed, and stored electronically, there is a marked reduction in paper use.

In 1990 LDS Hospital entered into a joint programming development project with Transcriptions, Ltd. This system is used for transcribing other medical reports such as: history and physical examinations, discharge summaries, consultations, operative reports, and emergency reports. The text of these reports is now available to the Emergency Department, Health Information Services, and Quality Management Department. It is planned that upon completion of initial testing, these reports will be accessible to other designated patient care areas to remote terminals in doctors' offices and clinics, and to our home healthcare teams.

Conclusion

We have described a diverse array of clinical applications of the HELP system's capabilities. We believe that an integrated computerized record can be the principal instrument for the improvement of the quality and efficiency of patient care. The American Health Information Management Association (formerly American Medical Record Association) has taken a strong stand on this issue.[46] Physicians McDonald, Eddy, and Berwick have set in place the structural basis for the implementation of a much more organized and structured process of patient care.[47-50] Based on our experience we feel that computers will be the vehicle that carries the goals of continuous quality improvement into the next decade.[50-52]

Finally, it is the goal of the developers of the HELP system to incorporate the mission of the Computer-based Patient Record Institute (CPRI)[4] into the planning and development of the computer-based patient record of the HELP system:

1. Support the effective, efficient use of computer-based patient information in patient care, healthcare policy making, clinical research, healthcare financing, and continuous quality improvement.
2. Educate change agents and stake holders (including the general public and healthcare professionals) about the value of computer-based patient records in improving patient care.
3. Foster the computer-based patient record as the primary vehicle for collecting patient data.
4. Promote the development and use of standards for computerized patient record security, data content, structures, and vocabulary.

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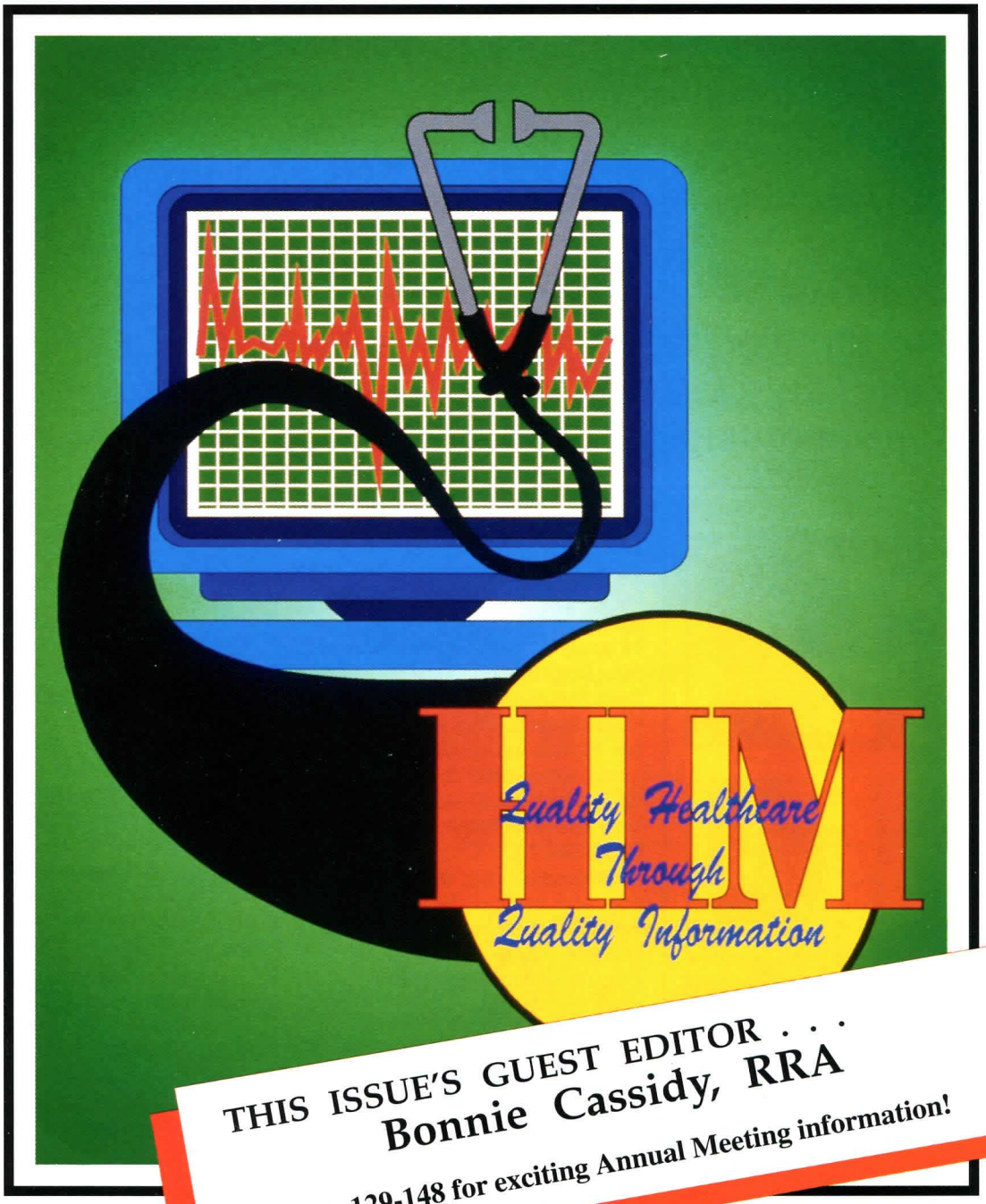

THIS ISSUE'S GUEST EDITOR . . .
Bonnie Cassidy, RRA

See pages 129-148 for exciting Annual Meeting information!