The Florida Senate

Interim Project Report 2004-143 *December 2003*

Committee on Health, Aging, and Long-Term Care James E. "Jim" King, Jr., President

ANALYZE THE USE OF COMPUTERIZED PHYSICIAN ORDER ENTRY (CPOE) SYSTEMS IN HOSPITALS AS A TOOL FOR REDUCING MEDICAL ERRORS

SUMMARY

Computerized Physician Order Entry (CPOE) systems are a tool that can be used to reduce medical errors by permitting the direct entry into a computer of orders by physicians. CPOE systems can be designed to offer the physician decision support, such as alerting the physician that the patient is allergic to the drug prescribed, that a test being prescribed has recently been ordered and that a result is pending, that there may be adverse drug interactions with other drugs the patient is taking, and that the prescribed dosage may not be correct. Confusion of drugs with similar names and decimal point errors also can be avoided.

The costs of implementation and ongoing maintenance of CPOE and the significant change required in physicians' way of working are a deterrent to implementation of CPOE systems. However, the benefits of CPOE include reduced adverse drug events, standardization of care, and improved efficiency of care delivery.

This Senate Interim Report looks at the use of CPOE systems in hospitals and presents data on implementation of such systems in Florida hospitals.

The report makes six recommendations:

1. Because Florida hospitals are beginning to implement CPOE, and because of the complicated factors involved in successful implementation, the Legislature should not mandate the use of CPOE in hospitals at this time.

2. Florida's university-based patient safety centers should analyze the return on investment that could be realized from implementing CPOE in large and small hospitals in both urban and rural settings.

3. The 2-hour continuing medical education course in patient safety required for Florida Physicians should include instruction to familiarize physicians with CPOE.

4. Each hospital's patient safety officer, required under s. 395.1012, F.S., should identify ways that inpatient care processes that affect physicians, pharmacists, nurses, and ancillary personnel could be redesigned for implementation of CPOE.

5. In order to make CPOE systems user friendly, hospitals implementing CPOE should involve the providers who will use the system in the process of system design.

6. Florida health care leaders should be involved in the national development of standards for electronic health records and related patient safety initiatives, including CPOE, so that Florida's health care system will be poised to implement these important improvements in health care delivery and patient safety when national standards are adopted.

BACKGROUND

Patient Safety

As the 2003 Legislature addressed Florida's medical malpractice insurance crisis, the reduction of medical errors received renewed attention as one method of lowering the number of malpractice claims. A review of professional liability closed-claims data for the period 1990 – 2002 revealed that, in each of those years, more than 60 percent of indemnity claims paid in Florida were for injuries that occurred in the hospital setting. Any effort to reduce medical malpractice claims must respond to errors in the hospital setting.

In 1999, the Institute of Medicine reported that at least 44,000, and perhaps as many as 98,000, American hospital patients die each year as a result of medical error.[1] The lower number is extrapolated from a study conducted in Colorado and Utah and the higher number from a study in New York. Medication errors both in and out of the hospital account for more than 7,000 deaths annually.

The Leapfrog Group, comprised of 145 public and private organizations that provide health care benefits, is a leader in establishing a national emphasis on patient safety. The group identifies problems and proposes to hospitals solutions that have the potential to save lives. The Leapfrog Group has recently focused on three practices that likely would improve patient safety: computerized physician order entry for filling prescriptions, evidenced-based hospital referral, and intensive care unit physician staffing. The Leapfrog Group recommends using CPOE for medication orders because a computerized prescription system "can reduce serious medication mistakes by up to 86 percent".[2]

The Governor's Select Task Force on Healthcare Professional Liability Insurance made 12 recommendations to improve health care quality in its January 2003 report. In the recommendation most closely related to CPOE, the task force proposed:

> *The Legislature should timely develop or adopt statewide electronic medical records and protocols for a physician medication ordering system. The system should be developed collaboratively with hospitals, physicians, and other health care providers. The physician medication ordering system should be implemented first. The system could be implemented initially with a web-based data exchange platform which establishes interconnectivity among providers. Another possibility is to begin with business functions, which provide an early return on investment, and then include clinical functions.*

The recommendation of the Governor's task force is instructive of the issues that surround CPOE. The recommendation acknowledges the need for standardization and calls for statewide protocols, in a year when health care leaders nationally are calling for a system that would be standardized across all 50 states. The recommendation calls for collaboration among providers to develop the system, recommends a first step, and suggests two possible ways to begin—providing options to a group that has been slow to adopt information technology in clinical settings. Clinical health care is distinctive among U.S. enterprises in its slowness to adopt computerization, and this recommendation of the Governor's task force asks the Legislature to take the lead in encouraging health care providers to move forward with clinical information technology, beginning with CPOE.

Computerized Physician Order Entry (CPOE)

A January 2003 report[3] prepared by First Consulting Group for the organization Advancing Health in America and the Federation of American Hospitals notes that:

> *Order writing is the mechanism through which physicians' diagnostic and therapeutic plans are converted into action. Virtually every intervention in patient care outside of surgery – performing diagnostic tests, administering medications, taking a patient's vital signs – is initiated by a physician's written order. This critical step in the care process represents a point where intervention can have a high impact on preventing medication errors and improving adherence to care guidelines.*

Computerized Physician Order Entry (CPOE) systems are a tool that can be used to reduce medical errors and improve patient care by permitting the direct entry into a computer of orders for diagnostic tests, medications, patient care and referrals by physicians. The basic CPOE system is a computer application that accepts physician orders electronically, replacing hand-written orders on an order sheet or prescription pad. Most CPOE systems communicate the orders entered into the system electronically to the hospital departments and personnel responsible for their execution. The departments or personnel can send back notification of the status of the order or the results, such as laboratory or x-ray results.

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[1] Institute of Medicine, Kohn, Linda T., Corrigan, Janet M., and Donaldson, Molla S., Eds. *To Err is Human: Building a Safer Health System*, National Academy Press. 1999.

[2] Leapfrog Group. "Survey Results". http://www.leapfroggroup.org/consumer_intro2.htm

[3] First Consulting Group for Advancing Health in America and Federation of American Hospitals. "Computerized Physician Order Entry: Costs, Benefits and Challenges – A Case Study Approach." 2003.

Some of the potential benefits of the electronic communication of physician orders include the following efficiencies:

- Improved process turnaround times – for example, reduced time from ordering to arrival of the medication;
- Improved documentation received by ancillary departments, such as pharmacy and radiology, thereby reducing the chance of misinterpretation of an order and improving documentation needed for payment; and
- Reduced need in ancillary departments for re-entry of data into the ancillary computer system.[4]

More advanced CPOE systems also provide physician decision supports at the point of ordering. Examples of physician decision supports that can be provided by a CPOE system include:

- Alerts to possible patient allergic reactions to prescribed medications and recommendation of alternative medications;
- Alerts to possible dosage errors;
- Notifications that new orders for tests duplicate tests that have recently been ordered and that a result is pending;
- Pre-programmed institutionally reviewed and approved sets of orders to facilitate the process and help physicians follow accepted protocols for ordering tests and medications for common diagnoses;
- Programmed protocols for complex order types involving calculations and multiple-day orders dependent on test results; and
- Costs and a list of possible alternatives or a list of restricted indications for orders for a particularly expensive test or medication.[5]

Two Examples of Hospitals' Experiences in Implementing CPOE

According to a 2002 survey, 9.6 percent of hospitals in the United States have CPOE completely available; 6.5 percent have CPOE partially available; and 83.7 percent do not have CPOE available to physicians. In the hospitals that have CPOE completely available, use of the system is required at 46.2 percent of the hospitals, encouraged at 19.8 percent, and optional at 34.1 percent of the hospitals.[6]

At Brigham and Women's Hospital in Boston, where CPOE is part of an integrated computing system that provides clinical, administrative, and financial computing services to the 720-bed hospital, order entry was found to be "the single most effective tool in improving the quality of care via the computer."[7] The goals in the development of the Brigham Integrated Computing System (BICS) were to establish a client-server technical platform to support the hospital's expansion, and to build new clinical information systems that would change the computer from a reporter of facts to an active partner in clinical care. Management support for change in the way providers work was essential to the acceptance of BICS. Seven factors were identified as essential for successful implementation of BICS:

- Senior management backing—All 3 chief officers supported the system's development.
- Quality focus—The hospital had patient safety studies and procedures in place before implementation.
- Clinician input—Information system staff includes practicing physicians, nurses, and pharmacists.
- Past successes—The system provided electronic mail, and results review before clinical applications were implemented.
- Champion identification—Respected leaders and advisory groups represent the users' interests in system design.
- Post-implementation support—Teams provided "extreme responsiveness" during the rollout of the system.

[4] Ibid.
[5] Ibid.

[6] Ash, Joan S., Gorman, Paul N., Seshadri, Veena, and Hersh, William. "Computerized Physician Order Entry in U. S. Hospitals: Results of a 2002 Survey", *Journal of the American Medical informatics Association*. 2003. JAMIA PrePrint; http://www.jamia.org/ doi:10.1197/jamia.M1427

[7] Teich, Jonathan M., Glaser, John P., Beckley, Robert F., Aranow, Meg, Bates, David W., Kuperman, Gilad J, Ward, Michael E., and Spurr, Cynthia D. "The Brigham Integrated Computing system (BCIS): Advanced Clinical Systems in an Academic Environment". *International Journal of Medical Informatics* 1999. Vol. 54, No. 3.

- Quality review process—Committee review, testing, updating and monitoring ensure that each software intervention fulfills the task it was designed to do.

Entering an order into the computer may take longer than writing the order by hand. However, at Brigham and Women's Hospital, physicians spend an average of 27 minutes per day entering orders, which is "not significantly different from the time they spent on paper orders.[8] Of approximately 15,000 orders written each day, about 400 are modified as a result of a computer prompt. All orders entered into the system are legible, whereas a pre-order entry review had shown that the name of the ordering physician was not recognizable in 80 percent of the handwritten orders.[9]

Cedars-Sinai Medical Center in Los Angeles had a different experience with its implementation of CPOE. Cedars-Sinai spends about 25 percent of its annual capital budget on information technology and the organization spent several years developing a system to take advantage of Web technology to improve patient care. After looking at available products which did not meet the hospital's goals for browser-based technology that is highly flexible, fully integrated with ancillary services, and user-friendly, the board of directors decided to develop their own system. After three years of development and preparation, Cedars-Sinai began a pilot program of the system in August 2002. The pilot was successful, and in October the hospital began to implement the system, floor by floor, throughout the hospital. Physicians were required to be certified to use the system and 150 physicians who did not become certified were suspended. Some members of the medical staff complained that the required compliance with CPOE certification was unfair. The system was operational for more than two-thirds of the hospital's patients when the administration decided to temporarily suspend the implementation of the physician order entry system. In describing the lessons learned from the implementation thus far, the Chief Medical Officer of Cedars-Sinai said, "One of the most important lessons learned to date is that the complexity of human change management may be easily underestimated."[10]

Challenges to Implementing CPOE

Any organization attempting to implement CPOE faces four principle categories of challenges: affording the initial investment and ongoing costs; changing the way physicians work; redesigning inpatient care processes that affect physicians, pharmacists, nurses, and ancillary personnel; and implementing a highly reliable, responsive, and user-friendly CPOE system.[11]

The costs of CPOE include those for hardware, software, practitioner training, technical support, and integration with existing systems. One study estimated the cost of implementing CPOE at a 500-bed hospital to be approximately $8 million, and the annual cost of maintaining the system would be $1.3 million.[12] Implementation costs vary widely depending on the size of the institution and the existing hardware and software systems.

For physicians, computerized order entry does not save time during the ordering process, although time may be saved later with fewer calls from pharmacists, nursing, and ancillary services to clarify orders. CPOE systems may require an increase in the time required to write orders and sometimes physicians must respond to requests for additional information presented by the system during the ordering process. Switching from hand writing orders to using a computer requires a significant change in physician work patterns.

CPOE systems are not stand-alone systems just used by physicians, but rather are highly integrated with existing hospital systems. CPOE is the core of the entire order management process. It affects care planning, pharmacist decision making and workflow, nursing workflow and documentation, and communication with ancillary services such as laboratory and radiology. Implementing a CPOE system affects how all these participants in a patient's care do their jobs.

For a CPOE system to be effective, it must be user-friendly, accommodating both experienced and novice computer users. The system must be fast, with a minimal number of computer screens for viewing and order entry, and the shortest possible response times for a variety of types of routine orders. Decision support must be highly customizable and requires multiple

[8] Ibid.
[9] Ibid.
[10] Langberg, Michael L. "Challenges to Implementing CPOE; a Case Study of a Work in Progress at Cedars-Sinai" *Modern Physician*. February 2003.

[11] First Consulting Group for Advancing Health in America and Federation of American Hospitals. "Computerized Physician Order Entry: Costs, Benefits and Challenges – A Case Study Approach". 2003.
[12] "Computer Physician Order Entry and Quality of Care", Annals of Internal Medicine, Vol. 139. No. 1, 2003

software interfaces between ancillary computer systems and the CPOE system.

Categories of CPOE Benefits

The January 2003 study prepared for the Federation of American Hospitals by the First Consulting Group reviewed the literature relating to CPOE and identified the following categories of benefits from CPOE:

- Reduced number of serious medication errors and adverse drug events;
- Better adherence to standards of care, which led to better therapy, and ultimately better outcomes at lower costs;
- More prompt diagnosis and therapeutic intervention;
- Better use of scarce resources;
- Better regulatory compliance;
- Reduced patient lengths of stay; and
- Reduced use of tests and expensive medications.

Physicians' Use of Computers

The extent to which physicians use computers in their own offices, while not directly related to CPOE, does indicate that most physicians practice without information technology for patient records or billing. While more than 90 percent of physicians communicate with colleagues via e-mail and use electronic networks to manage their investments and to access new medical knowledge, only 30 percent have automated billing in their offices and 17 percent have computerized their patient records.[13] The contrast between health care and other U.S. enterprises was described succinctly: "While information technology is advancing rapidly in other sectors of the U.S. economy, the U.S. health care system remains mired in a morass of paper records and bills, fax transmittals and unreturned telephone messages."[14]

Future Development of Information Technology

A new report by the Institute of Medicine[15] calls for the development of a national health information infrastructure with targeted support from the federal government for its development. Such a federal initiative has been compared to the Hill-Burton Act that provided funds for the construction of community hospitals. The proposal could also be compared with the federal legislation that established the e-rate for schools and libraries to permit nationwide access to the Internet.

In the absence of a federal initiative, private vendors, hospital systems, and state governments will continue isolated efforts to implement CPOE and other information technology to support patient safety in hospitals. California legislation in 2000 required hospitals, as a condition of licensure, to submit to the state Department of Health Services a plan to reduce medication related errors. The plans, which must have been submitted by January 1, 2002, had to include technological solutions. Forty-six percent of the plans included CPOE. The plans must be implemented no later than January 1, 2005.

METHODOLOGY

Staff reviewed research reports on the use of CPOE to reduce medication errors and coordinated with FSU College of Medicine researchers to obtain data on the implementation of CPOE in Florida hospitals.

FINDINGS

Data from Florida Hospitals

The Patient Safety Center at the Florida State University College of Medicine is conducting a study of the Information Technology (IT) capabilities of Florida Hospitals. Preliminary results from a survey conducted during the summer and fall of 2003, with 40 percent of hospitals responding, indicate the following:

- When asked to indicate their hospital's current top information technology priorities, the highest response from all the hospitals (50.6 percent of respondent hospitals) was to implement **technology to reduce medical errors and promote patient safety**.

[13] Goldsmith, Jeff, Blumenthal, David, and Rishel, Wes. "Federal Health Information Policy: A Case of Arrested Development". *Health Affairs.* July/August 2003.
[14] Ibid.

[15] Institute of Medicine, Aspden, Philip, Corrigan, Janet M., Wolcott, Julie, and Erickson, Shari M., Eds. *Patient Safety: Achieving a New Standard.* The National Academies Press 2004. Readable at: http://books.nap.edu/catalog/10863.html

Implementation of technology to reduce medical errors and promote patient safety was also the highest response from hospitals for the next two years (55.4 percent of respondent hospitals).

- 12 percent of the hospitals have a fully operational **CPOE** system in place in at least one part of the hospital.
- 5 percent of the hospitals have begun to install **CPOE** hardware and software in at least one part of the hospital.
- 28 percent of the hospitals have developed a plan to implement a **CPOE** system in at least one part of the hospital.
- 54 percent of the hospitals have not yet begun to plan for the use of a **CPOE** system.
- 13.3 percent of the hospitals currently use **bar coded medication management**, and 57.8 percent plan to do so within the next 2 years.
- 84.3 percent of the hospitals currently use IT applications in their **pharmacy**, and 9.6 percent plan to do so within the next 2 years.
- 62.7 percent of the hospitals use IT capability for **pharmacy dispensing**, and 24.1 percent plan to do so within the next 2 years.

Conclusion

The history of the use of information technology in clinical practice by physicians and hospitals does not indicate that progress can be mandated. The implementation of CPOE has been successful where administrators and practitioners supported the change. The best way to bring about further use of CPOE in Florida would be for the Legislature to encourage the state's existing patient safety centers at universities to work with hospitals to improve their use of information technology to improve patient safety.

RECOMMENDATIONS

1. Because Florida hospitals are beginning to implement CPOE, and because of the complicated factors involved in successful implementation, the Legislature should not mandate the use of CPOE in hospitals at this time.
2. Florida's university-based patient safety centers should analyze the return on investment that could be realized from implementing CPOE in large and small hospitals in both urban and rural settings.
3. The 2-hour continuing medical education course in patient safety required for Florida Physicians should include instruction to familiarize physicians with CPOE.
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6. Florida health care leaders should be involved in the national development of standards for electronic health records and related patient safety initiatives, including CPOE, so that Florida's health care system will be poised to implement these important improvements in health care delivery and patient safety when national standards are adopted.