ABSTRACT

While it is widely written that advanced clinical information systems can help healthcare organizations reduce adverse medical events and increase patient safety, Alamance Regional Medical Center (ARMC) has proven that it truly does. ARMC chose Eclipsys’ Sunrise Clinical Manager for its ability to provide knowledge-based clinical decision support and its alert capabilities at the time of order entry. Since its organization-wide rollout in summer 2000, ARMC has been using the computerized physician order entry (CPOE) system with widespread success and has transformed the care delivery process.

Marie DiFrancesco, RN, MBA, and Terri Andrews, RN, MBA

In 2000, the Institute of Medicine’s report, To Err Is Human, propelled the issue of patient safety into the glare of the public eye. Consequently, a national debate was launched about the extent of medical mistakes in U.S. hospitals and how to prevent the occurrence of such errors in the future. As a result, both academic and community hospitals throughout the country are increasingly responding to these concerns by committing to the use of information technology, such as computerized physician order entry (CPOE), in their organizations. While the patient safety debate rages on, many highly respected medical journals are publishing studies that support the use of information technology and the impact it can have on saving lives.

KEYWORDS

Computerized physician order entry (CPOE)  Workflow automation  Clinical decision support
Community hospitals and IT  Physician adoption  Nursing informatics
In fact, a recent study published by the New England Journal of Medicine explored this concept and found that the use of IT can reduce medical errors by enhancing communication among nurses, physicians, and clinicians and providing decision support. Citing a lack of information about patients and medications as the cause of almost half of all serious drug errors, the study suggests that the key to improving patient safety is greater access to drug and reference information— which is made available through clinical information systems on computers and handheld devices.

**A New Vision**

While the benefits of IT are becoming more and more accepted, Alamance Regional Medical Center (ARMC) has already proven that advanced clinical information systems can truly help healthcare organizations reduce adverse medical events and increase patient safety. As a not-for-profit, private, community healthcare system, ARMC serves Burlington, NC, and the surrounding area with a state-of-the-art, 238-bed medical center, 81-bed nursing home, and continuing care retirement community. The health system offers a full spectrum of inpatient and outpatient services to more than 140,000 people each year, meeting the communities needs at every stage of life—from the youngest newborn babies to elderly patients who may require critical care, long-term care, or home health services. ARMC employs 1,500 healthcare professionals and 240 private physicians who are critical to the operational success of the medical facility.

ARMC’s dedication to providing the best possible patient care became highly visible in 1995, with the opening of its new, modern medical complex, enabling it to provide more cost-effective care while offering patients convenience, comfort, and easy access to the health system’s comprehensive array of services. Fulfillment of that commitment not only required intense strategic planning, but was also dependent on a forward-thinking vision from many of ARMC’s key decision makers, including the board of trustees, administrators, department heads, physicians, and clinicians. These key decision makers began a process of educating themselves on the use and benefit of information technology in healthcare in the early 1990s.

In 1996, ARMC developed its first formal information systems (IS) strategic plan, and began to consider implementing an advanced clinical information system to improve patient care, streamline workflow, and reduce costs. At the core of this shift was the use of cutting-edge IT with the introduction of clinical information solutions.

**Selection Process**

With strong support from upper management and physician leadership, and the right resources in place, ARMC began a systematic approach to selecting a clinical information system that fit its needs. The process began by establishing teams consisting of management, administration, IT staff, physicians, nurses, and other clinicians. ARMC looked for an automated tool that would provide the detailed information necessary to help control costs in its managed care environment. A structured selection process was followed through the use of requests for information (RFIs), scripted demonstrations, and reference site visits.

After evaluating the offerings of six health information technology (HIT) vendors based on strategic tactics, actions, and healthcare delivery concerns, Eclipsys Corp.’s Sunrise Clinical Manager was selected. A key factor in the selection of Eclipsys’ CPOE system was its Knowledge-Based Orders feature. This important feature provides clinical decision support and alerting capabilities at the time of order entry to improve the delivery of patient care. Clinical decision support rules and alerts provide the entire clinical care team with critical information where and when it is needed. With actionable information at the point of care, physicians can analyze treatment histories, model best practices, and measure and monitor clinical outcomes, which helps deliver optimal patient care.

ARMC determined that achieving true success with a clinical information system would require merging two critical parts of the healthcare delivery process: business and patient care. This vision was predicated upon the understanding that both parts of the health equation would benefit from the system. As a result, CPOE became the starting point for IT solutions at ARMC and served as a stepping stone toward the goal of obtaining a complete electronic medical record.

**Implementation**

Prior to the introduction of Eclipsys’ Sunrise Clinical Manager, ARMC operated almost exclusively with stand-alone systems, Ward clerks used a core healthcare information system (HIS) with basic order entry for the lab and radiology departments, but the system lacked meaningful order sets or rules for clinicians. The system relied on a
mainframe with either dumb terminals or Telnet access. ARMC’s new automated solution would give clinicians a single-source, full patient profile and detailed clinical information in a timely manner. With information more readily available, and the ability to access more sources of information simultaneously, clinicians’ decision making would be improved.

In November 1998, results reporting was available hospital-wide with CPOE introduced on a pilot unit. ARMC successfully achieved organization-wide rollout of Clinical Manager and its Knowledge-Based Orders in the summer of 2000. Recognizing the importance of demonstrating the system’s success through key indicators that align with a healthcare organization’s strategic goals, ARMC established benchmarks to measure how the system improved care. This initiative was undertaken by providing statistically significant information touting the benefits of the clinical information system to all employees throughout the health system. ARMC believes that this was key to maintaining and expanding clinician acceptance and support of the new IT system.

To ensure an optimum transition process, the implementation team required that the CPOE “go live” be divided into 28-bed units, one at a time, floor by floor. For the first two weeks of the CPOE implementation in each unit, the head of the Clinical Informatics Council, the informatics educator, and IT clinical analysts made frequent rounds and held daily meetings with clinicians and staff. They were also available by pager to answer questions 24/7. Upon completing the enterprise-wide rollout, 150 workstations and 18 Medical Logic Modules (MLMs) – a tool that enables physicians to work within the latest algorithm-based clinical practice guidelines – were in use.

Currently, ARMC employs the equivalent of 24 full-time employees in its IS department, and the system consists of 600 users with a maximum of 85 users at any given time. System capabilities include Knowledge-Based Orders (real-time alerts at time of entry), clinical decision support (event monitoring flags conflicts that fall outside of normal parameters), order communication and management, interdisciplinary clinical documentation, remote physician office access, disease management care documentation, electronic medication record, and ancillary support.

Rex Street, vice president of operations and finance at ARMC, said, “Given today’s healthcare environment, we were feeling competitive pressures and found ourselves dealing with islands of automation throughout our various facilities. Eclipsys’ Sunrise Clinical Manager provides us with one clinical information system to bridge our resources and help us bring together disparate systems across the organization.”

In a few short years, ARMC has emerged as a leader among healthcare organizations in using an advanced clinical information system to improve patient care and streamline workflow. Choice of additional information technology continues to be based upon specific strategies. ARMC is shifting away from a “best-of-breed” approach and is identifying appropriate information technology solutions from a single vendor whenever possible. This facilitates ease of support and integration of information technology to the healthcare system.

Physician Adoption and Cultural Challenges

Committing to a CPOE system is often the first time many healthcare organizations have implemented a large-scale technology system in the patient care process. Whether a large academic medical center or small community hospital, the adoption of IT easily becomes a major cultural challenge for many physicians within the organization. These challenges most frequently occur in community hospitals, such as ARMC, when a clinical information system is deployed and “voluntary” physician adoption is critical to the success of the CPOE system. As a pioneering community hospital, ARMC was one of nine participants in a 2003 study conducted by The California HealthCare Foundation (CHCF) and First Consulting Group, titled “Computerized Physician Order Entry in Community Hospitals: Lessons from the Field.” The study explored the unique challenges associated with implementing CPOE in a community hospital setting and achieving high physician adoption. According to the study, nearly 89 percent of U.S. hospitals are community hospitals, where most physicians are not employed by the hospital or are “voluntary,” a critical factor significantly adds to the challenge of gaining physician participation in training and use of CPOE.

As a community hospital, ARMC was faced with numerous challenges specifically related to physician adoption of the new CPOE system. First, ARMC does not own any of the physician practices; second, all attending staff are physicians – there are no interns or residents; and third, there is no paid medical director. To overcome these obstacles, a physician review board was developed to represent the physicians’ perspective. These individuals served as the

“... a physician review board was developed to represent the physicians’ perspective.”
“physician champions.” As a result, the most prevalent challenge in achieving successful implementation of the IT system – environmental culture – was overcome.

Training

From early on, the IS department recognized that successful implementation of the system meant educating clinicians. It also realized that the level of competency among users would vary greatly. The core team members decided that a systematic development of resources and continuing education processes were needed.

ARMC began staff training four weeks before the implementation of Clinical Manager. Because physicians, nurses, and other clinicians vary in their comfort level with computers and technology, training was tailored to meet their unique needs. Novice computer users were scheduled for classes that included Keyboard and Mouse Survival Training prior to actual program training. Nurses and other clinicians received on-site instruction in a classroom setting. Classes were divided into two three-hour sessions. The first class covered navigation of the software, designing lists and filters, use of results reporting, finding and entering required patient information, and flow sheet documentation. The second class was devoted to order-entry functionality. Handbook references, fliers, e-mail, messages within applications, and poster boards kept users informed.

Physicians responded well to individual training sessions with an IT analyst who was familiar with ARMC’s organizational policies and procedures. By training each of its physicians on the system, ARMC achieved exceptional voluntary adoption in a short time. Individual departments developed trainers to support their staff going forward. Critical issues were addressed immediately through IT support staff, the help desk, or online support features.

In addition to physicians, nursing administrators committed four hours per week for each practicing clinician to the Clinical Informatics Council. The purpose of the council is to build and customize the CPOE program, based on departmental feedback from the weekly sessions. The goal of these efforts is to maintain a safe and functional computerized medical record system. ARMC is dedicated to providing continued training for core team members and has made a resource library available to staff that consists of reference materials on a variety of relevant HIT topics. ARMC believes that it is extremely important for all core team members to understand the needs of the healthcare organization, the changing environment of IT solutions, and the complex issues around regulatory guidelines and standards.

ARMC developed a three-pronged approach to support the end-user community, and it has proven successful. Representatives from education, the nursing staff, and information systems meet weekly to address clinical informatics issues. This Informatics Team also includes a clinical informatics educator who provides ongoing clinical training as part of the education department.

CPOE Improves Workflow for Physicians and Other Clinicians

Real-time access to patient records and clinical data empowers physicians, nurses, and other clinicians to respond appropriately, while minimizing duplicate testing and potential medication errors. Physicians can access patient charts remotely from their home or office, and can enter orders based on real-time results and information within the patient’s electronic record.

Physicians benefit from the ability to evaluate patient information and place orders prior to making their rounds by freeing up extra time for patient visits and time spent at the bedside.

Nurses also benefit from the time saved when physicians are able to preview patient records before morning rounds and remotely enter orders. With CPOE, each patient care decision is supported by order sets that reduce the need to rely on memory. The tedious and unreliable method of transferring patient information from written notes into patient files is eliminated, and potential transcription errors are circumvented. Nurses are able to reallocate their time attending to patient needs.

Furthermore, if a physician places an order for a diagnostic test, he or she is able to monitor the system for results and place additional orders remotely based on real outcomes. If there is a problem with an order, a drug, or even an insurance coverage issue, alerts are flagged immediately. Potentially serious problems are avoided (e.g., medication errors, allergic reactions), rejected claims are diminished, and duplicate tests are minimized. The pharmacist, radiologist, physical therapist, nurse, and the emergency room doctor all view the same information through the system, without ever having to search for a paper-based chart or patient record.

Today, virtually all of ARMC’s 240 affiliated physicians get test results online, with more than 80 percent of the physicians entering orders for medications, lab, and radiology tests through the CPOE system. This is a remarkable
The Numbers Reflect Return on Investment

ARMC's first benchmarking activities will evaluate the working success of the system by examining improvements in patient care that have resulted from clinicians' immediate access to information.

Medication Errors

In the paper, “A Technological Approach to Enhancing Patient Safety,” Dennis O'Leary, president of the Joint Commission for the Accreditation of Healthcare Organizations (JCAHO), stated, “Medical error reduction is fundamentally an information problem. The solution to reducing the number of medical errors resides in developing mechanisms for collecting, analyzing, and applying existing information.”4 A standard ordering process begins with a physician writing a medication order, which is then given to the registered nurse for translation and possibly a dosage calculation.

Unfortunately, during this process there is room for human error. The use of CPOE significantly reduces these potential risks by eliminating much of the possibility for human error. In ARMC's case, Clinical Manager immediately demonstrated the benefits of CPOE as well as the value of built-in alerts, such as drug-to-drug interactions and medication allergies. The best return for ARMC was a 72 percent reduction in potential medication errors during a three-month period of time.

ARMC views patient safety as the primary foundation to providing the best possible care. In turn, ARMC is focusing its efforts on decreasing potential errors during the medication administration and documentation process. The implementation of the electronic Medication Administration Record (MAR) system reflects ARMC's goal to further develop electronic automated processes to enhance patient care while simplifying clinician workflow. ARMC will also conduct a performance improvement study to analyze the impact of Clinical Manager's automated MAR on the potential medication error rate as well as evaluate the effectiveness of clinical alerts to clinicians.

Preventing for Advanced IT Solutions

As the state of information technology continues to evolve, ARMC management recently revised the strategic plan for the IS department that placed the new clinical information system within the context of the health system's overall strategic business plan. Under this initiative, a new IS Strategic Planning Committee was established under the auspices of the Strategic Business Planning Committee. The committee researched, analyzed, and developed overviews of general HIT trends along with updates on IT spending, regulatory issues, and clinical innovations. Both physicians and department managers were surveyed to identify the needs of individual departments throughout the organization. Through the survey results, it became apparent that ARMC required a comprehensive, enterprise-wide system that would integrate and automate critical patient information.

ARMC then conducted a retreat for senior management and the leadership of the IS department to begin developing specific strategic tactics based on the needs identified for individual departments. With department needs and HIPAA issues reviewed, participants developed evaluation criteria to govern the selection of the IT systems. The final draft of the IS plan revealed several key focus areas, each accompanied by tactics and actions:

"One of ARMC's first benchmarking activities will evaluate the working success of the system by examining improvements in patient care that have resulted from clinicians' immediate access to information."
FOCUS: CPOE AND PATIENT SAFETY

I. Government and Payers (compliance)

II. Physicians and Staff (Web-accessible applications, training, and education)

III. Public (patient satisfaction support and Web site)

IV. Integration (application vendor consolidation, application interfaces, general financial/patient accounting system replacement, physiological measurements of integration)

V. Governance (monitoring and prioritization, information system supplemental support)

VI. IT Infrastructure (handheld/personal digital assistant/wireless computing support, application service providers/remote hosting, security, system redundancy)

Based on this information, ARMC built an enterprise-wide strategic business plan that reflected IS solutions as they applied to each of the departmental areas (see exhibit 1).

Paving the Way for Future Technologies

Following successful implementation and use of CPOE, ARMC experiences daily benefits related to improved patient care and operational efficiency. The healthcare system attributes its achievements to teamwork as well as a number of individual initiatives, including strong physician champion, administrative support, an excellent training program, and a solid project management team.

To date, ARMC has primarily focused its efforts on patient safety studies and how to achieve impressive patient outcomes at the community-based medical facility. Physicians have come to understand that the system is a tool that truly aids them in decision making and saves critical time and steps in the care delivery process. ARMC firmly believes that technology can help healthcare organizations reduce costs, improve patient care and safety, and streamline workflow, as well as improve staff and clinician morale and overall employee retention.

CPOE has paved the way for future technologies at ARMC and contributed to its ongoing vision of improving patient care while transforming the healthcare delivery process.

About the Authors

Marie DiFrancesco, RN, MBA, is lead clinical analyst at Alamance Regional Medical Center in Burlington, NC, and a frequent presenter and author on the positive outcomes achievable with information technology and workflow transformation utilizing CPOE.

Terri Andrews, RN, MBA, clinical systems manager at Alamance Regional Medical Center in Burlington, NC, managed the CPOE implementation project and often speaks about physician adoption of CPOE at healthcare industry conferences.

References


