

Computerized Physician Order Entry: A Healthcare Clinical IT Solution

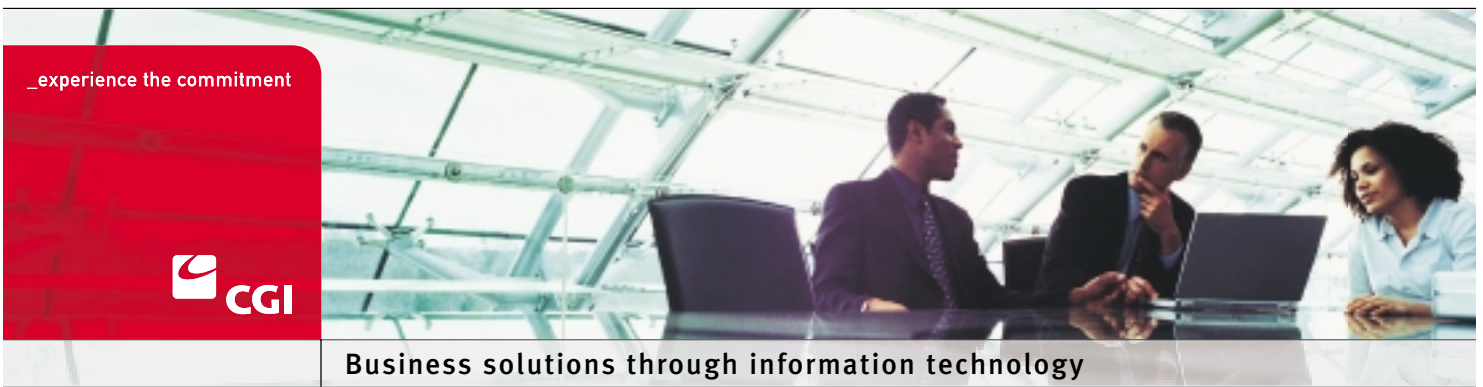




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Introduction

The patient care landscape is rapidly changing to a clinically driven, technology managed, expert system. It is a system that helps physicians deliver patient care more precisely and helps hospitals and medical organizations continuously improve delivery of care. The folks at Ohio State University (OSU) Health System, Columbus, have at least glimpsed at that future landscape. Mark Hagland, a writer for Healthcare Informatics magazine states “They’re in the vanguard of patient care organizations using computerized physician order entry (CPOE) systems which, authorities say, best represent the legacy of years of expert-systems development work in healthcare. And what OSU is doing is a microcosm of what will happen across healthcare in the next few years, experts predict.”¹

For nearly 2-1/2 years, OSU has had a fully deployed CPOE system in place. What’s more, the huge integrated health system (2,000 physicians, 6,000 staff, 897 beds, 40 care sites) hasn’t just implemented the typical pilot system in a couple of small departments. “CIO Asif Ahmad notes that 100 percent of our orders are performed electronically now; 80 percent are physically entered by the physicians and the rest are verbal orders entered by nurses but co-signed by physicians.”²

A CPOE system can help address a major dilemma facing the healthcare industry today. It can help support the needs of caregivers while helping all hospital personnel reduce medical errors. In response to events such as those published in the Institute of Medicine report on medical errors, healthcare managers are searching for more reliable ways to deliver medical care. For example, trying to improve patient care while also fulfilling the demands of healthcare managers severely hinder the precious time physicians have. In addition, medical knowledge increases constantly while clinicians face escalating demands to treat as many patients as possible in a given period.

At the same time, regulations and hospital procedures require caregivers to document all clinical activity to make certain that patients receive appropriate care and that the caregivers are reimbursed. Care Delivery Organizations (CDO) will increasingly address this dilemma through CPOE systems that will make the most of the time when the physician is seeing the patient and the details of the point-of-care encounter are most fresh in the physician’s mind. A fully functioning CPOE system must belong to a tightly integrated computer-based patient record system (CPR). Otherwise, physicians, at the time of order creation, will not have ready access to pertinent clinical data, including other relevant conditions or protocols that may have come about through previous encounters with the patient by other physicians. Furthermore, when CPOE is part of the CPR, the functions touched off by a physician’s orders can proceed as efficiently and with as much automation as possible. CPOE-related functions include everything from administrative activities to x-ray scheduling. “Gartner believes that all CPOE systems must be implemented as part of a comprehensive CPR strategy.”³ Most importantly, a CPOE system should reflect the work practices of individual physicians. Physicians won’t use a CPOE system if it seems clumsy or takes too much time. Accordingly, a good CPOE system will seem transparent to the physician and can be customized to suit individual preferences and the methods of the different medical specialties.

Partners HealthCare’s CPOE, CPR with Knowledge Management

The Brigham and Women’s and Mass General hospitals of Partners HealthCare has proposed a scenario of CPOE and knowledge management in a real time integration of CPOE, patient medical record (CPR) and clinical knowledge database to improve the reduction of clinical errors and improve patient outcomes, which are the real drivers behind CPOE. Their approach imbeds immense amounts of constantly updated clinical knowledge management into the technology that physicians use to do their jobs (CPOE).

A physician needs to know approximately 10,000 different diseases and syndromes, 3,000 medications, 1,100 laboratory tests and many of the 400,000 articles added annually to the biomedical literature. In addition, according to the Institute of Medicine's 1999 report "To Err is Human", more than 1 million injuries and as many as 98,000 deaths each year are attributable to medical errors. A study conducted at Partners HealthCare revealed that 5% of patients under medical care had adverse reaction to drugs, 43% of which were classified as serious, life threatening or fatal. Another study at Brigham and Women's Hospital surgical intensive care unit revealed that almost half of the 6 most common tests ordered were clinically unnecessary and more than half of the prescriptions for a particular heart medication were inappropriate.

Partner HealthCare's approach to CPOE was built on a set of integrated information systems. It uses a common logic engine that executes physicians' orders through a checks and decision rules engine. The system also has an event detection system that alerts a physician by pager when a hospitalized patient's monitored health indicators depart significantly from what is expected in the course of treatment. Minor variations in the physician's orders can be routed to the nurses' station to be entered into the CPOE system. This order entry, referral, computerized medical record, and event detection system operates in real time giving the clinician up-to-the-minute updates to the patient record and the prescribed course of treatment.

In addition, Partners HealthCare has other knowledge resources on-line that are more extensive but must be sought out by the care provider. These are referred to as The Handbook and include: on-line journals and databases, care protocols or guidelines for particular diseases, interpretive digests prepared by Partners physicians, formulas of approved drugs, and details in their use, and on-line textbooks, all accessible through an integrated intranet portal. (The Handbook is accessed 3,000 times a day whereas there are over 13,000 physician orders entered each day at Bingham and Women's Hospital.)

This expert system is not yet complete, in that medical knowledge has not yet been codified for all diseases treated, but a study has shown that serious medication errors have been reduced by 55%. The physician can remind doctors of drugs needed by a particular patient as well as recommend cheaper or more effective drugs.

Because few Commercial-Off-The-Shelf (COTS) packages allow customization of the logic needed, Partners chose to develop its CPOE expert system from scratch. The infrastructure pulls together a knowledge base and logic modules with an integrated patient-record system, and event management system, an intranet portal along with several other capabilities. In order to keep the clinical database current, several specialty committees were formed to identify, refine and update the knowledge base.

In contrast, a stand-alone CPOE system may have a lower initial cost, but it will also have a higher total cost of ownership and reduced long-term functions.

Benefits and Limitations of a Stand-Alone CPOE System

On the surface, implementing a stand-alone CPOE has significant appeal. It provides a relatively rapid way to reduce many errors associated with the ordering process if the system:

- Is only designed for physician entry of orders
- Usually a limited profile of all active (and inactive) medications
- Performs drug/drug interaction and drug/allergy checking

A CPOE system with these minimal capabilities can reduce errors associated with physician handwriting, poor communication, incomplete orders and lack of simple clinical decision support (for instance, checks for drug/drug interactions and allergies).

Implementing a stand-alone system can be easier, faster and certainly far less costly in the short term than a more comprehensive solution. It permits the CDO to focus on a single task that requires fewer resources than for CPOE as part of a CPR.

However, a stand-alone CPOE approach has significant limitations and will also mean duplication of effort by physicians — for example, fully documenting the orders in progress notes or needing to log into a separate system for pertinent lab results when creating an order. A fully functional CPOE system must know not only what orders and medications have already been entered for a patient but also:

- The clinical status of the patient
- What clinical management protocols are in effect for that person
- What other clinicians participate in the patient's care
- How treatment for one diagnosis may interact with the management of another condition affecting the same patient

It also requires the CPOE to interact with virtually all of the other components of a clinical automation system.

In addition, a greater portion of the support burden for a stand-alone CPOE system must fall on the CDO because the order-entry system vendor likely will not be familiar with the various components in the CDO's IT environment that came from other suppliers. In the long term, a CDO would be making a mistake only implementing a CPOE and pharmacy system from one vendor, results reporting from another vendor and remaining clinical functions from other vendors. Recognizing that CDOs face financial, cultural or, to some extent, technical barriers to full CPR implementation, the Gartner Group strongly recommends that a CDO choosing to start with a CPOE implementation should use the same vendor that will eventually provide its CPR. CDOs that implement stand-alone CPOE systems should recognize that in the long run, those systems cannot match the functions of an integrated solution. The vast majority of CDOs should therefore select a CPOE system from a vendor that can also supply a comprehensive CPR.

Barriers To Adopt CPOE

There are many barriers to the adoption and use of computer applications in health care. More than twenty years ago these were identified as lack of involvement by clinicians, inadequate long-term financial commitment, poor planning and implementation, substandard functionality and reliability of the technology, and lack of standardization of medical terminology. Unfortunately, many of these barriers persist today.

Physicians' work practices can create sociological barriers to CPOE, including changes in physicians' work practices, particularly the increased time that it takes to enter point-of-care orders. The organizational impact of CPOE systems and the commitment, effort, and resources required to implement these systems are great and impact the clinicians required to utilize a CPOE.

The current levels of information technology in healthcare are another barrier. Healthcare has been known to have underinvested in information technology compared with other industries, as well as being more reliant on legacy (old) systems that were designed for administrative support functions. Even in hospitals with extensive clinical information systems, the "islands of data" are spread across numerous system platforms that use different technology and standards. In order for a CPOE to be effective applications must be integrated.

The lack of financial incentives remains a crucial barrier to CPOE. The lack is in the alignment of financial incentives for organizations to adopt the technology. The cost of implementing a CPOE depends on many factors, but those factors relate to the number of millions of dollars. "However, the cost savings of using CPOE may not accrue to physicians and hospitals under

current reimbursement arrangements. In a fee-for-service environment, reducing hospital lengths-of-stay by avoiding adverse drug events or reducing the number of tests ordered may have a negative impact on hospital finances. Even in a prospective payment or capitated environment, the investment required can be hard to justify when there are powerful short-term cost pressures and the benefits are unsure and occur in the medium to long term.”⁴

Commercial Off The Shelf (COTS) systems are yet another problem. Most of the leading healthcare vendors’ packages allow very little customization of the logic needed, so some CDOs are choosing to develop their own CPOE expert system from scratch. Currently “homegrown,” CPOE systems are more prevalent in the healthcare industry although most hospitals without the resources to develop CPOE expert systems must purchase vendor solutions. “In addition, none of the commercial systems in the market place today appear to provide the functionality of the best home-grown systems. Two recent reports give an overview of commercial CPOE systems and indicate a recent increase in the number of systems available in the marketplace.”⁵

Encouraging the Adoption Of CPOE

An important and growing body of evidence shows that a CPOE expert system can reduce medication error rates and can influence physicians to order medications and tests more clinically appropriate and cost-effective. The recently passed mandates issued by the California Senate and the Leapfrog Group appear to have stimulated vendors to increase the number of commercially available systems, as well as to increase the number of hospitals wanting to implement a CPOE system. However, their impact on the adoption of CPOE will be blunted unless insurers or patients selectively choose hospitals and physicians based on its use. Given the past history and track record of hospitals and IT, it may be ambitious to simply require the use of a CPOE, providing incentives, research and procedures, and assessing a CPOE’s impact must be employed to ensure its adoption.

Providing incentives. It has been shown that the profitability of a new surgical or diagnostic technology is a strong incentive for its adoption by hospitals. Providing financial incentives will similarly increase hospitals’ adoption of CPOE. These incentives could be part of an overall plan to improve quality through the increased use of information technology. The U.S. Congress passed two bills that provide grants to hospitals and skilled nursing facilities to implement information systems designed to improve patient care and reduce medical errors. The bills passed are The Health Information and Quality Improvement Act of 2001, which provides \$420 million annually for ten years, and The Medication Errors Reduction Act of 2001, which provides nearly \$100 million, annually for the next ten years. The first bill requires that the Agency for Healthcare Research and Quality (AHRQ) provide advice on selection of systems and evaluate the impact of the program. In addition to the congressional legislation a differential reimbursement scheme to reward hospitals and physicians using CPOE may be difficult to enact but could be very effective. Another incentive plan is the use of selective contracting with providers using CPOE and is the most likely approach that will be pursued. The Leapfrog Group is taking a more proactive approach; they are providing lists of hospitals using CPOE technology to patients and payers.

Research and procedures. Incentives may induce hospitals to adopt CPOE but may not be sufficient to convince physicians to adopt its use. Additional efforts must be made to show the benefits and improvements of a CPOE system will improve physicians’ perceptions, however, getting them to use it is ultimately up to hospital leaders. CDOs must minimize any additional time constraints imposed by a CPOE. This can be achieved by ensuring that system response time is sub-four seconds, giving physicians a choice to enter all orders on the computer, PDA, or Tablet PC, providing predetermined lists for common conditions and medications, and integrating a CPR and Decision Support System (DSS) that permits

physicians to view patient histories, test results, and notes. Physicians must be involved in developing the rules and knowledge base of the decision support system that will be integrated in the CPOE system, or they may reject any attempts to modify their patient care process. CDOs must allow physicians to try CPOE and must provide adequate training and support. Another approach to training and support would be for hospitals that have implemented a CPOE to act as mentors for new adopters. Finally, vigilance is a must to ensure that the CPOE does not introduce new errors into the CDO's enterprise databases or into patient care procedures.

Assessing the impact of a CPOE. Professional and Physician organizations as well as healthcare vendors must develop standards for technology and clinical nomenclature and for minimum requirements required for a CPOE. These developed guidelines, standards, procedures, and measurement criteria could be coordinated by JCAHO or the Agency for Healthcare Research and Quality (AHRQ). The ideal CPOE system will be a direct reflection of each CDO's point-of-care processes and procedures; they will be designed using guidelines, standards, procedures, and measurement criteria that are established by government, physicians, clinicians, accreditation organizations, business, private citizens, and system developers. Consider the following suggestions when determining a CPOE.

Computerized Physician Order Entry Systems

Consider the Physicians

CPOE, in which the physician directly enters orders into the system, is the most difficult type of order entry to implement. A system designed to support direct interaction by physicians must meet a different standard than one designed for other caregivers:

- Physicians face constant time pressure.
- They interact with computer systems idiosyncratically.
- The system must be exceptionally easy to learn since physicians have little time for training.
- The system must support activities specific to medical specialties, varying workflow patterns and mobile point-of-care operation.

Achieving a comprehensive and highly integrated CPOE system requires a CPR. As a result, in the long term, CDOs will do better implementing a CPOE system as a part of an overall clinical automation strategy rather than as a stand-alone component that the CDO will interface with other clinical information systems only later on.

CPOE Interface Challenges

To achieve the fullest possible functions, the order-entry system must interact with a large array of systems. For this reason a CPOE system must be part of an enterprise-wide CPR strategy.

Here is a partial list of components that must integrate with a CPOE system:

- Clinical data repository (CDR)
- Clinical decision support system (CDSS)
- Enterprise master person index
- Lab system
- Radiology system
- Web environment
- Clinical documentation system
- Controlled medical vocabulary (CMV)
- Scheduling system
- Pharmacy system
- Billing system
- Security management system

This extensive list represents a strong argument against CPOE being implemented as a stand-alone application. Given the scope of integration required for full function, starting with a standalone CPOE application means that the CDO will need to support a large number of

interfacing efforts over time. To be sure, a CPR requires interfacing efforts, but a stand-alone CPOE will require more. Thus, the final cost and effort of a stand-alone system will almost certainly exceed that of a CPOE system that is part of a CPR from the start.

Characteristics of a Full-Function CPOE System

CPOE systems should have the following characteristics:

- Efficiency
- Configurability
- Patient safety
- Optimization
- Documentation
- Comprehensiveness
- Security
- Compliance
- Scheduling
- Accounting

CDOs considering a CPOE installation should understand the features of each vendor's product and how the vendor plans to expand this capability over time to full CPOE functions. Most importantly, CDOs' clinical IT infrastructures must also support the essential functions required to get physicians to start using the CPOE system. Otherwise, physicians may reject the CPOE system and subsequently cause the whole project to fail.

Summation of the Critical Success Factors for a CPOE

Virtually no healthcare organization has a fully functioning off the shelf CPOE system. However, with products and technologies maturing rapidly, competition and the need to improve care will force CDOs to support CPOE systems.

The best strategies will reflect two key ideas. First, CPOE systems will operate most effectively within a CPR — and they will cost less in the long run than stand-alone CPOE implementations. Second, CDOs should design their CPOE systems, not for administrative expediency, but to meet the needs of physicians and other users; otherwise, most of the benefits will be lost.

Supporting CPOE systems should belong to the CDO's larger strategy for implementing a CPR that supports the enterprise's full range of clinical activities and serves as a host environment for its order-management capabilities. The order entry process affects all aspects of the CDO's business, including clinical quality, financial management and regulatory compliance. In addition, a CPOE system must be an integral part of a tightly coupled CPR that will reduce unnecessary work, such as keying in basic patient information several times or accessing disparate systems to get the information the caregivers need.

When implementing a CPOE system, the CDO should keep uppermost in their tactical strategy: Order entry yields the largest potential benefits for patients and their organization during the point-of-care encounter, when the physician actually creates orders. If a nurse, ward clerk or pharmacy technician enter orders, much of the effective ordering process becomes diluted because the physician cannot receive immediate feedback affecting the quality and cost of care. However, the CDO should design the CPOE system not to optimize data capture but to assist the physician in his duties. Physicians simply will not use a CPOE system that seems clumsy or takes up too much time. Thus, a good system will have the speed, ease of use and flexibility to assist physicians, regardless of specialty, as they do their work each in the way they prefer.

CPOE is not a panacea, but it does represent an effective tool for bringing real-time, evidence-based decision support to physicians. Governments, employers, and the community must realize that without a coordinated plan to encourage CPOE adoption and evaluate its impact, adoption of this technology by hospitals and physicians will continue to be slow.

About CGI

Founded 1976, CGI has worked with clients in a wide range of industries to help them leverage the strengths of information technology (IT) to optimize their business performance and produce value-driven results. We also offer a comprehensive array of business process outsourcing (BPO) services, enabling us to help manage and improve our clients' day-to-day business processes while freeing them up to focus more on strategic decision making. Our consulting, systems integration and outsourcing services provide a total solution package designed to meet our clients' complete business and technology needs. We approach every engagement with one objective in mind—to help our client win and grow. CGI provides services to clients worldwide from offices in Canada, the United States, Europe, as well as centers of excellence in India and Canada.

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Footnotes:

- ¹ Mark Hagland, "Doctor's Orders," Healthcare Informatics, January 2003: 39.
- ² Mark Hagland, "Doctor's Orders," Healthcare Informatics, January 2003: 39.
- ³ Gartner Group Inc., "Strategic Analysis Report: How to Gain Value From Physician Order Entry," 09/2002.
- ⁴ T.A. Massaro, "Introducing Physician Order Entry at a Major Academic Medical Center: Impact on Organizational Culture and Behavior," Academic Medicine (January 1993): 20-25.
- ⁵ ECRI, "Computerized Provider Order Entry Systems," Health Devices (Sep/Oct 2001): 323-359; and J. Metzger and F. Turisco, "Computerized Physician Order Entry: A Look at the Vendor Marketplace and Getting Started," December 2001.