Lessons Learned During 15 Years of Clinical Information System Experience

Donna Miranda, MSN, RN; Willa Fields, DNsC, RN; Karen Lund, BSN, RN

This article describes lessons learned during an initial intensive care unit point-of-care clinical information system implementation and subsequent expansions to other units and hospitals in a multihospital healthcare delivery system. Although the implementation and expansions were primarily successful, lessons learned include developing a broad base of support, making decisions through consensus, addressing conflict when it occurs, keeping user expectations realistic, preparing for the change process, implementing the computer information system in stages, challenging existing work processes, viewing the implementation as a process, and choosing a project leader with outstanding communication and group process skills in addition to technical skills.

Key words: Clinical information systems. Nursing informatics. Human factors. Implementation

INTRODUCTION

In 1985, Sharp Memorial Hospital implemented its first bedside point-of-care clinical information system (CIS) in the Surgical Intensive Care, Medical Intensive Care, and Coronary Care Units. Throughout the next 15 years, the system was expanded to other units and hospitals within Sharp HealthCare. During these 15 years, major changes occurred in healthcare delivery, reimbursement, management, and information systems (IS). This article describes the lessons learned when implementing and expanding a point-of-care CIS in a changing healthcare environment.

Sharp HealthCare, a comprehensive healthcare delivery system in San Diego, California, comprises 4 acute care hospitals, 3 specialty hospitals, 3 skilled nursing facilities, 24 medical clinics, and 5 urgent care centers. The Sharp HealthCare workforce numbers more than 10,000 employees, in addition to the 2,300 physicians on the hospital medical staffs and 1,300 physicians in the medical groups.

Sharp HealthCare began in 1955 when it opened its first stand-alone, not-for-profit community hospital, the Donald N. Sharp Memorial Community Hospital. In time, Sharp HealthCare merged, affiliated, or purchased other healthcare entities. This growth affected the hospital organizational structure, focus, priorities, and locus of control. The result included management reorganizations, turnovers, and changes in leadership. External changes in healthcare included decreased hospital reimbursement; increased regulatory requirements, legal liability, confidentiality, and security issues; and improved functionality of healthcare computer systems. Through all of these internal and external changes, Sharp HealthCare successfully implemented a CIS in 4 phases from 1985 to 1999.

The CIS was the first clinical computer application in the patient care areas. The majority of the nurses and other hospital staff had no previous computer experience at either work or home. Fortunately, the culture at Sharp was one of innovation and change. The staff’s expectation was a usable CIS, and the definition of usable was anything that helped them document patient care. An atmosphere of excitement pervaded as the nurses and vendor embarked on making their dreams of computerizing patient care a reality.

The initial CIS implementation in the 3 intensive care units (ICU) included 166 users for 35 beds with 49 CIS workstations. Today, the CIS at Sharp HealthCare has 2,584 users for 384 beds with 477 CIS workstations and is planning for further expansion. Each implementation strategy was adapted to meet the challenges of a changing healthcare environment and to include lessons learned from previous implementations. A successful implementation plan includes technical, social, and political challenges to overcome in addition to team composition and training plans.
Training users to operate a computer was one of the biggest challenges in early implementations. The experience at Sharp is an example of the need to anticipate challenges and develop an action plan that will promote support during implementation.

THE SHARP HEALTHCARE EXPERIENCE

Initial Computer Information System Implementation

The ICU implementation from 1985 to 1986 was a pioneering effort. The selected product was under development, and staff at Sharp collaborated with the vendor to define user requirements and functionality. There was a limited body of knowledge to build upon for system implementation, and the vendor had no previous customers for support and guidance. The state of the art was not well defined. The engineers and hospital executive staff were confident that the technology existed to create a CIS, and the hospital nursing staff was eager to duplicate the paper chart on a computer.

The major challenge was to create a usable CIS. User expectations were low, and excitement was high. Anything the system did was viewed as positive.

Creating the functionality, teaching staff computer skills, and providing support during and after implementation was surmountable. These were operational issues that were solved with project plans that included identifying and training “super users,” offering classes, providing terminals to practice computer and CIS skills, and supporting users with a 24-hour, 7-day-a-week help desk. However, involving the right people and addressing group dynamics proved to be more difficult than anticipated.

Initially, the CIS was envisioned as a critical care nursing documentation system. The concept of interdisciplinary care and documentation was not widely accepted. The hospital leadership CIS design team included the ICU nurse executive, managers, staff nurses, clinical nurse specialist, and pulmonologist. Physicians-at-large were not included as leaders or members of the implementation teams nor were the respiratory therapists, chaplains, or other disciplines because they would not be primary users of the CIS. Non-nurses continued to use the paper chart and accessed the CIS only to review what had not yet been printed on paper. The system became known as a nursing documentation system, although it was later realized that from a technical perspective, the CIS was capable of being an interdisciplinary documentation system. The perception of the CIS as only a nursing tool plagued its use and support for many years. The primary lesson learned in this early phase was the importance of involving a wide range of potential users to create a CIS vision that could have capitalized on the flexibility of the CIS to meet the documentation needs of multiple disciplines.

Emergency Department Expansion

Sharp HealthCare executive staff recommended waiting at least 1 year before implementing the CIS in the next clinical area, the Emergency Department (ED). This would provide time for the vendor and staff to refine the CIS and expand its functionality. Unfortunately, internal and external forces delayed the implementation for 7 years.

In the late 1980s, Sharp changed its hospital information system (HIS) vendor, and this change channeled scarce capital dollars from the CIS expansion to the new HIS implementation. Managed care was beginning to flourish in Southern California, and with that, decreased hospital revenues and limited capital dollars. In 1992, funds were approved to expand the CIS to the ED.

By 1992, CIS applications were more common in healthcare and the vendor had installed the CIS in sites other than Sharp HealthCare, although this would be the vendor’s initial ED implementation. The hospital staff was now more experienced with computers, and they had high expectations for CIS functionality. Computers were no longer a novelty at work or home. Sharp and the vendor were once again embarking on a partnership to develop a new product. The ED CIS was envisioned to replace the paper chart and be an interdisciplinary tool. Therefore, all disciplines were involved in defining requirements and creating screens. There was active participation from nurses, physicians, respiratory therapists, dietary staff, and unit clerks. The CIS was to meet the needs of all disciplines, not only nursing.

Pertinent ED patient information (eg, allergies, weight, and medications) would electronically populate specified fields in the ICU chart. Redundant charting could be eliminated. The ICU nurse could review an ED patient’s chart online before the patient was physically transferred. In spite of these advancements, the air of excitement that pervaded the CIS development for the ICUs was replaced with an attitude of frustration. Instead of being in awe of what the CIS could do, there was annoyance at what still needed to be developed. The goal for the CIS in 1985 was to convert the paper record to an automated electronic record. In 1992, the goal was more complex. Although the staff realized they were collaborating with the vendor in an alpha product, they expected that their participation ensured their recommendations would be incorporated into the product; the CIS would maximize efficiencies for collecting clinical data and supporting clinical decision making, performance improvement, and research.
Executive management, the system administrator, and the vendor knew the technologic capability existed to create the desired ED product, but the software programs needed to be developed to handle the short length of stays and wide range of patient ages, procedures, and diagnoses in the ED. Sharp and the vendor had a history of an informal relationship without clearly communicated milestones and target dates. Therefore, there were not always clear expectations from either side of development goals, due dates, or the functionality of a delivered product. The result was frustration and misunderstandings from both sides.

The primary lesson learned in this phase of the expansion was the need to create a more formal business relationship between Sharp and the vendor with mutually agreed-upon goals, expectations, milestones, and target dates for product delivery. As previous research has demonstrated, major problems develop when there is a discrepancy between user expectations and system functionality. The consequence is impaired credibility of the product. Often when one expectation is not met, the entire product is viewed as inadequate. In addition to a more formal business relationship, this scenario might have been avoided had the CIS been clearly implemented as a pilot project or alpha test. The staff and vendor would then have the expectation that they were participating in a work in progress instead of a completed, fully functional system.

**Sharp Mary Birch Hospital for Women Expansion**

The Sharp Mary Birch Hospital for Women was built in 1992, and a hospital-wide CIS was budgeted in the construction expenses. Construction expenses were greater than anticipated and management reorganizations precluded the hospital-wide implementation. The CIS was implemented in those clinical areas where the majority of patients were served: labor and delivery, operating room, post-anesthesia care unit, and newborn nursery. The postpartum area and neonatal intensive care unit (NICU) did not implement the CIS until the 1999 expansion.

The CIS was now a mature product, and the development was focused on customizing the functionality for a women's hospital. Although multiple disciplines would use the CIS, it was still implemented as primarily a nursing tool. As a community hospital with an independent medical staff, the physicians were not mandated to use the CIS, a politically correct decision at the time that had strategically negative effects. The obstetricians planned to document their delivery summaries online, and the pediatricians and anesthesiologists were to use the CIS for review; their notes and orders were maintained on the paper chart. Because postpartum and the NICU were not implemented, the CIS did not encompass the entire patient stay. Both a paper and an electronic chart were to coexist.

The Sharp Mary Birch Hospital for Women implementation was concurrent with the ED implementation. Now there would be 3 distinct areas within Sharp with the CIS: the ICUs, ED, and the Women's Hospital. During the years on implementation and expansion, each area created its own choice lists and database dictionaries independently. The result was different choice lists in each area for items such as cardiac rhythm and different database names for identical data elements such as blood pressure. The priority was to configure the CIS to meet the needs of the specific areas. These decisions initially affected the ability to electronically share some data from one clinical area to the others and to analyze aggregate patient data. These problems were ultimately corrected, but they could have been avoided had all areas agreed upon global choice lists and dictionaries.

Although an interdisciplinary team developed the CIS configurations, new documentation forms with additional information were created but not tested by end users for impact or feasibility. The physicians, nursing leaders, and researchers on the design team viewed the CIS as a tool to support both patient care and research. They created the CIS to include both clinical and research data. They did not anticipate the end users’ reactions to collecting the additional data and the additional time needed. For example, the new OB risk screen was research driven and the choice list included medical, not nursing, terminology. Medical diagnoses, such as renal insufficiency, were on the list but not signs and symptoms, such as pale urine. The nurses felt comfortable choosing a diagnosis if the patient said “I have renal insufficiency.” But if the patient said “My kidneys don’t work well,” the nurses wanted to document what the patient said and not assign a medical diagnosis. Therefore, the nurses chose not to use the choice list option of renal insufficiency but documented the patient’s verbalizations in free text. Although the free-text documentation met clinical needs for documenting risk factors, it did not meet research needs for electronic retrieval or aggregate data analysis. Both researchers and staff were dissatisfied; the researchers still needed to rely on manual chart reviews to categorize risk factors, and the staff was frustrated dealing with a limited choice list. The nurses believed they were data collectors for research, not clinicians documenting information needed for patient care.

Because the CIS was being implemented in 2 hospitals and 3 different clinical areas, new lessons were being learned. It was apparent that someone needed to exert control over assigning database dic-
tionary names and choice lists. Additionally, new documentation forms needed to be pilot tested with end users before final approval. Previous implementations had been a duplication of the paper record. The Sharp Mary Birch Hospital for Women was the first area to create new forms specifically for the CIS that supported both clinical documentation and research needs.

**Sharp HealthCare Systemwide Women’s Services Expansion**

In 1997, two Sharp HealthCare Hospitals needed to replace their fetal surveillance systems. Management decided to evaluate a CIS with a fetal surveillance system for the 3 major women’s services because an electronic record would more efficiently meet hospital data retrieval requirements. A 20-member interdisciplinary planning/steering committee was formed, which included physicians, management, end users, and IS staff from the 3 hospitals. The first challenge was choosing a CIS vendor. The 2 new hospitals did not want to accept the current CIS without going through a formal decision-making process. They wanted to be part of the decision to choose a CIS that best met the needs of all of the hospitals. Therefore, to promote group cohesiveness and decision making, the committee embarked on a process to evaluate the CIS market and choose the best CIS to meet the needs of inpatient women’s services. Requests for information were given to the major vendors, site visits were made, and the market was quickly narrowed to 2 products: one with a NICU product in beta testing and the existing CIS.

A majority of the planning committee members voted for the existing CIS, because it was a fully functional product and none of the modules was in testing. Unfortunately, the planning committee leaders received filtered information from the dissenters and were not aware of the extent of the dissension until implementation. The dissension could have been dealt with and resolved at the outset through a communication and education plan with clear and consistent messages. For example, additional product demonstrations and meetings describing the chosen product in more detail might have helped the dissenters to better accept the chosen CIS. By not addressing the dissension at the beginning, implementation did not proceed smoothly in some areas.

Implementation at the 3 hospitals was phased in during 1998 and 1999. The operational issues of educating and supporting staff from preimplementation through postimplementation went smoothly. The major challenge continued to be managing group process and building consensus. The Sharp Mary Birch Hospital for Women had resolved most of its previous documentation issues, and it did not see the need for meetings to create new forms, choice lists, or database items. The 2 new hospitals wanted to configure the system to meet their specific patient population needs and not merely accept existing configurations. Through a proactive stance, configuration task forces were created with management, end users, and physicians from the 3 hospitals. These task forces reviewed specific screens and needed to agree on one configuration for all sites. What resulted was not only a consistent configuration across the three hospitals but also group cohesiveness, respect among members, and better acceptance of the CIS.

**DISCUSSION**

The current healthcare environment is one of multi-hospital systems with sophisticated computer users who have high expectations for what a CIS should do. The marketplace has several excellent and mature CIS products available. It is important to match user expectations and CIS functionality. When a mismatch is not resolved, deinstallation becomes a costly alternative that could be avoided. Therefore, the following recommendations were made to facilitate the organizational issues with a CIS implementation:

- Develop a broad support base for vertical and horizontal decisions in the organization by involving a cross-disciplinary team to select and implement the CIS.
- Make decisions through consensus whenever possible. If consensus is not achieved, listen to the dissenters and proactively address their concerns.
- Address conflict when it occurs; do not ignore it, because unresolved conflict continues to grow until it becomes a crisis.
- Keep realistic expectations. A discrepancy between user expectation and actual computer operations is a major problem in implementations and user satisfaction.
- Develop a formal business relationship between the client and the vendor with mutually agreed-upon goals, expectations, milestones, and target dates for product delivery.
- Prepare users to be realistic about the change from a paper chart to a CIS. Change, no matter how positive it will ultimately be, is usually difficult because it is different from the status quo.
- Implement the CIS in stages: initially with basic documentation functionality and later with advanced functionality. CIS products are quite sophisticated and the multitude of choices is often overwhelming to the user initially.
- Challenge existing work processes. Do not replicate the paper chart; redesign the care process.
• View implementation as a process that spans time and is managed by an oversight committee. Then, as suggestions for improvement are made, the structure is in place to implement the changes.
• Choose a system administrator/project leader with outstanding communication and group process skills. A technically excellent computer person without the requisite communication and group process skills may be doomed to failure and unable to develop broad support and facilitate consensus.

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REFERENCES


Donna Miranda, MSN, RN, is a senior systems analyst at Sharp HealthCare and manages the CIS. She has been involved with the development and expansion of the CIS since 1985. Willa Fields, DNSc, RN, is currently the vice president of patient care information systems at Sharp HealthCare. Previously she was director of clinical data management at ClinComp, International, where she assisted customers with data retrieval, analysis, and reporting from their CIS.
Karen Lund, BSN, RN, is currently a product manager at Bridge Medical, Inc. Previously she was an account manager at ClinComp, International, where she assisted customer sites with development, teaching, implementation, and expansion of their CIS.