A Case Study on Computerized Physician Order Entry

A Blueprint for a Beginning

MASSACHUSETTS TECHNOLOGY COLLABORATIVE

NEHI *New England Healthcare Institute*

CPOE Initiative Advisory Committee - December 2006

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ACKNOWLEDGMENTS

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EXECUTIVE SUMMMARY

Background

The Massachusetts Hospital CPOE Initiative is a ground-breaking and dynamic undertaking that has brought critical people in the state of Massachusetts together to accelerate the adoption of an innovative technology that, if implemented thoughtfully and effectively, can save lives and save money.

A report published in 2003 by the Massachusetts Technology Collaborative (MTC) and the New England Healthcare Institute (NEHI) demonstrated that substantial savings to the health care system in Massachusetts could be achieved by the adoption of a technology called Computerized Physician Order Entry (CPOE).

CPOE is a computer application used to enter diagnostic and therapeutic patient care orders. Clinical decision support incorporated within the order process provides the physician with knowledge of potential medication errors and recent test results, and prompts for standard screening tests.

Published research studies have demonstrated that CPOE systems save lives by reducing adverse drug events. The technology also saves costs by improving resource utilization and lowering the length of hospital stays. Although there are many clinical benefits of CPOE, hospitals in Massachusetts (other than several of the major teaching hospitals) have not adopted the technology at a significant rate, primarily because of cost and implementation barriers. These barriers include:

- Cost – there is an initial capital outlay of approximately $ 210 million for implementation, and there are long term costs for the supporting infrastructure, staff training and on-going support;

- Standardization – there are currently no minimum standards for CPOE applications or for interoperability with other systems;

- Quantitative Measures – there is a lack of compelling evidence on the specific benefits of the use and operation of CPOE systems; and

- Change – The adoption of a CPOE system requires a major change in hospital operations and a big commitment from hospital staff and leadership to make it happen successfully.

The Massachusetts Hospital CPOE Initiative

A group of interested members of the Massachusetts health care community, under the leadership of Mitchell Adams, Executive Director of MTC, and Dr. Wendy Everett, President of NEHI, decided to address the issue of CPOE adoption in Massachusetts by creating the Massachusetts Hospital CPOE Initiative (Initiative).

The goal of the Initiative is to begin implementation of CPOE in all hospitals in Massachusetts within four years. Although it is a short time frame, the members of the Initiative felt strongly that it was necessary to generate momentum for technology adoption that would save lives in Massachusetts and bring savings to the broader health care system. In 2005, the Massachusetts legislature appropriated $500,000 to provide essential seed funding for the Initiative. Over the course of the first year of the Initiative, MTC contributed an additional $1,200,000 and NEHI provided staff and services to support the effort.

Initiative Process

For the Initiative to go forward there were several key things that needed to be accomplished: a readiness assessment of all hospitals in Massachusetts to adopt CPOE; the development of CPOE standards to ensure that the computer systems contained the necessary capabilities; and the development of a cost model framework to provide hospitals with a fair estimate of what it would cost to adopt CPOE. The Initiative engaged the First Consulting Group (FCG) to conduct this work.

Readiness Assessment

FCG designed an on-line survey to send to all hospitals in Massachusetts who did not already have CPOE systems. Of the 73 hospitals in Massachusetts, thirteen had CPOE systems, leaving 60 hospitals to be surveyed.

The survey covered the following eight areas:

- CPOE project status
- Care standardization
- Information technology (IT) management
- IT infrastructure
- Clinical IT experience
- Organizational structure and process
- Leadership and culture

There was an average of nine questions in each category, for a total of 75 questions.

Eighty-five percent of hospitals completed the self-assessment survey. This response rate was the result of follow-up phone calls and a strong endorsement from industry leaders, such as the executive staff of the Massachusetts Hospital Association and the Massachusetts Council of Community Hospitals.

FCG reviewed and scored the responses and used the information to determine which hospitals were ready to implement CPOE.

CPOE Site Selection

In order to have a robust demonstration project, the Initiative members wanted to have a variety of hospital types involved in the process, reflecting different sizes, organizational structures, and geographic locations. The on-line survey scores that indicated hospitals were ready to implement CPOE or their reported start date to implement CPOE were used to select a variety of hospital types. It was also decided that the four hospitals involved in the Massachusetts e-Health Collaborative should be included in the Initiative. The e-Health Collaborative is an initiative of the physician community designed to promote the use of electronic medical records in three pilot communities in Massachusetts.

The twelve hospitals selected for site visits were referred to as the Group One hospitals. These hospitals were visited by leaders of the Initiative to confirm their readiness to implement CPOE; their commitment to participate in the Initiative; and to establish a long-term working relationship with the Initiative team.

Site Visit for Group One Hospitals

FCG conducted the Group One hospitals site visits. These visits were scheduled for two to three days and were designed to gather more in-depth information from the key areas outlined in the on-line survey.

In addition, each Group One hospital completed a budget for CPOE implementation that separated costs into three categories: capital, one-time operating expenses and ongoing operating expenses. These budget estimates were helpful to the hospital and were also helpful to FCG in identifying common costs across all hospitals and to help develop estimates for hospitals planning to implement CPOE systems in the future.

Remaining Massachusetts Hospitals

FCG sent hospitals not imminently ready to implement CPOE a feedback report. The report included their initial survey scores and a comparison of the average readiness scores of all hospitals. In addition, the report included recommendations for projects to help them with their CPOE readiness and lessons learned from other hospitals.

Standards for CPOE

The second key element to the Initiative was the development of CPOE standards. A group of expert advisors that included CIOs and physicians who had implemented CPOE systems were asked to develop a set of standards for the Initiative that focused on physician acceptance, implementability and value.

The advisors began with standards developed by Leapfrog, JCAHO, the Massachusetts e-Health Collaborative and others and adapted them. These draft standards were then reviewed and commented on by CPOE vendors, and selected physicians and CIOs. This group rated the standards as: essential now, essential in the future, or desirable for achieving successful implementation. A set of final CPOE standards were developed from this input.

Vendor Options

Choosing the right vendor option is critical and comes down to three possible options:

- Using CPOE software from the hospital's information system (HIS) vendor;
- Replacing some or all of the HIS vendor applications with a new suite including CPOE; and
- Installing a different CPOE vendor program that "wraps around" the current HIS.

Careful consideration should be given to all three options. In addition, a CPOE vendor may not be able to provide solutions that meet all of a hospital's requirements. Hospitals should carefully consider a vendor's adherence to standards, their system's record of reliability and the cost and purchase options offered by the vendor.

Conclusions

In its second year, the Massachusetts CPOE Initiative is developing performance metrics to demonstrate to providers, payers and consumers the extent to which Group One CPOE systems are improving the quality of care provided and reducing heath care costs.

Hospitals planning to implement CPOE can benefit from the lessons already learned.

- CPOE implementation is a change management process. Its implementation should be approached from both a technical and personnel perspective. The hospital should recognize that it is a change for the individual physician, the medical team, and the organization as a whole.

- A hospital's effective use of health information technology is now a common component of payers' reimbursement contracts. Pay for performance measures are commonly included in this contract. CPOE is an effective technology to help deliver and measure these qualitative process measures.

- The Commonwealth of Massachusetts has a history of collaboration. This Initiative was no exception, with initial involvement and sign-on by key leaders of the health care community, government and business. The Initiative also involved members of the technology community who knew what hospitals had and what they needed. The Independence of MTC and NEHI provided the key leadership link.

Case Study on Computerized Physician Order Entry

A Blueprint for a Beginning

According to the Institute of Medicine Report, *To Err is Human*, there are between 50,000 and 100,000 deaths in the U.S. each year due to preventable medical errors, many of which could be averted if a computer system were in place to provide information to physicians. Despite the availability of this technology, only a small percentage of hospitals have implemented it. In the fall of 2004, only 10 percent of Massachusetts hospitals had this technology.

A broad group of health care leaders in Massachusetts decided to change that percentage with the goal of implementation of computerized physician order entry in all Massachusetts hospitals in four years. This case study is about the early experiences of this goal, to allow other states to learn from our successes and failures.

Introduction

What is CPOE?

Computerized Physician Order Entry (CPOE) is a computer application that is used by physicians to enter diagnostic and therapeutic patient care orders. In most cases these orders are communicated electronically to the departments and personnel responsible for carrying them out, either by directly connecting to specific departmental computer systems that execute the order (such as laboratory or pharmacy systems), or by staff printing out the orders in the appropriate locations for execution. For CPOE applications electronically connected to departmental systems, confirmation of the order and the following result (in the case of tests) are transmitted back to the ordering physician.

The power of CPOE is not in automating the order-writing function for the physician, but in incorporating clinical decision support during the order-entry process. Clinical decision support capabilities range from very basic edits that check for required fields, to offering a list of default orders or order sets, to highly complex dosing calculations that consider patient characteristics, recent test results and knowledge-based rules.[1]

[1] "Advanced Technologies to Lower Health Care Costs and Improve Quality," First Consulting Group for MTC and NEHI, Fall 2003, p 22.

Benefits of CPOE Technology

The most important benefit of CPOE is medication safety. For example, CPOE systems can provide renal dosing guidance and adverse drug event prevention. CPOE systems have been shown to reduce serious medication errors by 55 percent and decrease adverse drug events (ADEs) by 17 percent[2]. These systems may also include "decision support" mechanisms that prompt clinicians to prescribe appropriate medications or do appropriate laboratory tests for a particular condition, and prompt for standard screening tests or vaccinations when they are due. Lastly, the speed of electronic delivery can decrease turnaround times for medication delivery, lab specimen collection, and completion of other diagnostic tests.[3]

CPOE systems also achieve significant cost savings through the reduction of medication errors and ADEs, as well as through the use of decision support capabilities that improve resource utilization and lower hospital lengths of stay. Examples of this include:

- Reduction in pharmacy charges of $500,000 through recommended dosage changes for a single drug (representing a 92 percent switch rate to a new dose)[4]

- Reduction in emergency department expenditures by $26 per visit[5]

Barriers to the Implementation of CPOE

Although the benefits of the technology have been demonstrated, there are also barriers in the system that impedes its implementation. One of the major barriers to implementation is cost. There is the initial capital cost of implementation as well as the ongoing operating costs. Community hospitals in particular have limited access to funds for major capital projects.

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[2] *Treatment Plan: High Tech Transfusion* (Case Statement for Implementation of CPOE in all Massachusetts Hospitals), First Consulting Group for MTC and NEHI, Fall 2004, p.14. (citing Bates D.W., et al, "Effect of Computerized Physician Order Entry and a Team Intervention on Prevention of Serious Medication Errors," *Journal of the American Medical Association*, Vol. 280, 1998, p.1311-16.).
[3] "Advanced Technologies to Lower Health Care Costs and Improve Quality," p23.
[4] "Computerized Physician Order Entry: Costs, Benefits, and Challenges – A Case Study Approach" First Consulting Group for MTC and NEHI, Fall 2004, p.23 (citing "Computerized Physician Order Entry: Costs, Benefits, and Challenges, A Case Study Approach," for the American Hospital Association and the Federation of American Hospitals by First Consulting Group, January, 2003).
[5] "Computerized Physician Order Entry: Costs, Benefits, and Challenges – A Case Study Approach" First Consulting Group for MTC and NEHI, Fall 2004, p.23 (citing Overhage, J.M., et al., "A Randomized Controlled Trial of Clinical Information Shared from Another Institution." *Annals of Emergency Medicine* 39:1 January 2002).

In addition, there are no minimum standards for CPOE applications such as clinical decision support or interoperability with other electronic systems. Effective measures to demonstrate the benefits of the operation, use and performance of CPOE systems have not yet been developed. There remains a lack of compelling evidence about the specific benefits of the technology. Lastly, CPOE is a change management process that requires reconfiguration of hospital operations and a willingness and support of the staff and leadership to accept change. Estimates of CPOE adoption across the United States vary from five to nine percent.[6]

Background

How the Massachusetts Hospital CPOE Initiative Began

The benefits of CPOE outlined above were published in a report commissioned in 2003 by the Massachusetts Technology Collaborative (MTC) and the New England Healthcare Institute (NEHI), *Advanced Technologies to Lower Health Care Costs and Improve Quality*. This report provided evidence that there are existing technologies that can dramatically lower health care costs and improve the quality of patient care.

In this report, inpatient CPOE (hereafter CPOE), demonstrated the greatest annual net benefit of the seven technologies featured. In addition to its potential cost savings, it was a technology that, other than in the large Boston teaching hospitals, was not being adopted at a significant rate.

The demonstrated improvement in patient safety and the potential for health care cost savings inspired the formation of the Massachusetts Hospital CPOE Working Group (Working Group). The Working Group was made up of interested members of the health care community consisting of providers, payers, and state and federal government leaders and led by NEHI and MTC. Appendix One lists the Working Group members.

Organization of the Massachusetts Hospital CPOE Initiative

The Working Group made a decision to implement CPOE in all hospitals in Massachusetts in four years, creating the Massachusetts Hospital CPOE Initiative (Initiative). Establishing a four year time frame for the Initiative brought commitment and momentum to the project.

Under the leadership of Mitchell Adams, the Executive Director of MTC, and Wendy Everett, the President of NEHI and in collaboration with the Massachusetts Hospital Association and the Massachusetts Council of Community Hospitals, the Working Group oversaw the publication of a report defining the barriers and costs of adoption of CPOE and identified a framework and pathway for universal adoption of CPOE in

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[6] Koppel, R., et al. "Role of Computerized Physician Order Entry Systems in Facilitating Medication Errors." *Journal of the American Medical Association* Vol. 293, No. 10, 2005, p. 1198.

Massachusetts.[7] The research and modeling, conducted by the First Consulting Group (FCG) under the direction of Dr. Erica Drazen, demonstrated that an initial investment of $210 million dollars to install CPOE systems in all Massachusetts hospitals would have the potential to bring an *annual* return on investment of $275 million to the state's health care system.[8]

The early success of the Working Group's bold undertaking can be attributed to its collaborative approach to the Initiative. Collaboration brought all of the necessary players into the planning and support of the project. The membership of the Working Group was seen as a significant symbol of commitment by the right people to get the job done. NEHI's and MTC's independence allowed acceptance of the Initiative's framework.

The Working Group presented a balanced perspective of the undertaking, acknowledging realistic barriers to the Initiative, but not allowing them to paralyze progress. The Working Group members used their leadership to raise awareness of the Initiative and to build support in the community.

Funding of the Initiative

Seed funding for the Initiative was essential to:

- Conduct a readiness assessment of Massachusetts hospitals;
- Determine standards for CPOE systems to ensure that available systems contained the necessary capabilities to realize the potential of CPOE; and
- Estimate an individual hospital's cost of implementing CPOE.

The Massachusetts legislature appropriated $500,000 for the Initiative and MTC financed $1,200,000 (through June 2006). The Initiative has been successful to date, because it has had adequate personnel to support the collaboration and to manage the project on a day-to-day basis.

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[7] *Treatment Plan: High Tech Transfusion* (Case Statement for Implementation of CPOE in all Massachusetts Hospitals), First Consulting Group for MTC and NEHI, Fall 2004.
[8] *Treatment Plan*, p.3

The Initiative

Assessment of Hospital Readiness

In order to begin this state-wide CPOE Initiative, we needed an assessment of the current status of CPOE implementation in all Massachusetts hospitals. In concert with the Working Group, FCG, MTC, and NEHI designed an on-line survey to:

- Learn more about the status of CPOE implementation in Massachusetts hospitals;
- Obtain hospital-specific information for use in projecting the costs of implementing CPOE; and
- Provide a framework for hospitals to assess their readiness for successful CPOE implementation.

Massachusetts has 73 acute care hospitals. Thirteen of these hospitals had implemented CPOE systems or were expected to have begun implementation by the end of 2005. These hospitals were excluded and the remaining 60 hospitals were surveyed.

The On-line Survey

FCG created an on-line self-assessment survey that included questions about the hospital's demographics, its clinical information systems, its staffing levels, and the hospital's assessment of its readiness to implement CPOE in the following eight categories:

- CPOE Project Status (Planning) – Does the hospital have a formal plan for CPOE?
- Leadership – Is the leadership of the organization committed to CPOE?
- Organizational structure and process – Does the organization have formal processes to exchange quality and patient safety information?
- Culture – Does the hospital have a culture of patient safety and quality improvement?
- Care Standardization – To what extent is patient care standardized within the hospital?
- Clinical Information Technology Experience – Do providers in the hospital currently use electronic systems to provide care?
- Information Technology Management – Does the hospital have an Information Systems Steering Committee?

- Information Technology Infrastructure – What core information systems does the hospital have?

The categories averaged nine questions each for a total of 75 questions. Appendix Two contains a copy of the on-line survey.

The on-line survey was sent out in April 2005, accompanied by a cover letter to the hospital's CEO with directions for completing the survey as well as a unique login name and password to provide confidentiality of the responses. A second letter and follow up calls were made through August 2005. Fifty-one of the sixty hospitals responded. It was determined that 49 of these hospitals had not yet started to implement CPOE and they were invited to be part of the Initiative.

Although 85 percent of the hospitals responded to the survey, it took follow up work and endorsement from industry leaders, the Massachusetts Hospital Association and the Massachusetts Council of Community Hospitals to reach such a high response rate.

Responses to the survey were reviewed and coded by staff at FCG. A total score based on the percentage of questions answered affirmatively for each of the eight categories of readiness was calculated for each respondent. (Some organizations' responses included multiple hospitals). The average percentage of positive responses for each category is shown in Exhibit One.

Exhibit One

	Readiness Scores for the Responding 49 Hospitals			
Assessment Component	All Responding Hospitals	Hospitals <100 beds	Hospitals 100-199 beds	Hospitals 200+ beds
A. CPOE Project Status	52	41	53	57
B. Leadership	59	55	62	59
C. Organizational Structure and Process	89	89	92	86
D. Organizational Culture	79	72	83	80
E. Care Standardization	75	78	80	66
F. Clinician IT Experience	62	58	64	64
G. Information Technology Management	77	66	83	78
H. Information Technology Infrastructure	38	28	46	35

Selection of Group One Hospitals

The survey responses were used to identify a group of hospitals that were ready to implement CPOE, based on their scores and their predicted start date for CPOE implementation. Particular attention was given to scores recorded in leadership, organizational structure, IT management and IT infrastructure.

In addition to the hospitals' scores in these categories and the start date that they forecasted for CPOE, thought was given to finding variety in hospital size, type, and geographic location. It was also decided that the four pilot hospitals involved in the Massachusetts e-health Collaborative[9] should be involved in this Initiative.

There were twelve hospitals (or hospital systems) that appeared ready to begin implementation of CPOE in 2006. These hospitals are now referred to as the Group One hospitals and are listed alphabetically in Exhibit Two.

Exhibit Two

Anna Jacques Hospital	Lahey Clinic
Brockton Hospital	Milton Hospital
Children's Hospital	North Adams Regional Hospital
Good Samaritan Hospital	South Shore Hospital
Hallmark Health (2 hospitals)	UMASS Medical Center (2 hospitals)
Holyoke Medical Center	Winchester Hospital

These Group One hospitals confirmed their readiness to implement CPOE in 2006 and committed to participate in the next phase of the Initiative

Site Visits of Group One Hospitals

The next major step in the Initiative was a site visit to the Group One hospitals. The site visits were designed to gain in-depth insight into the eight areas targeted in the on-line survey, particularly to gain more insight into the hospital cost of implementing CPOE (see discussion below on CPOE costs).

These individual site visits were scheduled for two to three days and targeted key people within the organization. Appendix Three is a copy of the site visit interview guide used by FCG. Two FCG consultants conducted the interviews, one focusing on clinical and operational issues and one on technology issues.

[9] The Massachusetts eHealth Collaborative was formed in 2004 as an initiative of the physician community to bring together the state's major health care stakeholders for the purpose of establishing an EHR system that would enhance the quality, efficiency and safety of care in Massachusetts.

At the end of the site visit, a summary of the findings was presented to the hospital staff that had been involved in the self-assessment and the site visit. This summary included an updated assessment of projects that needed to be completed before the hospital was ready to implement CPOE. The summary also included a spreadsheet of each hospital's estimated costs to implement CPOE. Appendix Four is a sample cost estimate.

FCG then offered to do a personal presentation of the survey findings to the Group One hospitals' executive team. A majority of hospitals accepted. The FCG presentations included feedback for each of the eight components of readiness and ended with suggestions for planning and implementation projects. Appendix Five is a sample presentation.

The Group One hospitals saw the survey, site visit and the FCG presentation of findings as positive steps in helping them to plan for their CPOE implementation. Hospitals commented that it helped to validate internal agendas and provided additional momentum for the project.

A CPOE Budget Model for Group One Hospitals

An important step in the Group One hospitals implementation of CPOE systems was the development of a cost model by FCG to assist them in projecting their CPOE implementation costs. Appendix Six contains the cost model. FCG built the following costs into the model based on input from the industry and recent CPOE implementations.

- Capital software costs must include the CPOE application, medication administration application, and an upgrade to the pharmacy application, if necessary. Interfaces between CPOE and pharmacy applications are also included when necessary, since these applications must be tightly integrated to support the level of clinical decision support and communication between a pharmacy department and physicians.

- Physician adoption is critical to the success of CPOE implementation. The implementation of the technology is only half of the solution. Therefore, single physician sign-on is a critical system feature in order to engage physicians in the process. This product allows the physician to sign on once and access many applications, such as PACs, results review, clinical content, and CPOE. Access must also be easily available. In addition to adding workstations on the inpatient units, supporting wireless networks within the hospital and remote access at home and in the physician's office are often cited as requirements for physician acceptance and are included in this model.

- CPOE is a critical component of care delivery and must be available at all times. To support this level of performance, the cost model includes capital costs for application server and network monitoring tools, and business continuity that provides for redundant network access, application servers and databases, so that the system is reliable and available on a 24 hour basis.

- Salaries for new positions were not capitalized for community hospitals – only teaching hospitals. Community hospitals felt that the additional staff were permanent and would participate in the ongoing support of CPOE and other advanced clinical applications.

CPOE Costs for Group One Hospitals

Group One hospitals used the CPOE budget model to categorize their budget projections into capital, one-time operating expenses, and ongoing operating expenses. The following are definitions of each category:

- Capital costs include: hardware; software; computer networking equipment (including wireless network capabilities); workstations, printers, and handheld wireless devices; and implementation services, including assistance in change management from the vendor or outside consultants.

- One-time operating costs include: leadership resources to direct the project and ensure physician participation; and information systems analysts, physicians, and other clinicians to design, configure, and install the system, including all of the essential rules and alerts that make the CPOE system effective (one-time operating costs may include incentive payments to physicians to facilitate adoption of the new systems).

- Annual operating costs include: the costs associated with maintaining the hardware, software, network equipment, computer interfaces, and user devices (including reviewing and updating all of the clinical rules and alerts on a regular basis).

This budget model provided the hospital with a tool to obtain a good assessment of its estimated CPOE costs. The budgets also enabled FCG to identify capital and operating line item costs that were common across all sites and helped to determine other cost criteria, such as hospital size and clinical applications already installed. Lastly, these individual budgets were used to develop costs estimates for hospitals planning CPOE implementation.

Remaining Massachusetts Hospitals without CPOE

The hospitals not selected to be in Group One (i.e. not ready to implement CPOE in 2006) received a *Feedback Report* and a written report entitled *CPOE Readiness Roadmap Guide.* Appendix Seven is a sample of the feedback report and the roadmap guide.

The feedback report reflected the specific hospital's readiness to implement CPOE systems, including their readiness scores and the average readiness scores of all hospitals, so that they could compare themselves to other hospitals.

The roadmap guide provided recommendations on critical factors and projects from other hospitals that had implemented CPOE. The roadmap was designed to mirror the eight components of the on-line survey. Each component is described with a review of its importance to successful CPOE implementation. Each component also contains a list of projects that may be helpful for hospitals to address gaps in their readiness.

Setting Standards for CPOE

CPOE Standards Requirements

For CPOE systems to deliver their full benefits, they must have the capability to provide clinical decision support for the physician. This includes pre-programmed order sets that only require modification for specific exceptions; alerts for medication allergies and dosages that are out of range; warnings of potential duplicate medications or tests; and calculations of appropriate medication dosages based on the patient's weight, age or renal status.

To provide these benefits, CPOE systems must be designed to be "user friendly" for the provider. This component is particularly important in a community hospital, where physicians may not admit a high number of patients on a regular basis.

For the onset, the Initiative did not want to endorse or recommend a specific CPOE vendor, yet wanted to identify a set of CPOE system standards that *any* vendor or product should have in order to be successful. This approach would provide help and support to the hospitals without identifying or recommending any particular product or vendor.

The Initiative therefore formed a group of Standards Advisors that included CIOs and physicians that had developed CPOE applications and implemented commercial CPOE solutions. The Standards Advisors were asked to develop a set of CPOE system standards that would maximize physician acceptance, were easy to implement, and could meet performance standards.

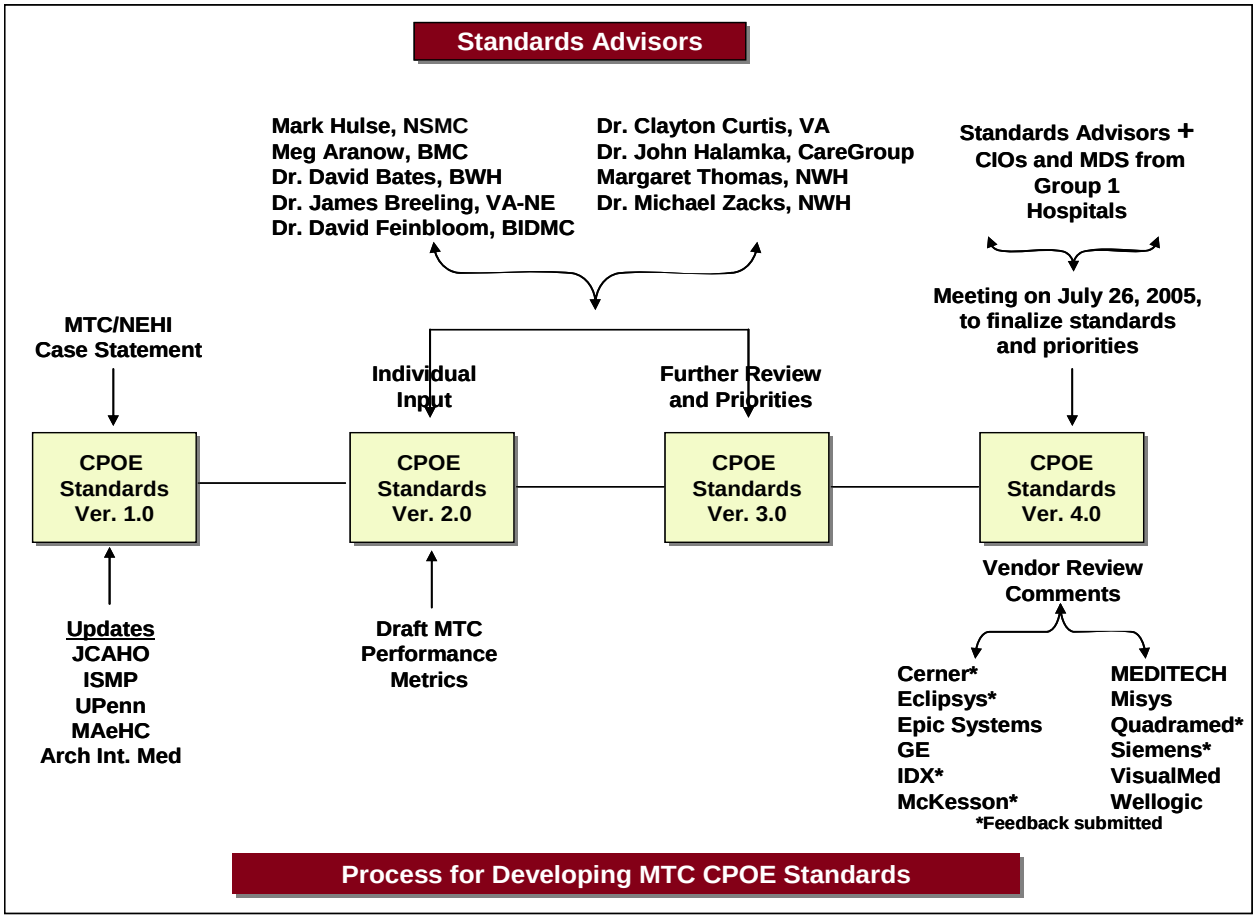
- Physician Acceptance – the system's features are user-friendly, highly functional and valuable to physicians.

- Ease of implementation – the system can be rolled out throughout the hospital with the necessary support for order management and related processes. It is interoperable with other computer applications and meets all regulatory requirements such as HIPAA, JCAHO, etc.

- Performance standards – the systems utilized clinical decision support tools as part of ongoing efforts to improve quality, safety and cost effectiveness of inpatient care.

The Standards Advisors followed the multi-step process outlined in Exhibit Three as they developed the standards:

Exhibit Three



As an initial step, previous standards developed by the Leapfrog Group, JCAHO, the Massachusetts e-Health Collaborative and other sources were compiled. The Standards Advisors reviewed this draft and made changes and additions to it.

The revised draft standards were then sent to CPOE system vendors for their comments on whether or not these were important elements of a CPOE system – not on whether or not their own proprietary system had each of these elements. In addition, the Standards Advisors met with selected physicians and the CIOs from several of the Group One hospitals. At this meeting participants rated the system requirements by the following priorities:

- *Priority* 1 (Essential Now) – must be included in the CPOE application to be successful;

- *Priority* 2 (Essential Future) – not as critical for initial implementation, but required in the future; and

- *Priority* 3 (Desirable) – not absolutely essential for success, but increases the chances of success with physician acceptance, hospital-wide implementation, and achieving significant gains in quality and patient safety.

The Initiative recognized early-on the importance of getting the CPOE standards right through a process that focused on physician acceptance and usability. Feedback, input, and a multi-disciplinary approach were keys to the success of the CPOE standards' development. As a result of this work, final standard requirements were developed and are listed in Appendix Eight.

Vendor Options

Once a hospital has an understanding of the standards needed for a CPOE system to deliver its full benefits, the hospital must consider how to select and install it. There are three vendor strategies to consider: using CPOE software from the organization's current Hospital Information System (HIS) vendor; replacing some or all of the HIS vendor applications with a new suite of clinical applications that includes CPOE; and installing a different vendor's CPOE program that "wraps around" the organization's legacy HIS applications. The advantages and disadvantages of these approaches are described below in Exhibit Four.[10]

[10] "*Treatment Plan,"* p.8.

Exhibit Four

	1.Using CPOE Capabilities from current HIS Vendor	2. Replacing some or all of the HIS Vendor Applications with a new vendor suite	3. Installing a different vendor's CPOE program that wraps around legacy HIS applications
Description	Hospitals today have an information system with applications that support admissions/discharge and basic order management; many HIS vendors also offer advanced clinical applications such as CPOE and an electronic medication administration record (e-MAR)	A number of vendors offer a suite of clinical applications including CPOE. Because a minimum set of applications is needed for CPOE, this approach often requires replacing and/or duplicating software applications already in use.	Several vendors now offer CPOE and other advanced clinical applications designed to integrate with a hospital's legacy HIS. This does not necessarily require duplication HIS applications and databases.
Advantages	▪ Adding CPOE involves less disruption of current systems and processes ▪ Likely to implement more quickly than a replacement solution and costs less	▪ Provides an opportunity to select a solution that meets full CPOE requirements ▪ In some cases, also provides an opportunity to upgrade a hospital's technical architecture.	▪ Provides an opportunity to select a solution that meets full CPOE requirements ▪ In some cases it also provides an opportunity to upgrade a hospital's technical architecture ▪ Cost and time to make CPOE operational is likely to be less than Option 2
Disadvantages	▪ Not an option if CPOE product does not meet standard requirements	▪ Costs and time to operational CPOE are typically greater that Options 1 or 3 ▪ The IS department may need to manage two application architectures and their integration requires a higher skill level set than needed for the HIS (for a period of time)	▪ Cost and time to make CPOE operational likely to be greater than option 1 ▪ Vendors and/or CPOE solutions are new to the marketplace. ▪ The IS department needs to mange two application architectures and their integration requires higher level skill sets than is needed for the HIS

The Basics of a Minimum Application Suite

The software application for CPOE cannot be implemented as a stand-alone product. As a result, decisions about installing a CPOE system have much broader implications for the entire suite of applications supporting clinicians, nurses, and pharmacists in the hospital.[11]

[11] "*Treatment Plan,"* p. 9.

Most vendors describe the minimum suite of applications required to make CPOE functional as:

- Order Management and Results Reporting
- Clinical Data Repository (or patient database that may include a rules engine)
- Rules Engine, if not integrated with other applications
- Physician Portal integrating CPOE and Results Management

In addition, most hospitals plan to implement additional clinical applications to support nursing processes and to capture clinical documentation notes. In order to provide necessary patient information for decision support tools in CPOE (e.g. allergies, weight), some online nursing documentation is also required to make CPOE functional.

Because of the complexity of medication management, patient medication orders must be passed across the hospital's pharmacy, medication administration, and nursing applications to support each step needed to respond to the physician's order and to deliver the medication to the patient. This need, to support the roles and work of the physician, the pharmacist and the nurse, leads many hospitals to make decisions about CPOE concurrent with decisions about the hospital's entire clinical application suite.

Not all vendors however, currently offer CPOE solutions that meet all of the standard requirements described above. As a result, there are often trade-offs between what the vendor can provide and what the hospital considers an important capability. Beyond physician acceptance, implementation, and performance, the following issues are essential to consider when assessing vendor applications:

- the vendor track record in achieving successful implementation, including system reliability and response time in hospitals of comparable size and complexity;

- the fit of the vendor technology architecture with the hospital's technology strategy;

- the vendor's adherence to standards to promote interoperability among information systems (including LOINC, SNOMED, DICOM, HL-7 3.0 and ICD-10CM, all of which are rapidly gaining support for industry adoption);

- the technical requirements of implementation and ongoing maintenance and their match with the hospital's skills and resources; and

- the cost and purchase options offered by the vendor.[12]

[12] "*Treatment Plan,"* p. 10.

Lessons Learned

The following section is a description of the important lessons the Initiative has learned to date.

CPOE Technology

- CPOE implementation is more than a technology installation; it is a change management process. And as such, its implementation should be approached from both the technical, organizational and personnel perspective. The hospital should recognize that it is a change for the individual physician, the medical team, and the organization as a whole. For CPOE implementation to be successful, the organization will need:

    - Senior management support for success;
    - "Buy in" from the bottom up – the hospital needs a multi-disciplinary; steering group made up of nurses, pharmacists, residents, etc.;
    - Mandatory use of the technology;
    - 24/7 technical support for the process change; and
    - Roll out of the change slowly and without fanfare.

- There are many perceptions in the medical public that define CPOE systems. To gain a better understanding of where hospitals are in their planning or implementation, it is important to define what inpatient CPOE is, before asking hospitals whether or not they have it, and whether or not they are planning to implement it. Having a common definition to work from provides a better landscape of where hospitals are in implementing the technology and gives hospitals a realistic idea of what their true CPOE costs are. For example, hospitals may not consider maintenance and backup costs in their initial budgets, if they are not included in the definition of the overall system needs.

- Hospitals need to carefully consider their strategy for CPOE implementation and how it fits into the organization's overall planning. This is particularly crucial when it comes to purchasing the technology.

CPOE's Impact on the Health Care System

- A hospital's use of health information technology is a widespread component of payers' reimbursement. Pay for performance measures are commonly included in these contracts. CPOE is an effective technology to help deliver and measure these qualitative process measures.

- The trend of hospitalists is growing. The term 'hospitalist' refers to a physician who primarily cares for hospitalized patients. As the number of hospitalists grows, the number of physicians caring for patients in the hospital will decrease. This means there will be fewer physicians who need to be trained to use CPOE.

Alternatively, hospitalists may show a greater insistence for CPOE and its applications. This will have important implications for CPOE demand, acceptance and implementation.

- Massachusetts's residents are admitted to the state's teaching hospitals at a far greater rate than the national average (40% versus 13%). This drives community hospitals to compete for admissions with the larger teaching hospitals and amongst themselves. Competition demands that the quality of care a patient receives be the same, no matter where they are treated. CPOE technology enables this to happen and makes it a technology vital to all hospitals.

The Massachusetts Hospital CPOE Initiative

- The state of Massachusetts has a history of collaboration. This Initiative was no exception, with initial involvement and sign-on by key leaders of the health care community, government and business. The Initiative also involved members of the technology community, who knew what technology hospitals had and what they needed. The Independence of MTC and NEHI provided the key leadership link.

The Initiative Process

- All hospitals that completed the on-line survey received a feedback report as well as a roadmap guide. The guide lays out foundations that the organization must have in place for eventual success with CPOE implementation. Providing hospitals with this guide proved to be a very effective tool for self-reflection and management of what can be a significant undertaking.

- In addition to the feedback report and the roadmap guide, the on-site visit was a valuable tool for the Group One hospitals. It emphasized and fleshed out in-depth information, such as CPOE costs that could not be verified from the survey. It also verified that the information provided in the on-line survey was accurate.

- The Initiative carefully considered the number of hospitals to include as Group Ones, as well as regional and specialty hospital inclusion. A critical mass of hospitals spread through out the state is essential to generate support, interest and momentum. Having a select number of specialty hospitals also provides a demonstration of the technology's effectiveness in a variety of environments.

- The Initiative sought government involvement early on in the process. The project's success is facilitated with awareness and support of local, state and federal leaders.

- The collaborative climate in Massachusetts extends to the hospital community. The Initiative has demonstrated that competing hospitals can work together to implement CPOE. They are cooperating to share HIT and learn from each other.

Next Steps – The Initiative Year Two

- As Group One hospitals are ready to implement CPOE, the Initiative is working to develop a model that will demonstrate evidence of quality improvement and cost reduction through adoption of the technology. The Initiative has formed the Benefits, Performance and Payment Working Group to accomplish this. The group has already met and established its mission to:

    - Identify the benefits of both quality and costs of hospital based CPOE;
    - Establish performance metrics as a basis of determining the effective operation of CPOE;
    - Project financial and other benefits on a hospital specific basis;
    - Allocate the financial benefits to hospitals and payers on a hospital specific basis; and
    - Encourage payment models that would provide incentives for hospitals to implement CPOE systems and to operate them effectively.

- The Initiative is also continuing to work with Group One hospitals to assist them in developing strategies that will address gaps in their readiness assessment. This is being done through work teams made up of key hospital staff, members of the Initiative, and outside experts. The Initiative will also continue to work with the remaining Massachusetts hospitals in a similar manner to help them develop strategies to prepare them for CPOE adoption.

  The first meeting of the group was held in April. They identified six high priority areas that required further research about best practices.

  • physician incentives
  • process design
  • metrics/baseline measures
  • physician training
  • organization/governance of clinical decision support
  • leadership commitment

- The Initiative is working with the CPOE vendor community to develop system features that will most effectively address the Initiative's CPOE standards. This work involves critical input from the hospital community.

- In April of this year the Governor and Legislative Leaders of Massachusetts passed landmark legislation (now Chapter 58 of the Acts of 2006) that will provide health care coverage for virtually all Massachusetts citizens – a first in the nation. This legislation also included $5 million in support of the Massachusetts CPOE Initiative.

- The Initiative plans to publish a follow-up report documenting the Initiative's progress from April 2006 to April 2007.

Appendix One

Massachusetts Hospital CPOE Working Group – Fall 2004

Mitchell Adams, *Executive Director*, Massachusetts Technology Collaborative
Christopher R. Anderson, *President*, Massachusetts High Technology Council
Gary Austin, MD, *Vice President*, MEDecision
Charles R. Buck, Jr.,ScD, *Consultant*
Marylou Buyse, MD, *President*, Massachusetts Association of Health Plans
Rich Castaldo, *Senior Vice President, H&W*, Fidelity
Benson T. Caswell, *Executive Director*, Massachusetts Health and Educational Facilities Authority
David Cochran, MD, *Senior Vice President, Strategic Development*, Harvard Pilgrim Health
Wendy Everett, **ScD**, *President*, New England Healthcare Institute
John Glaser, PhD, *CIO*, Partners HealthCare Systems Inc.
Paula Griswold, *Executive Director*, Massachusetts Coalition for the Prevention of Medical Errors
Louis Gutierrez, *CIO*, Massachusetts Executive Office of Health and Human Services
John Halamka, MD, *CIO*, CareGroup Healthcare System
Annette Hanson, MD, Former Medical Director, Massachusetts Division of Medical Assistance
Roberta Herman, MD, *Senior Vice President and Chief Medical Officer*, Harvard Pilgrim Health Care; *President*, Alliance for Healthcare Improvement
Ron Hollander, *President*, Massachusetts Hospital Association
Peter J. Koutoujian, *Chair, Health Care Committee,* Massachusetts House of Representatives
Rick Lord, *President and CEO*, Associated Industries of Massachusetts
Alan Macdonald, *Executive Director*, Massachusetts Business Roundtable
Allen Maltz, *CFO*, Blue Cross and Blue Shield of Massachusetts
Robert Mandel, MD, *Vice President E-Health*, Blue Cross and Blue Shield of Massachusetts
Jack Mollen, *Senior Vice President, Human Resources*, EMC
Dolores Mitchell, *Executive Director*, Group Insurance Commission
Richard Moore, *Chair, Health Care Committee*, Massachusetts Senate
Tom Pyle, *Consultant*
Barbara Rabson, *Executive Director*, Massachusetts Health Quality Partners
Jim Roosevelt, *Senior Vice President and General Counsel*, Tufts Health Plan
Tom Sommer, *President*, Mass MEDIC
Elizabeth Bell Stengel, *Executive Director*, Conference of Boston Teaching Hospitals; *Director, Govt. Relations*, Boston University School of Medicine
Elliot Stone , *Executive Director and CEO*, Massachusetts Health Data Consortium
Thomas Sullivan, MD, *Past President*, Massachusetts Medical Society
Donald J. Thieme, *Executive Director,* Massachusetts Council of Community Hospitals
Gordon Vineyard, MD, *President and Chairman of the Board*, Massachusetts Health Data Consortium
Gene Wallace, *Executive Vice President of Administration and CFO,* Harvard Vanguard Medical Associates
Charlie Welch, MD, *Past President*, Massachusetts Medical Society
Mike Widmer, *President*, Massachusetts Taxpayers Foundation

Appendix Two

On-Line Survey

This online survey collects information about plans and organizational and technology readiness of Massachusetts hospitals to implement inpatient Computerized Physician Order Entry (CPOE). A separate survey is completed for each hospital.

The information requested pertains to characteristics of the hospital and its medical staff; leadership and overall project status of any CPOE initiative; cultural, operational, computer use, and other factors that influence the amount of time it typically takes for a successful project; and the extent to which the IS organization and IT infrastructure may require enhancement or upgrading.

Providing the requested information is likely to require input from the CIO/Director of IS, Patient Care Services/Nursing, and Quality Improvement or Operations.

- Input from IS will be needed for Sections A, B, F, G, and H.

- Input from staff familiar with nursing, clinical operations, and quality improvement will be needed for Sections B, C, D, and E.

To facilitate the process of assembling information from these sources, the survey will remain online until the "Completed" option on the main screen has been checked. Another option is to assemble the small number of individuals and complete the survey as a group. The survey should take no more than 1.5 to 2 hours to complete.

Information is requested in three ways:

- Statements with a Yes (true) or No (not true) answer;

- Statements with a Y/N answer also requesting clarification or a description; and

- Questions or instructions seeking a text answer or other information (such as the best description of current status).

To start the survey, please first click on Demographics and complete the requested information. Once you have submitted this section, continue the survey by completing Sections A through I below.

DEMOGRAPHICS

Check all of the following that apply

- □ Academic teaching facility (own residency program)
- □ Community hospital with residents from external residency program
- □ Community hospital without residents
- □ Community hospital with predominantly employed physicians
- □ Community hospital with predominantly non-employed physicians

Name and contact information:

CIO/Director of IS:
Respondent(s) to Survey:
Contact person for possible site visit:

Inpatient Units

	No. Units	No. Staffed Beds
Med/Surg/Peds/OB	_____	_____
ICU/CCU/NICU	_____	_____
Behavioral Health/Psychiatry	_____	_____
Other_____	_____	_____
TOTAL	_____	_____

Medical Staff (please provide number)

Employed physicians with admitting privileges _____
Non-employed physicians with admitting privileges_____
Physicians with "hybrid" status (employed for part of their time, also in private practice) ____
Residents ____
Hospitalists ___
Intensivists ___

If staff includes hospitalists, approximate percentage of admissions managed by hospitalists ____

Nursing Staff (please provide FTE)

Nurses (RNs) on inpatient units ____FTE
LPNs/Health Assistants on inpatient units: ____FTE
Unit clerks ____ FTE

Approximate percentage of nurses on inpatient units who work part-time ____

Approximate percentage of nurses on inpatient units who are travelers or agency nurses ____

Pharmacy staff (please provide FTE for inpatient pharmacy)

Pharmacists _____ FTE
Pharmacy technicians _____ FTE

A. CPOE PROJECT STATUS

1. Check the following that best describes the status of a CPOE initiative in the hospital.

□ No Plans for CPOE
□ Plan in Development
□ Planned
□ Planned & Budgeted
□ Implementation in Progress
□ CPOE in Place

If you checked "No Plans for CPOE" or "CPOE in place," please skip to the end of the survey and indicate that you have completed the survey.

2. The hospital has a target date for beginning the CPOE pilot. Y* / N

   *If yes, specify calendar year _____

3. The hospital's IT budget includes CPOE. Y / N

4. The vendor of the CPOE application has been selected. Y / N

5. The hospital has identified the project team for CPOE. Y / N

6. A lead physician has been identified with dedicated paid time for the CPOE project Y* / N

   *If yes, ~FTE of time dedicated (>0.25 FTE, 1 FTE, etc.)

   _____

Name and contact information of lead physician

_____

Do you plan to reimburse other physicians for:

CPOE-related committee work? Y / N

CPOE user training? Y / N

7. A nurse has been identified with dedicated time for the CPOE project.

Y / N

8. A multi-disciplinary committee with decision-making authority exists or has been identified to oversee the CPOE project. Y/N

9. If a committee exists or has been identified, physicians from at least two clinical specialties (e.g., medicine and surgery) are members. Y / N / NA*

B. LEADERSHIP

1. The CPOE plan has been presented to the hospital's Board and the Board has endorsed the decision to move forward with CPOE. Y / N

2. The Medical Executive Committee (or equivalent) has endorsed the decision to move forward with CPOE. Y / N

3. Representatives of community physicians who admit to the hospital have been involved in the decision to move forward with CPOE Y* / N

*If yes, describe how _____

4. A hospital executive other than the CIO has accountability for the success of the CPOE project. Y* / N

*If yes, provide title of executive_____

5. A physician executive has accountability for the success of the CPOE project.

Y / N

6. The hospital sets a formal Quality Improvement/Safety agenda each year to identify improvement targets. Y / N

7. If the hospital has a QI/safety, agenda, CPOE is on it. Y / N / NA

8. The hospital has developed a set of objectives that outline what it expects to accomplish with CPOE. Y / N

9. Both pharmacy and nursing executives have been involved in the decision to move forward with CPOE. Y / N

C. STRUCTURE AND PROCESS

1. The hospital has a formal process for providing information to physicians about changes that affect them. Y* / N

*If yes, please list multiple communication mechanisms used

2. Please describe the options available to physicians to provide feedback about changes that affect them.

3. Pharmacists regularly participate in the role of clinical pharmacist on the inpatient units or clinical pharmacists conduct rounds on inpatient units. Y / N

4. The hospital undertakes clinical quality improvements that cut across disciplines and departments. Y* / N

*If yes, list two current efforts of this type:

_____

_____

5. The hospital has an interdisciplinary group that meets regularly to identify and address patient safety issues. Y* / N

*If yes, provide name of group _____

6. The hospital periodically adopts new quality/safety metrics when new gaps in care are identified and need to be addressed. Y / N

7. The board or a sub-committee of the board receives patient safety reports including metrics on a regular basis. Y / N

8. The hospital has staff resources with skill and experience in working with clinical and operational staff to improve high-risk or inefficient processes Y*/ N

*If yes, provide a brief description of one large scale effort of this type:

_____

9. Pharmacy, nursing, and the medical staff have worked together successfully to address a process with an identified quality or safety gap. Y* / N

*If yes, provide example(s): _____

D. CULTURE

1. The hospital has one or more committee(s) where administration and community physicians meet regularly to address issues in the hospital.

Y / N / NA

*If yes, provide names of these committees: _____

2. Active physician participation in hospital committees is part of what is expected to maintain privileges. Y / N

3. Most physicians believe the hospital is able to deploy Information Technology that improves care. Y / N

4. The hospital is involved in a patient safety or quality collaboration with an external organization (e.g., IHI, VHA, Premier, other hospitals in health system or state). Y* / N

*If yes, provide an example _____

5. Patient safety is a regular agenda item at medical staff meetings. Y / N

6. Patient safety is a regular agenda item at nursing staff meetings. Y / N

7. Physicians chair some improvement projects addressing care processes in the hospital. Y* / N

*If yes, provide an example of a physician-led project

_____

8. Representatives of community physicians are currently involved in at least one improvement project addressing care processes in the hospital. Y* / N

*If yes, please give the name of the project and the number of community physicians participating.

9. The hospital Medical Executive Committee (or equivalent) has set a policy regarding expectations for physician use of CPOE. Y / N

E. CARE STANDARDIZATION

1. To what extent are medication administration times standardized across acute care units in the hospital?

□ Not standardized
□ A few units
□ Most units

2. To what extent is documentation of medication administration standardized in care units in the hospital?

□ Not standardized
□ A few units
□ Most units

3. To what extent is medical record information on patient weight reliably updated for patients post-admission to the hospital?

□ Not reliable
□ More reliable in some areas
□ Reliable in most areas

4. The hospital has a process in place for developing, approving, and encouraging the use of standardized order sets and clinical protocols. Y/N

5. The Department of Medicine has a process in place to develop and encourage the use of standardized order sets and clinical protocols. Y/N

6. To what extent are diagnosis-specific order sets for hospital care (e.g., pneumonia, knee replacement) routinely used by physicians?

□ Not widely used
□ Used mostly in one clinical service
□ Widely used in at least two services

7. Physician compliance with the hospital policy for signing verbal and telephone orders is greater than 90 percent. Y / N

8. The percentage of medications ordered that are not included in the hospital's standard formulary is less than 5 percent. Y / N

9. The hospital's Pharmacy & Therapeutics Committee (or equivalent) regularly develops drug protocols for high-risk medications Y / N

F. CLINICIAN EXPERIENCE WITH INFORMATION TECHNOLOGY

1. The hospital uses an electronic order communication system (i.e., clerical staff, nurses, and/or pharmacy staff transcribe physician handwritten orders for electronic communication to ancillary departments). Y / N

2. Nurses on inpatient units complete some component(s) of nursing documentation electronically (e.g., vital signs, medication administration, or notes). Y / N

3. The majority of staff nurses on inpatient units (>50 percent) use electronic mail to communicate with each other and hospital departments. Y / N

4. The majority of physicians who admit to the hospital (>50 percent) access laboratory test results for their inpatients electronically.

If yes, indicate about how long this has been the case _____ Y / N

5. The majority of physicians who admit (>50 percent) review and sign transcribed documents (e.g., discharge notes, operative notes, consults) for their patients electronically. Y/N

6. Physicians can currently access electronic patient information such as transcribed documents and laboratory test results from locations outside of the hospital (e.g., from their office or home). Y* / N

*If yes, indicate about how long this has been the case _____

7. The majority of physicians who admit to the hospital (>50 percent) use electronic mail to communicate with each other and hospital departments. Y / N

8. A majority of physicians who admit patients (>50 percent) use an ambulatory EMR or e-prescribing software in their office practice or clinic. Y / N

9. The medical staff includes one or more physician(s) with prior experience with CPOE. Y / N

G. INFORMATION TECHNOLOGY MANAGEMENT

1. Representatives of the medical staff participate in selecting clinical software applications for the hospital. Y* / N /N A

*If yes, provide example of application_____

2. Representatives of community physicians participate in selecting clinical software applications for the hospital. Y* / N / NA

*If yes, provide approximate number involved in most recent election process _____

3. The hospital has an Information Systems Steering Committee. (or equivalent) with decision-making authority. Y / N

4. If the hospital has an IS Steering Committee, it includes representatives of the medical staff. Y*/ N / NA

*If yes, provide clinical specialties represented _____

5. If the hospital has an IS Steering Committee, it includes representatives of nursing. Y / N / NA

6. The staff of the IS Department includes clinical analysts. Y / N

7. The hospital has a process in place to monitor use of clinical computer systems and target physicians and nurses for additional training. Y / N / NA

8. The hospital has successfully rolled out clinical applications to physicians in the past. Y* / N

*If yes, please identify the application with the highest physician use.

_____

9. The hospital has a training team (in addition to any super users) that includes nurses and others who understand the needs and workflow of clinicians. Y / N

10. The IS Department includes staff with prior experience in planning for and implementing advanced clinical systems such as CPOE, clinical documentation, or medication administration record (MAR). Y /N

H. CPOE APPLICATION SUITE AND IS STAFFING

1. List current core HIS/clinical vendor, product, and version OR, if the hospital doesn't have a core vendor, please list by application type (e.g., A/D/T, Laboratory, Radiology, Pharmacy, Order Communication, Nursing Documentation) (For example, Results Review, Eclipsys, version 2.1)

_____
_____
_____

2. Check which of the following best describes the status of any electronic medication administration record (e-MAR) initiative incorporating bar code checking ("five rights" checking).

□ No Plans
□ Plan In Development
□ Planned & Budgeted
□ Implementation in Progress
□ e-MAR in Place w/o bar coding
□ e-MAR in Place with bar coding

3. If, the hospital has selected the software application vendor for CPOE and other advanced clinical systems, please provide vendor and product for each of the following:

CPOE_____
Clinical Data Repository_____
Pharmacy_____
eMAR_____
Nursing Documentation_____
Emergency Department _____

4. The hospital HIS or order communication software will need to be upgraded for CPOE Y / N

The Operating System used will need to be upgraded for CPOE. Y / N

5. New interfaces will be needed with:

Laboratory	Y/N
Pharmacy	Y/N
Radiology	Y/N
eMAR	Y/N
Other	Y/N
Specify Other:	_____

6. Please provide current and planned additional staffing to support CPOE.

	Current FTE	Additional FTE
Project Manager	_____	_____
Nursing/Clinical Analyst	_____	_____
Pharmacy Analyst	_____	_____
Other application support	_____	_____
MD(s) to support roll-out	_____	_____
Technical support	_____	_____
Other: _____	_____	_____

7. Does the IS Department anticipate the need for third-party consulting assistance beyond what the vendor provides to handle any aspect of the design, implementation, and training for CPOE? Y* / N

*If yes, estimated FTEs:_____ or $ _____

8. The IS Department includes staff with prior experience in planning and implementing advanced clinical systems such as CPOE, clinical documentation, or electronic medication administration record (eMAR).

Y / N

I. INFORMATION TECHNOLOGY INFRASTRUCTURE

Indicate the status of the following requirements for CPOE by putting a in the appropriate column:

Infrastructure Need	Not Begun	Assessed	Planned	Planned/ Budgeted	Work in Progress	Done	Not Needed
1. LAN/WAN can support additional end users with excellent performance							
2. Wireless LAN is in place to support CPOE/eMAR							
3. Remote access to CPOE from MD offices							
4. Sufficient work stations are in place on inpatient units and can support the CPOE application							
5. Mobile devices for MDs for CPOE, results review, reference, etc.							
6. Tools in place to expedite clinician sign-on (e.g., single sign-on, biometrics)							
7. Tools in place to support backups and recovery for CPOE suite							
8. Tools in place to monitor system and network performance							
9. 24x7 technical Help Desk/Service							

Infrastructure Need	Not Begun	Assessed	Planned	Planned/ Budgeted	Work in Progress	Done	Not Needed
10. 24x7 application Help Desk/Service staffed to support physician end users							
11. Business continuity/disaster recovery plan appropriate to support mission critical CPOE application suite							

Appendix Three

Interview Request List

Executive and Clinical Interviews and Clinical Unit Walkthrough Request List

To complete the CPOE Readiness Assessment, we are requesting a combination of individual interviews and clinical unit walkthroughs. Individual interviews and clinical unit walkthroughs 30-45 minutes. All the interviews will be conducted from the morning of ____to the morning of ____ . On the afternoon of _____, we would like to meet with you and the executives who will be responsible for the success of CPOE to review a roadmap for becoming more ready for CPOE implementation. To the extent possible schedule the executive level interviews first and the clinical unit walkthroughs last.

Individual Interviews (By title or equivalent position)	Name and Title	Date and Time	Contact Number/ Pager
Executive Sponsor for CPOE (CEO, COO, other executives)			
CIO			
CMO or VP of Medical Affairs (if applicable)			
Chairman of the Medical Staff			
CNO or VP Patient Care Services, 1-2 nurse leaders			
Clinical Quality/Risk Management/ Performance Improvement			
Physicians including Lead CPOE Physician (if named)			
Hospitalist (if applicable)			
Residents (if applicable)			
Leading Community Physicians (2)			
Chair, Pharmacy and Therapeutics Committee			
Director, Pharmacy			

Clinical Unit Walkthroughs	Unit	Date and Time	Location
Medical/Surgical Unit			
Intensive Care Unit			
Pharmacy			

Information Technology Interview Request List

Please schedule the following individuals as appropriate for all sites included in the project. Typically, technical interviews last approximately 45 minutes. Please determine the interview schedule and for each interview include name, title, interview location, and contact number.

Individual Interviews (by topic area to be covered)	Name *(individual site or system-level, as appropriate)*	Date and Time	Contact Number/ Pager
Chief Information Officer			
Clinical Applications Manager • Applications • Integration • DBA			
Technical Manager • Data Center • Network (including remote access) • Technical Support • Help Desk			

General Agenda for Technical Interviews

- Discuss the specifics of the technical area being addressed (majority of time for most interviews) – we will provide more detail.
- What are your biggest concerns about supporting the implementation of CPOE?

Information Technology Interview Request List

If possible, we would like to have the following documents (ideally electronically) in advance of our site visit. If not, we would appreciate having them available during the site visit. Please include any additional documentation, not listed below, that may be helpful for FCG to review. FCG will return all hard copies at the end of the site survey.

- Capital and Operating Budget for CPOE (if applicable)
- CPOE Implementation Plan (if available)
- List of Major IS Initiatives Planned for Next Two Years

The following documents need to be available on-site during our visit:

- Integration Architecture Strategy/Diagrams
- Network Design Diagrams (LAN/WAN/RAS/Internet

Appendix Four
Sample: CPOE Cost Estimates

Note: Many of the cost elements were not budgeted in the IT department. The budget Y/N column indicated whether the item had been included in the project budget. If the item was already in place, it was noted with a --. If the item was not required, it was noted as N/A.

CPOE Ongoing Costs – Estimate

MTC CPOE Cost Information Your Hospital – Ongoing Costs			
Cost Item	Your Hospital (thousands)	Budgeted Y/N	Comments
Hardware/Software			
Application Software Maintenance	$ 25	N	
Scanning/Archiving SW Maintenance	--		
Third-Party Software maintenance	$ 70	N	
Workstation Maintenance/spares	$ 35	N	
Mobile devices maintenance/ spares	--		included in work stations
SAN and Centera maintenance			
Single signon maintenance	$ 20		
Network:			
LAN maintenance	$ 35	N	
Network Monitoring equipment maintenance	--		
Remote Access equipment/lines maint.	--		
Interfaces:			
Interface maintenance	--		
TOTAL	$ 185	N	
Staffing required to support CPOE:			
Clinical analyst(s)/ clinical informaticists	75.0	N	1 FTE
Pharmacy analyst	37.5	N	0.5 FTE
CPOE Project Manager	100.0	N	1 FTE
Clinical Programmer/Screen Builder/ reporting	N/A		
Additional Help Desk Support	75.0	N	1 FTE
Network/equipment support for MDs/ MD Liaison	75.0	N	1 FTE
Additional NW support	N/A		
CDS analysts	N/A		
TOTAL	362.5		
Non-IT Resources:			
Clinical resources (nursing)	N/A		
Physician resource (MD)	N/A		
GRAND TOTAL			

One-Time CPOE Operating Costs – Estimate

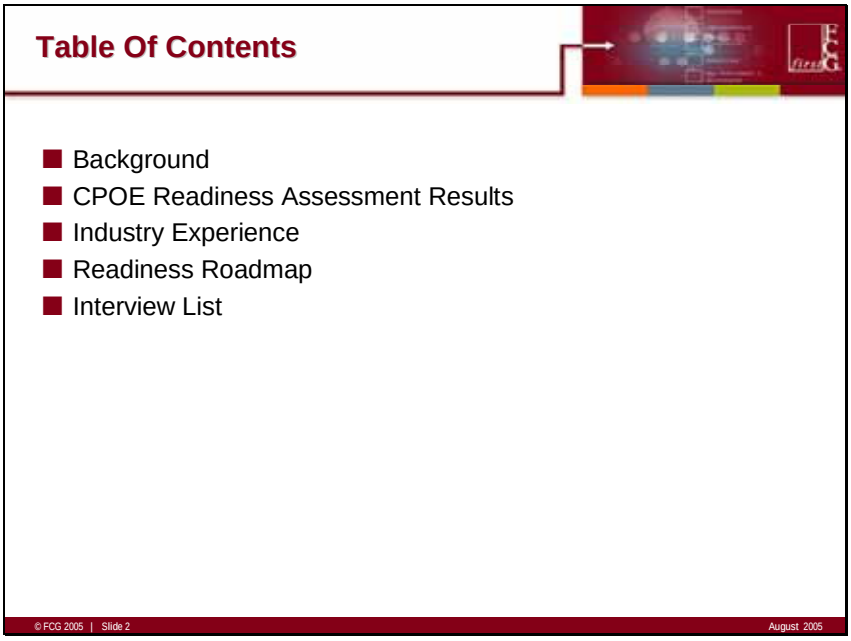
MTC CPOE Cost Information Your Hospital – One-Time Operating Costs			
Cost Item	Your Hospital	Budgeted Y/N	Comments
Other			
RFP Selection Costs	N/A		
	N/A		
End user testers			
Implementation Support			
MD Superusers/coach	N/A		
Nursing/UC super users	N/A		
Other	N/A		
TOTAL			

One-Time CPOE Capital Costs – Estimate

MTC CPOE Cost Information
Your Hospital – One-Time Capital Costs

Cost Item	Your Hospital (thousands)	Budgeted Y/N	Comments
Hardware/Software			
Servers and OS	$ 400	Y	
Application License Costs			
– CPOE	$ 160	Y	
– Bar coded medication admin	$ 50	Y	
– Pharmacy	--		Not needed
– Scanning/Archiving SW	--		Not needed
Third-Party Software license costs	--		Not needed
Workstations: MD	$ 150	N	FCG estimate based on bed size
Laptop carts			
Handheld Devices: MD/Nursing			
Additional server monitoring tools	--		Not needed
Business Continuity Plan/Tools	$ 350	Y	
Single Signon and Integration	$ 200	N	Recommended by FCG
Network:			
Install Wireless LAN	$ 350	Y	
Upgrade to LAN/wiring			Completed
Network Monitoring equipment	$ 100	N	
Remote Access equipment/lines/VPN	--		Completed
Interfaces:			
License fees for interfaces:	--		None needed
Implementation Costs for interfaces	--		None needed
MD Champion	$ 100	N	FCG estimate
Implementation			
Vendor Costs	$ 50	Y	
Consultant Costs	N/A		
MD Resources	N/A		Do not plan to reimburse MDs
Inhouse Staff			
Implementation Travel Costs	$ 5	Y	FCG estimate
Training			
Vendor Costs	N/A		Included in implementation
Consultant Costs	N/A		
MD Training	N/A		Do not plan to reimburse
Nurse Training	$ 32	N	FCG estimate based on staff size
Pharmacy Training	$ 2	N	
Other Training	--		
Other:			
Construction	$ 150	N	
TOTAL	$ 2,099		

Appendix Five
Group One Hospital Sample Feedback Presentation



CPOE Readiness Assessment Background

- This assessment was conducted as part of the MA CPOE Initiative
  - Sponsored by the Mass Technology Collaborative (MTC) and the New England Healthcare Institute (NEHI)
  - Support from provider and payer stakeholders
  - Goal: All acute care hospitals in MA have CPOE implemented in 4 years
- Elements of the MA CPOE Initiative
  - Assess CPOE readiness of hospitals
  - Assist hospitals in understanding and improving readiness
  - Define system standards
  - Define requirements for systems (to gain acceptance and benefits)
  - Estimate costs and benefits
  - Solicit proposals from vendors
  - Secure funding assistance

CPOE Readiness Assessment Background

- The assessment was conducted in two parts:
  - Hospitals performed a self-assessment
  - Hospitals with self-assessment results of "close to ready" were selected for site visits
    - Interviews conducted to assess technical, clinical, and organizational readiness
    - Gaps identified and translated into a "readiness roadmap" of preparation projects
  - Note: Site visits of 2-3 days are not sufficient for detailed planning – but a useful start.

Why Assess CPOE Readiness?

- High-profile change initiative
- Broad scope – few processes and departments remain untouched
- Need to design new processes and technologies to accommodate workflows and roles
- Often, lack of prior experience with project of same scale and complexity and involving MDs
- Investments are large – time, money, resources

In sum, this is a high-risk, high-gain project and you have one chance to get it right!

CPOE Readiness Assessment Components of Readiness

We assess nine components of readiness

Assessment Components	Definition
CPOE Project Status	Evaluates the status of organizing, funding, and staffing the CPOE effort, including decisions such as selecting the software vendor and identifying groups and individuals to oversee and manage the effort.
Leadership	Measures the level of the organization's commitment to CPOE as demonstrated by CPOE as a strategic priority with approved funding, a clear set of objectives for CPOE, and senior executive and physician accountability for and sponsorship of CPOE.
Organizational Structure and Process	Measures the presence and effectiveness of organizational structures, relationships, and processes that are essential to successful implementation and maintenance of CPOE. Includes the use of multidisciplinary teams, project management, physician participation in clinical initiatives, and the presence of effective communication channels.
Organizational Culture	Evaluates the organization's capacity to successfully implement a large-scale change initiative that has a significant impact on clinician practice.
Care Standardization	Measures the organization's track record and progress in reducing undesirable variation in processes and clinical practices, in measurement as input to improvement, with a focus on ordering and order management.

CPOE Readiness Assessment Components of Readiness (cont)

Assessment Components	Definition
Clinician IT Experience	Evaluates clinician experience with use of computers and clinical applications as a measure of the challenges that lie ahead in training and coaching physicians and nurses to use CPOE.
Information Technology Management	Evaluates the roles, structure, and methodologies used to plan and support mission-critical clinical applications and meet clinical user needs.
Information Technology Infrastructure	Evaluates the status of the technical infrastructure's ability to support access, retrieval, and data management for advanced clinical systems performance levels.
CPOE Application Suite and IS Staffing	Assesses the extent of application replacement or rollout needed in advance of CPOE, the need for new interfaces, and the additional staff and external resources that will be needed (used for cost estimates only).

Reference

- For an overview of assessing computerized physician order entry (CPOE) refer to the article:
  - Stablein D, Welebob E, Johnson E, Metzger J, Burgess R, & Classen D. Understanding Hospital Readiness for Computerized Physician Order Entry. *Joint Commission Journal on Quality and Safety* 29:336-344, 2003.

CPOE Readiness Assessment Results – Priority Scale

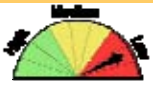
- Assessment results are presented as a priority scale – red indicates the lowest level of readiness.

Well Developed

Current efforts are on target and provide a solid foundation for CPOE readiness; sustain current activities and continue to improve.

Partially Developed

Some critical items and requirements are in place; however, current efforts need continued support and expansion.



Needs Work

Organization has not addressed all critical items within this component and is vulnerable without strengthening this category.

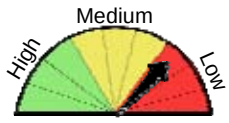
We assess what is needed for "go live." For hospitals that are a year away from implementation, some scores are appropriately low.

Our overall assessments is that Your Hospital is on track

- Infrastructure projects are underway
- Organizational culture ready for clinical change
- Success in past change initiatives involving physicians
- Need to accelerate work on care standardization
- Need to develop team, name physician leader
- Increased use of hospitalists will reduce training needs, create cadre of committed physicians

CPOE Assessment Results CPOE Project Status

Readiness Assessment Findings



Comments

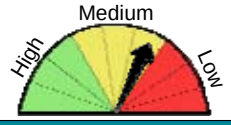
Need to:

- Set vision and objectives for CPOE
- Design the physician engagement strategy
- Identify the physician leader
- Develop the project structure and plan

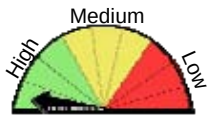
Suggested Implementation Projects

- Planning for CPOE generally takes time to accomplish
  - Vendor strategy and necessary contracting,
  - Cost estimation, budgeting, and budget approval
  - Identification of physicians and nurses with dedicated time to work on the project
- The status of these preparations is a useful gauge of how soon actual rollout can realistically occur.
- A physician leader for the project is essential
  - With dedicated time to guide decision-making in system-setup and rollout
  - To be change agent, advocate, and consensus builder
  - To ensure MD input is reflected in decision-making
  - To coach/encourage adoption and push when necessary
  - Spread the word about the clinical case for CPOE
- Another key element is a multi-disciplinary committee with decision-making authority

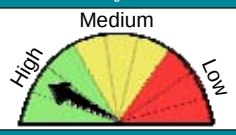
CPOE Assessment Results
Leadership

Readiness Assessment Findings	Industry Experience
	■ CPOE is a clinical change, not an IS project. ■ Leadership starts at the top – Board involvement – Medical Executive Committee engaged – Senior executives with defined leadership roles ■ Senior executives must be engaged and visible in support – A senior executive accountable – A physician executive accountable – Nursing and pharmacy leadership in support and at the table ■ The rallying cry for CPOE is patient safety – Tied to the quality improvement agenda – Widely understood throughout the hospital – Reflected in vision and objectives – Measurement to reveal baseline and show progress
Comments	
■ Neither the Board nor the MEC has *formally* endorsed CPOE as a high-priority hospital initiative ■ Executive ownership and accountability for success with CPOE should be clarified and serious consideration given to ownership by medical leadership ■ Active patient safety initiatives provide opportunity to tightly link CPOE with patient safety ■ A CPOE vision and concrete objectives are important for building organizational understanding, as well as for tracking and demonstrating success	

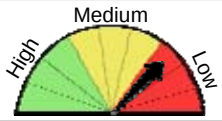
CPOE Assessment Results
Structure and Process

Readiness Assessment Findings	Industry Experience
	■ CPOE is 20 percent technology and 80 percent politics and process. Success requires capacity for change. ■ Prior experience with large-scale change initiatives is a plus as is a track record of medical staff, nursing, and pharmacy all addressing an identified gap in a process or practice. ■ Clear consistent communication is one key to bringing physicians on board: – The rationale – The project and how they will be involved – What they and their patients will gain – How the hospital will work with physicians to make the transition as easy as possible and successful ■ Successful hospitals use many formal and informal means to communicate with and hear from physicians.
Comments	
■ Strong quality improvement efforts in place are a big advantage to the hospital as it approaches CPOE. ■ Planning for many aspects of CPOE should be aligned with quality improvement initiatives (e.g., Med Reconciliation, abbreviations, stroke). ■ During system implementation, consider JCAHO, IHI 100,000 Lives, Leapfrog, and other quality and safety recommendations in the development phase.	

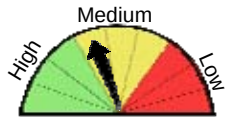
CPOE Assessment Results
Culture

Readiness Assessment Findings	Industry Experience
	■ Usually CPOE requires building or enhancing the relationship between the hospital and physicians – Belief that all are working toward a common goal – Trust that the hospital can deliver IT that improves care ■ Hospitals with a track record of including community physicians in committee work and improvement projects have a distinct advantage. ■ A culture of patient safety is the ideal backdrop for CPOE: – Goals and metrics widely understood – Reports at medical and nursing staff meetings ■ Organizations must have a realistic strategy for engaging physicians. Success requires working within the professional culture and governance of medical practice to achieve universal adoption, rather than merely issuing a mandate. ■ A few organizations compensate physicians (including community) to participate in CPOE set-up or training (but not to use the CPOE system). ■ For some physicians (i.e., department chairs, hospitalists) expectations for CPOE are written into contracts, job descriptions, and performance evaluation criteria.
Comments	
■ Many positives – MD involvement in QI and IS Steering Committee – Organizational focus on patient safety – Hospital involved in external collaboratives focused on safety – Some patient safety initiatives are physician driven (Stroke, Community Acquired Pneumonia, CHF) ■ Hospital still needs to develop position and policy concerning transition to CPOE – Expectations about physician use – Phase-in period – Process for encouraging and monitoring compliance – Hospital efforts to ease transition (support, coaching)	

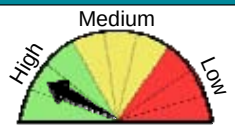
CPOE Assessment Results
Care Standardization

Readiness Assessment Findings	Industry Experience
	■ CPOE is 20 percent technology and 80 percent process and politics. Order management must be re-examined and a new process designed. This task typically reveals many non-standard practices to be brought into line and requires new efforts focused on standardizing major aspects. ■ One of the major benefits of CPOE is reducing unnecessary variation in practice and addressing gaps in safety. Some hospitals spend up to a year standardizing and preparing disease-level order sets and drug protocols. For many hospitals having physicians at the table to lead and participate in this work is new territory. ■ Prior work in either of these areas is a head start in setting up the structures and process to determine, implement, and encourage compliance with process and practice standards. ■ Policies must be established for verbal and telephone orders, as part of hospital policies about use of CPOE. Hospitals that achieve widespread physician adoption typically adopt formal policies that define the (limited) conditions when verbal orders or telephone orders are permitted and involve physician executives in managing compliance.
Comments	
■ Ongoing initiatives will increase standardization pre-CPOE in medication administration. ■ Current QI efforts are giving improvement teams good experience in reaching consensus and encouraging adoption of order sets and other standardized practices. ■ Need for an institutional process and policy around order sets and protocols is *recognized* but work to establish has not begun. For CPOE, this will need to address: – Order sets – Medication checking clinical decision support – Other uses of decision support (duplicate laboratory checking) ■ Investment in additional resources (dedicated people or evidence-based medicine tools) would increase speed of progress	

CPOE Assessment Results
Clinician Experience with IT

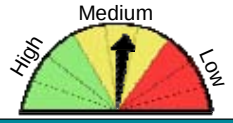
Assessment Findings	Industry Experience
	■ For physicians, mastering CPOE requires some training, a lot of coaching, and a personal investment in becoming an efficient user. ■ The more experience the medical staff has had with routine use of computers in the hospital and their practices, the less the hospital needs to train them in basic computer navigation. ■ Some hospitals plan system rollout to ease physicians through the transition: – First introduce e-mail and results look-up; – Then offer online document review and signature (a big win with physicians); – Some put remote access (from office and home) in place before CPOE. ■ Prior success in delivering clinical IT to physicians also builds trust and confidence that such projects can be a win-win for hospital and the medical staff.
Comments ■ Physician remote access will reduce the challenges of introducing CPOE. ■ The planned rollout of e-signature will be a big win and further reinforce regular use of computers for care. ■ Optimizing the Visual Flowsheet and PCI for physicians would further build physician enthusiasm.	

CPOE Assessment Results
Information Technology Management

Readiness Assessment Findings	Industry Experience
	■ When CPOE is the first advanced clinical application, IS departments often do not have the skills and experience on the staff. ■ Design and build of CPOE requires new disciplines (e.g., rapid application development and testing processes) and new dedicated (e.g., clinical analysts, physicians to spend time on set-up, trainers, possibly a clinical applications manager). ■ CPOE requires 24x7 access to staff able to assist physician users. ■ The earlier physicians (including community physicians) participate in decision-making about IS the better. Ideally roles should include system selection, system planning, system setup, and rollout strategy. Physician representatives are also critical for the IS Steering Committee and/or CPOE Project Committee, which is often lead by a physician. ■ Most organizations have implemented strict CPOE policies and procedures for training – "no training, no access" and monitor attendance. These organizations have made the most progress.
Comments ■ The training approach for Clinical Documentation implementation was very successful and provides a good model for planning for CPOE. ■ Current involvement of community physicians in IS Steering Committee, system selection, and rollout is a good starting point for involving MDs in subsequent planning and decision making for CPOE. ■ A plan for monitoring physician use and targeting physicians for individual follow-up will be important for success with CPOE.	

CPOE Assessment Results
Information Technology Infrastructure

Assessment Findings



Comments

- Projects already underway will build additional components of infrastructure for CPOE:
  - Upgrade to Citrix for remote access
  - Disaster Recovery project
  - Adding wireless access points to non-patient care areas
- Further ramping up of infrastructure in a few areas should include:
  - Physician access (fixed and mobile)
  - Enhanced access (sign-on, possibly proximity badges and/or biometrics)
  - Physician Help Access staffed 24x7 (e.g., Hot Line)

Industry Experience

- Many hospitals must upgrade network, desktop support, processing power, and redundancy to meet CPOE system performance requirement.
- "No physician stands in line waiting to access the system" is a design rule.
- Secure remote access is a must to allow physicians to enter orders from home, office, etc.
- The majority of organizations who have recently implemented CPOE implemented mobile, wireless devices for CPOE from the onset (laptops on medication carts, portable flat screens for clinical rounds).
- The CPOE device plan is a combination of mobile and workstations to accommodate a unit's specific workflow and ergonomics.
- System integration between orders, pharmacy, clinical data repository, and clinical documentation is essential to achieving a smooth workflow and eliminating duplicate entry.
- System response time and availability are significant issues for physicians and they will not adopt a system where they perceive the response time to be slow or the system unavailable.
- Use of biometric and proximity devices for user authentication is in the early stages of adoption.

Roadmap for Readiness Activities:
Planning Projects

Projects	Recommendations	Timing*	Budget+
Set CPOE Vision and Objectives for Your Hospital	■ Create a shared, clinical vision for how care will be delivered once CPOE is in place – use to educate/generate discussions with the clinicians. ■ Define expectations for physician participation and policies to reach objectives (use, by when); incorporate in vision and objectives (e.g., "CPOE will become the vehicle for physicians to write all orders in this hospital."). ■ Define specific patient safety objectives that can be tracked as evidence that value of CPOE is being achieved.	2-3 months	
Design Physician Engagement Strategy	■ Develop and approve physician engagement strategy: – Expectations (policy, monitoring) – Incentives and support ■ Design approach to training and support to maximize physician acceptance and speed of transition.	3-6 months	
	■ Set up process for ongoing use, monitoring, and follow-up.	Within 3 months before go-live	
Evaluate PCM to enhance usability for physicians	■ Engage IS Steering Committee. ■ Involve new CMO and community physicians in evaluation. ■ Depending upon decision, purchase and incorporate into CPOE plan.	4 months, start now	
Develop CPOE Project Structure and Plan	■ Hire project manager. ■ Develop a comprehensive CPOE implementation plan, including schedule and milestones, pilot (if applicable), and rollout strategy.	Start now	
	■ Assemble Project Advisory Group. ■ Identify the members of the project team. ■ Define and communicate accountabilities, roles, and responsibilities. ■ Hire analysts.	6 months (start once project manager is on board)	
	■ Hire additional technical resources.	Within 3 months before go-live	

*Unless specified, projects can start now but can be deferred until later in the planning process.
+Capital costs, first-year maintenance costs later in the planning process.

Roadmap for Readiness Activities: Planning Projects

Projects	Recommendations	Timing	Budget
CPOE Access Strategy and Device Deployment	■ Will be essential for order management with CPOE. Creates a clinician-driven analysis of the access requirements for CPOE in clinical and support areas. Technical resources will be required to facilitate the consideration of devices and technology. ■ Project includes the selection, design, installation, and configuration of end user devices to support CPOE.	3-6 months (Start at least 9 months before go-live)	
Single Sign-On Selection and Implementation	■ Single sign-on strategy to synchronize the log-on process and support pass-thru of authentication credentials to multiple information systems. Select a product that will best fit the current application mix. ■ Consider proximity devices and biometrics for enhanced ease of access and log-off.	Optional, TBD in plan	
Physician Help Desk Strategy	■ Investigate options for providing 24x7 CPOE support for physicians. An MD Help Service needs to take into account physicians who are not regular admitters to your hospital and come to the hospital after hours and on weekend. Consider a Physician Hot Line.	(Part of CPOE plan)	
Disaster Recovery/ Business Continuity Plan	■ Complete a disaster recovery/business continuity plan that provides for high availability and performance for the clinical applications suite.	5 months (complete 6 months before go-live)	
Develop Communication Plan	■ Develop a communication plan that conveys clinical vision, objectives, CPOE as an organization-wide initiative that will change the way care is delivered, project status, and successes throughout the organization. The communication plan will provide the structure and form the foundation for ongoing efforts to keep staff informed and involved during the CPOE project and related activities.	Part of CPOE plan	

Roadmap for Readiness Activities: Implementation Projects

Projects	Recommendations	Timing	Budget
Link CPOE to the Overall Medication Management Software	■ Purchase and implement medication administration software.	Complete 6 months before CPOE go live	
Enable CPOE in ED	■ Purchase ED software.	Complete 6 months before CPOE go-live	
Enable Wireless Connectivity	■ Complete wireless rollout.	Complete 3 months before CPOE go-live	
Implement CPOE Train Staff		Per CPOE plan	

Interview Participants

CEO	CFO
CIO	COO
VP Patient Care Services	CPOE Project Manager
CMO (if applicable)	VP of Medical Affairs (if applicable)
VP Patient Care Services	Chairman of the Medical Staff
Director of Clinical Quality/Risk Management	Leading Community Physician
Hospitalist (if applicable)	Residents (if applicable)
Chair, Pharmacy and Therapeutics Committee	Director of Pharmacy
Clinical Applications Manger	Technical Manager

Appendix Six
Cost Model Framework

Budget Line Items		
Budget	Cost Category	Description
Capital	Hardware/Software:	
	Server upgrade/monitoring tools	Upgraded or new server to host CPOE and CPOE-related clinical applications, includes additional tools to monitor usage and alert operators when there are problems with hardware or software performance
	CPOE software	License fee for CPOE software
	Medication administration software	License fee for medication administration software
	Pharmacy software	License fee for new or upgraded pharmacy system needed to support the CPOE implementation
	Single sign-on	Hardware and/or software that allows end users to access multiple applications via a single logon.
	End user devices	Additional workstations, tablets, laptops, and other end user devices to support CPOE implementation
	Business continuity	Hardware and software to support 100 percent uptime. This typically means redundant networks, application servers, and data bases.
Network		
	Wireless Local Area Network	Implementation of a new wireless network
	Upgrade existing networks	Additional hardware and tools to support the new equipment and access to the local area networks and/or wide area network
	Network monitoring tools	Tools that monitor network usage and performance, and alert network staff to a problem or potential problem
Interfaces		
	License fees and implementation costs	Software license fees and implementation costs to install a new interface. For example, interfacing CPOE to another vendor's pharmacy system or medication administration system
Implementation		
	Vendor costs	Clinical system vendor's fee to implement the application(s) at the hospital
	Additional outside assistance	Contracted assistance for additional implementation support for CPOE
	MD resources	Payment to community physicians and/or hospitalists to participate in the design and implementation of CPOE
	Hospital staff	Payment to other hospital departmental staff to participate in the design and implementation of CPOE
	Implementation travel costs	Travel expenses for vendor and outside contracted assistance as part of the CPOE implementation project

Budget Line Items		
Budget	**Cost Category**	**Description**
Training		
	MD training	Payment for physicians' time to participate in CPOE training classes or one-on-one training
	Nurse training	Payment for nurses and unit coordinators for time spent in CPOE training classes
	Pharmacy training	Payment for pharmacists and pharmacy techs for time spent in CPOE training classes
Other		
	Construction	Construction costs on the nursing units or other hospital space to provide room for additional workstations
	CPOE Planning	Cost for outside assistance to help the hospital create a detailed CPOE implementation plan
	RFP preparation/selection	Payment for outside and/or internal assistance to develop a CPOE system request for proposal and select the product
One-Time Operating	**User Testing:**	
	End user testers	Payment for internal resources to conduct an end user test of the CPOE application prior to implementation
Implementation Support		
	MD super users/coaches	Payment to internal staff to work as CPOE coaches for MDs
	Nursing/UC super users	Payment to internal staff for post-implementation support on inpatient units
	Other	Any other expense not otherwise listed
Ongoing Operating	**Hardware and Software**	
	Server maintenance	Annual maintenance fee for the CPOE application server/tools – if upgrade or new server was needed
	Clinical application software maintenance	Annual maintenance fee for CPOE and other clinical application software (pharmacy and/or medication administration) as needed
	Single sign-on maintenance	Annual maintenance fee for single sign-on
	End user devices – maintenance and spares	Annual maintenance fee for devices and/or money for new devices
Network		
	Network maintenance	Annual maintenance fee for upgraded wired and/or wireless networks and equipment
	Network monitoring tools maintenance	Annual maintenance fee for network monitoring tools
Interfaces		
	Interface maintenance	Annual maintenance fee for new CPOE-related interfaces
Additional IT Staffing		
	CPOE project manager	Salary and benefits for new position
	Clinical analysts/informaticists	Salary and benefits for new position(s)
	Pharmacy analyst	Salary and benefits for new position

Budget Line Items		
Budget	Cost Category	Description
	Programmers	Salary and benefits for new position(s)
	Help Desk support	Salary and benefits for new position(s)
	MD Liaison	Salary and benefits for new position
	Network analysts	Salary and benefits for new position(s)
	Clinical decision support analyst	Salary and benefits for new position
Non-IT Resources		
	Physicians	Compensation for ongoing physician involvement with the rollout and support of CPOE application
	Nursing/UC	Compensation for ongoing nursing and unit coordinator involvement with the rollout and support of CPOE application

Appendix Seven

Massachusetts Hospital CPOE Initiative

Feedback Report

To

Sample Hospital

October 2005

Sample Hospital's Readiness Scores

Assessment Component	Description	Score (Percent of Elements in Place or Complete)
A. CPOE Project Status	The status of organizing, funding, and staffing the CPOE effort, including decisions such as selecting the software vendor and identifying groups and individuals to oversee and manage the effort	63
B. Leadership	The level of the organization's commitment to CPOE as demonstrated by CPOE as a strategic priority with approved funding, a clear set of objectives for, and senior executive and physician accountability for, and sponsorship of the project	56
C. Organizational Structure and Process	The presence and effectiveness of organizational structures, relationships, and processes that are essential to successful implementation and maintenance of CPOE. Includes multi-disciplinary teams, project management, physician participation in clinical initiatives, and the presence of effective communication channels	100
D. Organizational Culture	The organization's capacity to successfully implement a large change initiative that has a significant impact on clinician practice	78
E. Care Standardization	The organization's track record and progress in reducing undesirable variation in processes and clinical practices, in measurement as input to improvement, with a focus on ordering and order management	67
F. Clinician IT Experience	Clinician experience with use of computers and clinical applications as a measure of the challenges that lie ahead in training and coaching physicians and nurses to use CPOE	78
G. Information Technology Management	The roles, structure, and methodologies used to plan and support mission-critical clinical applications and meet clinical user needs	90
H. Information Technology Infrastructure	The ability of the current technical infrastructure to support access, retrieval, and data management for advanced clinical systems	45

	Average Readiness Score				
Assessment Component	**Sample Hospital**	**All Responding Hospitals**	**Hospitals <100 beds**	**Hospitals 100-199 beds**	**Hospitals 200+ beds**
A. CPOE Project Status	63	52	41	53	57
B. Leadership	56	59	55	62	59
C. Organizational Structure and Process	100	89	89	92	86
D. Organizational Culture	78	79	72	83	80
E. Care Standardization	67	75	78	80	66
F. Clinician IT Experience	78	62	58	64	64
G. Information Technology Management	90	77	66	83	78
H. Information Technology Infrastructure	45	38	28	46	35

Appendix Seven

Massachusetts Hospital CPOE Initiative

CPOE Readiness Roadmap Guide

October 2005

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INTRODUCTION

The Massachusetts Technology Collaborative has launched a project to achieve statewide implementation of Computerized Physician Order Entry (CPOE) in Massachusetts hospitals. About thirteen hospitals in Massachusetts have implemented CPOE, according to the information recorded in the The Leapfrog Group survey and available from the Massachusetts Hospital Association. The remainder, a total of 60 hospitals, were surveyed in April-June 2005 to ascertain the status of planning for, and implementation of, CPOE via an online assessment tool. The purpose of the assessment was threefold:

1. To learn more about the project status in Massachusetts hospitals to guide further planning of the statewide initiative.
2. To obtain hospital-specific information for use in projecting costs of implementing CPOE.
3. To provide feedback to hospitals about opportunities to improve readiness based on accumulated industry experience with successful CPOE implementation.

A feedback report has been prepared for each of the 51 hospitals that completed the online assessment, displaying results for each component of readiness examined. This handbook has been prepared to accompany the hospital feedback report.

The document mirrors the organization of the readiness feedback report, which covers eight different components of preparation for CPOE:

A. CPOE Project Status
B. Leadership
C. Organizational Structure and Process
D. Organizational Culture
E. Care Standardization
F. Clinician IT Experience
G. Information Technology Management
H. Information Technology Infrastructure

Each component includes a number of characteristics of the organization or the information technology in place that lays the foundation for eventual success with CPOE. When they are not present, the challenges ahead are greater; if a significant number are not present, projects can be delayed, stalled, or fail.

Each of the readiness components is described in this information guide, along with a review of the importance to a successful CPOE project. Typical projects are also listed that hospitals can organize to address readiness gaps. It is hoped that the information in the feedback report, combined with the information in this handbook, will help CPOE project leadership in each hospital to increase readiness. Other information resources that can be useful are listed in References and Appendix A.

A. CPOE Project Status

Implementing CPOE is a large-scale project for any hospital because it affects so many of the hospital's clinical staff – physicians, nurses, pharmacists – and the highly complex order management process. Within the Information Systems Department, many decisions are required, and possibly new applications. Like any other large project, CPOE requires detailed planning, dedicated resources, and effective project management.

The assessment examines readiness for this component, assuming the hospital was planning to go-live with CPOE in the next 6-9 months. In hospitals with implementation projected for further in the future, one would not expect all of the activities to organize the project to be completed.

Several aspects of getting organized often take so much time that they need to be completed well in advance:

- ***Budget*** – Resources must be budgeted over multiple years. Given the size of the expenditure, many hospitals require board approval.
- ***Vendor strategy*** – Some hospitals select the CPOE application of the current Hospital Information System (HIS) or Clinical Information System (CIS) vendor without a vendor search, others after performing due diligence in a review of the marketplace. When the hospital is considering swapping out some or all current applications to identify a satisfactory CPOE application, it typically takes12-18 months to have a contract in place.
- ***Hiring key members of the project team*** – Many hospitals need to hire additional staff with the right skills and experience, especially physicians, nurses, and IS clinical analysts to work on the effort. Considerable lead time is needed to recruit, hire, and orient new staff.

Hospitals that have succeeded with CPOE have all used a dedicated project team to accomplish the necessary planning, workflow analysis, system set-up, pilot testing, and phased rollout. At a minimum, the project team for a small to medium-sized hospital includes:

- Physician Lead (0.5-1.0 FTE)
- Project Manager from IS or Nursing (1.0 FTE)
- Nursing Lead (1.0 FTE)
- Pharmacy Lead or Analyst (1.0 FTE)
- IS Clinical Analyst (1.0-2.0 FTE)

In the initial stages of implementation not all of the clinical analyst time is likely to be required. Otherwise though, these staff are fully dedicated to the project for 12-18 months (or however long it takes to implement hospital-wide) and then on a scaled-back basis for ongoing support. In large hospitals, the project team is likely to include more representation from nursing and other departments, as well as possibly additional physicians.

CPOE implementation requires many decisions ranging from how far to push standardization in order management across departments and nursing units and how to train physicians to what values should be allowable entries for specific data fields in order screens, and what types of mobile devices to offer physicians. In addition to assembling the project team, getting the project structure in place requires assigning roles and responsibilities for decision-making during project planning, system setup, testing, piloting, and actual rollout.

Typically, a project steering committee is created to meet regularly (weekly during some phases) to review and guide the work of the project team. In addition, the Pharmacy and Therapeutics Committee (or a subcommittee) and Patient Safety and/or Quality Improvement Committees are responsible for many decisions involving medication management, order sets, and clinical decision support, with major policy decisions involving the medical staff or nursing referred to the Medical Executive Committee and Nursing Practice Council, respectively. (Project structures in three different community hospitals are described in Reference 1.)

Hospitals in early stages of organizing the CPOE project may find the following list of projects helpful.

No.	Initiative	Description	Major Activities
1	CPOE Project Plan	Creates a project work plan including milestones, activities, staff/responsibilities, timeline, and dependencies to implement and manage the CPOE initiative	•Develop a CPOE work plan and schedule that is realistic and measurable – one that is agreed upon by all constituencies •Convene multi-disciplinary representation to set expectations •Document and monitor CPOE implementation plan
2	CPOE Application Strategy	Determines how CPOE capabilities and implementation fit within the broader clinical applications portfolio and goals and organizational IT strategy – a precursor to selecting the vendor application for CPOE	•Discuss and plan with a multidisciplinary team how CPOE is to be integrated with advanced clinicals, such as multi-disciplinary documentation and electronic medication administration record •Determine a process for iterative cycles of planning and implementation •If CPOE is not being added to an existing clinical portfolio, it may require discussion within a broader clinical system strategy and consideration of vendor replacement or use of a wrap-around CPOE solution to meet the organization's needs
3	CPOE Vendor Selection and Management	Includes CPOE vendor selection from determining selection criteria to evaluating candidates and negotiating contracts	•Determine multi-disciplinary selection team and selection approach to include key decision points •Identify key requirements to differentiate vendor solutions* •Perform selection activities – market review to identify options, creation of a short list, demonstrations, reference calls, and site visits •Negotiate contract with selected vendor •Determine implementation plan with selected vendor •Determine vendor communication plan and manage vendor partnership
4	Budget Development and Approval	Creates a dedicated budget over several years for CPOE	•Estimate project resources (people and technology – types and dollars) to initiate and maintain CPOE •Obtain approval and funding sources

*MTC convened a group of advisors in Massachusetts to develop functional standards for the program. These address what is needed for physician acceptance, ease of implementation, and achieving the value from clinical decision support. Program participants can obtain a copy from MTC.

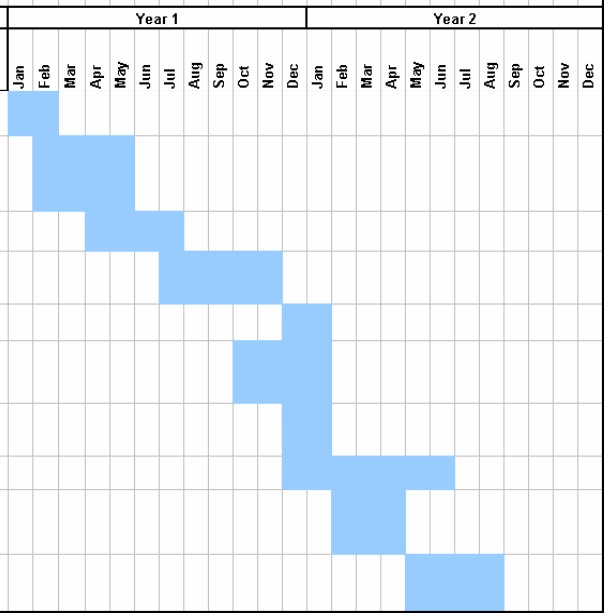
ADDITIONAL POINTS TO CONSIDER: ORGANIZING THE CPOE PROJECT

- Beyond formal roles in project management, physicians must own, lead, and drive design and implementation of CPOE. It is important to involve physicians, including independent community physicians, as early as possible.
- A strong project management orientation is required to keep the CPOE implementation on track and to ensure success.
- Creating a realistic project schedule and then committing necessary resources is one important step in organizing the CPOE project. The generic timeline shown on the next page does not incorporate the steps necessary in some hospitals to implement other software applications in advance of CPOE or to upgrade the network or other technology infrastructure.

Community Hospital CPOE Project Plan – Example

Application	Description
Required Prequisite Projects	
Application Platform Update	Install release of software needed for CPOE
Pharmacy upgrade/install	Install new system or latest release required for CPOE
Online-MAR	Install application or include as part of clinical documentation
Nursing documentation	Install functionality needed to collect patient data to support CDS
BC/DR upgrade	Implement solution that supports 24 by 7 uptime
Connectivity/Access	Wireless in the hospital, MD office connectivity, home access
Device Strategy	Tablets, workstations, laptops, PDAs including facility changes
Recommended Prerequesites	
Physician Desktop/Clinical Review	Physician application that supports results review and other look up functionality
Online Document Signing	Ability to sign documents on-line - first function that physicians use to enter information
ED Management	ED tracking, OE and management functions
Bar Code Meds Admin	Provides most up to date information about medication management

Computerized Physician Order Entry (CPOE)	Subtasks	Timeframe Range
Project Kickoff, Governance and implementation approach	Establish steering committee, application demonstrations, implementation appraoch, communications, core team roles and responsibilities	**1 - 2 months**
CPOE Design Work - Process	Establis ordering workflows, policies and procedures, standardize formulary, create order sets, agree on clinical deicision support criteria, and standardize dictionary terms and clinical vocabulary	**3 - 6 months**
CPOE Design Work - System	screen flows, and design interfaces. Finalize device strategy for nurses and physicians.	**3 - 6 months**
CPOE Application Configuration Changes and Interfaces	Develop dictionaries, code and unit test application and report changes, and code and unit test interfaces.	**2 - 6 months**
CPOE System and Interface Testing	Complete full system testing including all interfaces. Complete user testing.	**2 - 3 months**
Nurse, Unit Secretary, and Pharmacy Documentation Prep and Training	Prepare training materials and conduct training for nurses, unit secretaries and pharmacy personnel.	**2 - 4 months**
Physician Documentation Prep and training for pilot unit	Prepare training materials including smart cards for physicians,. Set training calendar. Conduct training for physicians on pilot unit.	**1 - 2 months**
Device Rollout	Purchase and install devices starting with the pilot unit.	**ongoing**
Live with Nursing (all units), physicians on pilot unit	Go live with nursing on all units and physicians on the pilot unit. Provide 24 by 7 go-live support for 2 weeks. Document and resolve open issues. Review and modify procedures as needed.	**2 - 4 months**
Physician Training for second and subsequent units	Select next physician group for CPOE go-live. Load new order sets, provide 1:1 training, provide 2 week go-live support for physicians, document issues and adjust application as needed. Continue roll out.	**2 - 4 weeks per unit/ MD group**



B. LEADERSHIP

Leadership is always cited as one of the critical success factors for CPOE. This is partly because any large-scale organizational project needs sustained commitment but also because this is usually the first time a hospital project affects how physicians do much of their work. Many of the challenges are organizational. Conventional wisdom from CPOE early adopters is that the work is only 20 percent technology and 80 percent change management and work flow.

Common leadership traits in hospitals that are successful with CPOE include:

- Senior executives have formal and visible roles in decision-making and ensuring the appropriate level of commitment throughout the hospital.
- The board is involved in endorsing the decision to implement CPOE.
- An executive other than the CIO is accountable, often the CMO and occasionally even the CEO.
- The Medical Executive Committee has endorsed the decision and is poised to play an active role in decision-making and policy development.
- Many physicians – including community physicians – have leadership, champion, or committee roles that connect them to decision-making.

All of these traits signal that CPOE is important and is going to happen. It also sets in place the right connections to decision-makers who can assign resources and remove barriers. For physicians, it shows that their issues and concerns will be given the proper attention.

Patient safety is the impetus for CPOE and for investing the considerable effort needed to put it in place. Hospitals that have achieved widespread physician adoption used patient safety as the clinical case (or “burning platform”) for taking action. A portion of the organizational challenge is motivating the medical staff to take time out of their very busy work life to learn how to do their work differently. Improving patient safety is a strong message against which it is difficult for anyone to argue that they do not have time. Using actual data on gaps in care – either already collected by the hospital as part of quality improvement or designed for this purpose – reinforces the message and puts to rest the inevitable reaction, “those errors do not happen here.” It also provides a baseline for demonstrating progress.

Hospitals in the early stages of putting in place the leadership for the CPOE project may find the following list of projects helpful.

No.	Initiative	Description	Major Activities
1	Establish CPOE Project Oversight and Leadership	Develops a structure to lead CPOE and establishes a decision-making structure to quickly resolve planning, design, implementation, and adoption issues	•Define executive and physician roles and accountabilities •Recruit physician leaders as necessary to ensure good representation on groups working on the project •Engage the Medical Executive Committee to develop policies about CPOE such as: –How soon CPOE will be required –Use of verbal and telephone orders –Use of hospital order sets Note: This may be accomplished as part of developing the CPOE Project Plan
2	Link CPOE with Quality Improvement	Integrate CPOE with Quality and Performance Improvement structures and processes	•Ensure that CPOE is on the quality/safety agenda and that the hospital community understands this connection •Integrate CPOE as one of the available interventions in quality/safety improvement projects •Involve the individuals and groups working on patient safety/quality in identifying initial performance improvement targets for CPOE and integrate into planning and rollout •Identify measures tied to the hospital's quality/safety goals that can be used to demonstrate the need for CPOE and the step-wise achievement of improvement •Collect baseline information and set up a process for monitoring as CPOE is rolled out
3	Define CPOE/ Clinical Vision and Objectives	Creates a shared, clinical vision for how care will be delivered once the new clinical processes and applications are in place. The purpose of developing and disseminating a CPOE vision is to gain consensus on the goal	•Outline impacts that CPOE will have on clinicians, focusing specifically on physicians, nurses, and pharmacists •Incorporate expectations about physician use and the value to patient safety and order management •Validate vision with clinical and executive staffs •Use vision to ensure common understanding of rationale and value of the project in the hospital community •Consider giving the project a name and/or slogan, if the hospital does not already have one for advanced clinical systems

ADDITIONAL POINTS TO CONSIDER: LEADERSHIP

- Passion (what some early adopters have called "a fire in the belly") and personal commitment are key characteristics of leaders of successful CPOE projects. This is probably more important than title.
- CPOE is not a technology initiative – it is a change in the way an organization delivers care and should be treated as a key building block on the road to safer, more reliable care.
- Having the CIO as the accountable executive is viewed by vendors and early adopters as a high-risk strategy.

C. Organizational Structure and Process

CPOE is a big change project. This component of the assessment looks at the organization's capacity for change, as indicated by structures, process, and past success with clinical change.

Change related to CPOE is easier to make in an organization with a track record of succeeding with big change projects. In some hospitals, multi-disciplinary committees have already tackled patient safety issues and other gaps in care in a big way. They may have worked on medication reconciliation at patient transfer to a new level of care, improvements in areas addressed by the JCAHO core measures, or large industry initiatives such as the IHI 100,000 Lives Campaign. When this is the case, there is both a sense of accomplishment and know-how in the hospital about how to work across departments and disciplines to achieve improvement. In this state, the organization has an easier time sorting out the many decisions involved in CPOE. If, on the other hand, past attempts at change have not included physicians or multi-disciplinary efforts have stalled or failed, the hospital needs to build credibility and know-how with some successes. (Reference 2 describes how one community hospital set about to do that in advance of CPOE.)

Communication, especially to physicians, is important to build the case that CPOE is the right thing to do and to keep everyone informed about what is happening and what to expect next. Community physicians are particularly challenging because they spend little time in the hospital and travel time makes it harder to attend medical staff meetings. A hospital that already has multiple mechanisms for both getting word out to physicians *and* hearing back from them about changes that affect them is way ahead of the game.

Hospitals in the early stages of tackling quality improvement on a large scale may find the following list of projects helpful.

No.	Initiative	Description	Major Activities
1	Develop Communication Plan and Process	Develops a communication plan to provide staff with accurate information regarding CPOE projects, and subsequent process/policy and procedure changes. *The goal of effective communication is to prevent issues from arising*	•Charter a Communications Team to manage communications for CPOE or advanced clinical systems, as appropriate •Determine target audiences, messages, and communication timing (consider coordinating communications with key milestones in the CPOE implementation plan) •Create new and strengthen existing communication channels, with a focus on the IS/physician dialog •Assign resources to prepare, distribute, and deliver information updates (presentations for staff meetings, newsletters, posters for the physician lounge, etc.) •Develop formal and informal feedback mechanisms especially two-way communication channels (e.g., intranet, suggestion boxes)

No.	Initiative	Description	Major Activities
2	Initiate Structure and Process for Hospital-Wide Quality/Safety Improvement	Sets up structure and process for accomplishing multi-disciplinary, multi-departmental improvement	•Engage medical, nursing, and quality leadership to set up structures and assign accountability and roles •Develop an agenda of patient safety/quality projects that are viewed as important •Incorporate measurement and reporting
3	Design and Implement Measurement Concerning CPOE	Sets up metrics and process for measurement that will document progress with adoption and value to patient safety and quality	•Starting with the vision and objectives, develop metrics of use and impacts on timeliness and quality of care •Consider measures already routinely collected and those available from the CPOE software •Assign resources and develop process for data collection and reporting •Collect baseline information •Incorporate measurement plan and results in communications to the hospital community

ADDITIONAL POINTS TO CONSIDER: ORGANIZATIONAL STRUCTURE AND PROCESS

- Leaders of successful CPOE projects advise that there is no such thing as too much communication, especially with physicians. Some have instituted a new position – physician liaison – to ensure that planned communication, both in person and via vehicles such as a newsletter, actually happens. If CPOE and other patient safety initiatives are to be discussed at staff meetings, someone needs to be responsible for preparing the materials.
- Two-way communication channels are critical to obtaining feedback about physician concerns so they can be addressed. Accessibility of executives and project staff is critical. Among the other vehicles some organizations use are focus groups, e-mail project mailbox, and voicemail box for the project. Quickly responding to each question or request is, of course, as important as soliciting feedback.
- In hospitals where the staff have little experience tackling gaps in care outside of their own department, JCAHO core measures and safety issues identified by the Pharmacy and Therapeutics or Patient Safety Committee are natural targets for building organizational structures for, and experience with, clinical change.
- Most hospital leaders report that not all physicians read electronic mail. As a result, this is usually employed as only one of the communication vehicles about big initiatives such as CPOE.

D. ORGANIZATIONAL CULTURE

The hard work of implementing CPOE is easier when the medical staff has a good working relationship with both the administration and the IS department, and the entire hospital community has come to expect a continuing focus on patient safety. This component looks at these signs that the organizational culture invites, rather than discourages, everyone to pitch in and play their role in an important change. It can be very difficult in some organizations to make change "stick."

A hospital where many physicians participate in and lead patient safety initiatives and patient safety is part of the organizational fabric (discussed at staff meetings, constantly referenced in communications) is the ideal backdrop for CPOE, which is logically tied to patient safety and quality. The nature of the historical relationship between physicians and the hospital determines how hard it is to convince the medical staff that all parties are working toward a common goal and that the hospital and IS Department can deploy computer systems that improve care and the work environment.

Every hospital needs to go through the steps of developing a physician engagement strategy. In those with a higher readiness score on this component, less is required upfront to build the necessary trust and consensus that CPOE is the right thing to do.

No.	Initiative	Description	Major Activities
1	Physician Engagement Strategy	Define expectations for physician participation, cultivate champions, and make a commitment to invest in making the transition for physicians as easy as possible	•Engage the Medical Executive Committee to define expectations for physician use of CPOE consistent with the Vision and Objectives (including timeline and related policies) •Reach consensus on the hospital commitment to physicians to invest in training and support •Identify incentives (if appropriate) for committee work and training •Cultivate physician champions across clinical departments and among community physicians and involve them in CPOE-related decision making •Formulate messaging around CPOE and communicate broadly to the medical staff •Develop process and accountability for monitoring adoption

ADDITIONAL POINTS TO CONSIDER: ORGANIZATIONAL CULTURE

- Project leads in hospitals that have adopted CPOE recommend being honest with physicians about CPOE; it does require some effort to learn and it will never be quite as fast as scribbling an individual order. However, when the hospital invests in setting the system up to be user friendly and in extensive training and coaching, electronic order writing can approach being time neutral. In situations where order sets can be employed, CPOE is much faster.

- Hospitals that succeed with physician adoption start out with the expectation that all orders (except for a few, defined circumstances such as a code) will be written in CPOE *once* everyone is convinced that order management is working properly, and physicians have had sufficient time to become proficient users. Realistically, at some point universal CPOE must become the standard of practice and its use enforced. (For more about how hospitals employ both ”carrots” and “sticks” and an example of a hospital policy, refer to Reference 1.)

E. CARE STANDARDIZATION

This component measures the ability of the organization to adopt or develop standard care processes and standards for care across the organization. This is important for CPOE because the computer expects a fairly regularized process. As CPOE project teams tackle order management work flow across the hospital, they are always surprised by the large variation in process and practice across clinical areas, which has crept in over the years. Some variation is warranted because the work is different, but much that is not is inconsistent with standard operating procedures of the hospital and/or complicates setup in CPOE. The extent to which hospital teams have already tackled standardization is both a measure of how much work lies ahead *and* whether the structures and processes are likely to be in place to accomplish this work.

Signs that standardization in medication management is already in place include whether medication administration times and documentation are the same across acute care units. Certain patient information such as weight and allergy are critical input to both physician decision-making and medication checking in CPOE. If they are not already captured reliably, special attention must be paid to this gap. Many hospitals have been hard at work on medication management processes because of the focus on patient safety and medication reconciliation. All of this is good preparation for CPOE.

Current practices in formulary management can also make CPOE easier or more difficult to implement. If the Pharmacy and Therapeutics Committee actively manages formulary, always maintaining the up-to-date list and achieving good compliance from physicians, many of the tasks in system setup will be easier. Otherwise, considerable work and discussion to achieve agreement lies ahead.

Much of the value of CPOE comes from using electronic ordering as a tool to guide and critique care. A second reason for looking at efforts to reduce variation in care is to ascertain the current state of institutional experience in coming together to determine desirable practice and encourage its adoption. One of the most powerful tools in CPOE for bringing recommended practice to physicians – pre-defined sets of orders for a diagnosis or condition – is also critical for physician acceptance because it cuts down on order writing time. The hospital will have a much easier time with CPOE if there are already processes in place to develop and encourage use of order sets and if order sets and protocols for high-risk medications have become part of how care is delivered. Therefore, these tools for reducing variation in care are also addressed in this part of the readiness assessment.

Hospitals in the early stages of working on care standardization may find the following list of projects helpful.

No.	Initiative	Description	Major Activities
1	Develop Process and Initiate Work on Institutional Order Sets	Jump-starts policies and process to develop and adopt order sets as a vehicle for improving patient quality and safety	• Engage Medical Executive Committee to set policy regarding use of institutional order sets and define process • Collect existing standing orders from all units of the hospital • Identify high-priority conditions and situations to be addressed and assign ownership • Convene assigned groups to research and reach consensus on recommended practices • Obtain review and sign-off by designated groups such as clinical departments, nursing, Pharmacy and Therapeutics committee, etc. • Educate clinical staff about rationale, policies, and rollout of order sets • Test and deploy order sets and protocols • Set up accountabilities and process for regular review and update of order sets and protocols
2	Review and Redesign Order Management	Provides an opportunity to increase standardization in order management, where it is desirable, in advance of CPOE	• Engage the MEC, Patient Safety, or other appropriate committee that governs safety to identify process targets and specific gaps to address • Utilize multi-disciplinary teams (physicians, nurses, pharmacists) to redesign the requisite processes to reduce undesirable variation • Pilot test new processes and revise as necessary • Engage the governing committee to approve hospital-wide adoption and make necessary policy changes • Communicate rationale and changes to clinicians in the hospital and conduct training as necessary • Rollout redesigned process components • Monitor use and effectiveness of redesigned order management processes
3	Develop Process and Plan for Managing CPOE Clinical Decision Support	Establishes in advance the priorities for clinical decision support in CPOE and sets up the process for managing it	• Engage quality and safety leadership in the hospital to develop policies about focus and plan • Assign a small number of physicians and clinical analysts to become experts in the CDS tools of the advanced clinical system to be used • Assign accountabilities, group and individual roles, and process for – Setting agenda and priorities – Setting up and testing CDS – Review and approval – Physician education – Piloting and rollout – Ongoing maintenance of rules and other tools • Identify required patient information (e.g., allergies, weight, BSA, current problems) needed by CDS and ensure documentation processes will provide it • Incorporate CDS setup in system implementation plan • Reference 3 includes approaches and tools for managing clinical decision support

No.	Initiative	Description	Major Activities
4	Update Pharmacy Formulary	Provides an opportunity to clean the formulary and collect the information needed for medication order master files in CPOE	•Engage the Pharmacy and Therapeutics Committee or other appropriate group to update the formulary •Use this as a good time to reassess hospital policies for formulary management •Ensure that all of the information needed for CPOE system setup is collected at the same time •Communicate to physicians any changes in formulary management

ADDITIONAL POINTS TO CONSIDER: CARE STANDARDIZATION

- JCAHO core measures and other regulatory requirements are a logical starting point for institutional order sets.
- Pre-CPOE, many hospitals have made hospital order sets available online via the hospital Intranet. Assuming that sufficient terminals and printers are available, online order sets can be printed from any location in the hospital. Any changes also go into effect immediately. Making order sets part of the standard care process in this way is great preparation for CPOE.
- Organizations build and improve their clinical decision support capability over several years. Many initially implement guided choices – templates, order sets, calculations, basic mandatory fields, and access to reference databases initially and then move to more advanced alerting and prompting later.

F. CLINICIAN IT EXPERIENCE

The learning curve for CPOE – and both the investment needed to coach physicians and the time lag before they become competent users – is reduced when clinicians in the hospital already routinely use computers. This part of the assessment looks for the typical pre-CPOE computer uses:

- Electronic mail for routine communication
- Retrieval of electronic laboratory test results and other patient information
- Online clinical documentation
- Online review and signing of transcribed reports both within the hospital and from outside locations

Many hospitals plan to introduce physicians to electronic results management and document signing ahead of time to ease the transition to CPOE.

Sometimes current use is uneven, with some physicians still relying on others to look up laboratory results, for example. In other cases, the views and screen flow can be improved to encourage more enthusiastic physician use or a new physician portal introduced that does a better job of organizing communications and information for physicians. Efforts such as these not only build computer skills for users but also increase the value of computer use.

The following projects may be of interest for hospitals with a low score on this readiness component.

No.	Initiative	Description	Major Activities
1	Optimize Current Applications for Physicians	Attempts to increase the utility and ease of use of current applications	•Engage IS and physician representatives to gain a better understanding of reasons for non-use and opportunities to optimize •Consider introducing new portal application, if relevant, and additional terminals, if this is a factor •Consider customizing displays and patient data flow sheets to meet the needs of different clinical services •Consider expanding online reference material that is a high priority with physicians
2	Increase Physician Use With Additional Support		•Evaluate data on system use to identify users to target for additional support •Design and implement coaching program •Monitor physician use on an ongoing basis

ADDITIONAL POINTS TO CONSIDER: CLINICIAN IT EXPERIENCE

- Prior success with delivering computer applications that physicians find useful builds trust in the hospital's ability to do so. This is another reason to focus on optimizing current applications for physician users.
- Most physicians welcome remote access to clinical systems because they can check on their patients from the office or home. Because this is also a pre-requisite for CPOE, many hospitals make it as easy as possible to establish remote access, including providing assistance with technical setup and other services.

- Although physicians are the focus of the above discussion, nurses also need to make the transition to computers. Depending upon the stage of clinical system rollout, many hospitals have opportunities to optimize use of nursing applications as well. Not only do nurses provide critical information such as weights needed for CPOE, but electronic documentation adds information about patient status and medication administration to what physicians can retrieve online. Often, hospitals find additional training and education can increase the adoption of point of care, real-time documentation by nurses.

G. Information Technology Management

The more experience the hospital IS Department has with advanced clinical applications, especially for physicians, the more likely that the existing staff and processes can support CPOE and that physicians trust the hospital to deploy systems that improve patient care. This component of the assessment looks at these processes. It also looks at the extent to which physicians are connected to decision-making about systems intended for them.

To manage large, complex IT projects, successful hospitals typically have an IS Steering Committee or other group overseeing IS projects, ensuring coordination between projects and other hospital initiatives, and monitoring progress to identify and address problems that arise. Important members of this group are executives and managers who have the clout to provide resources and remove barriers. In addition, the likelihood that clinician needs and expectations for computer systems are met is greatly increased when credible representatives of the medical and nursing staff directly participate in IS management. For CPOE it is also important that Pharmacy be at the table.

Mastering CPOE and becoming efficient at writing electronic orders requires some form of training for physicians. Unless the hospital has already implemented advanced clinical systems such as clinical documentation and electronic medication administration, clinician training is likely to require a new structure and approach that emphasizes coaching and provides multiple ways to learn. (Methods for, and lessons learned about physician training are discussed in Reference 1.)

No.	Initiative	Description	Major Activities
1	CPOE Training Plan	Creates a structure and process for training with defined roles and accountabilities to help position for successful implementation of CPOE	•Establish workgroup to define CPOE training structure and determine roles and responsibilities (especially for physician training) •Identify (recruit, as required) individuals to perform CPOE training •Develop course content and tools for classroom training, individual coaching, self-guided training, and assistance resources (e.g., online HELP, reference guides) •Determine adequacy of training space and enhance as necessary •Build training schedule coordinated with phased CPOE rollout •Develop methods for tracking training status and trainee satisfaction
2	Constitute or Revitalize IS Steering Committee	Creates or reactivates a group with decision-making authority to oversee large projects such as CPOE	•Define purpose and procedures •Recruit hospital executives, physician and nursing leadership, physician representatives (including community physicians), and managers from departments such as Pharmacy and Quality Management •Involve immediately in reviewing plans for CPOE, making decisions, and removing barriers

ADDITIONAL POINTS TO CONSIDER: INFORMATION TECHNOLOGY MANAGEMENT

- Early adopters of CPOE learned that for physicians coaching works better than classroom training so they emphasized coaching. Other lessons include that "just-in-time" is critical, including during the first few weeks of rollout and that physicians must be trained using the actual screens they will use.
- For CPOE and other advanced clinical systems, hospitals typically develop a training team that includes nurses and others who understand both the application and order management work flow, as well as rely heavily upon Super Users to provide assistance as needed.
- Some hospitals require participation in CPOE training/coaching before physicians are given electronic access to CPOE. This ensures that users have at least a basic understanding of how CPOE works before they start writing orders.

H. INFORMATION TECHNOLOGY INFRASTRUCTURE

Two aspects of IT performance are absolute prerequisites for CPOE:

- Availability (uptime) around the clock
- Instant responsiveness to each user keystroke and screen flip

When these are not in place, the hospital cannot count on accessing and managing patient orders at all times, and physicians must spend more time writing orders. Most hospitals need to invest in network upgrades, added processing power, and tools for monitoring and managing network and system resources to ensure the necessary level of performance for CPOE and other advanced clinical systems. In addition, provisions are made for system continuity in the event of a disaster, so that critical patient information is not lost and CPOE can be brought back online as soon as possible. This component examines the stage of preparation for these and other infrastructure requirements for CPOE.

Another absolute requirement is easy access to the system. If physicians are to write electronic orders for their patients, they need immediate access wherever they write orders – on the nursing units, in the physician lounge, in their office, from home. Requiring busy physicians to stand in line for a terminal is not acceptable, and hospitals usually deploy a mix of fixed and mobile devices to ensure quick access even during busy times of the day. Hospitals also promote and actively support remote access so that physicians can write admission orders from their office and check on patients, as well as write orders, from home.

Mobile access via a wireless network is not only expected by many physicians, but it is a good fit with physician workflow as they round on their patients and they need only to sign-on once. Wireless also reduces the need for fixed-user devices on space-constrained nursing units. Conventional wisdom is that mobile access is a pre-requisite for CPOE. (Wireless access is also required for nurses to document vital signs, medication administration, etc. in real time.)

Many hospitals offer physicians more than one type of mobile device, usually including laptops on carts, though they find that fixed devices in work spaces set aside for physicians are also required. It is important to involve physicians in the review and selection of wireless devices. Today mobile laptops and tablets are used most often because other devices with smaller screen real estate are functionally limited for viewing patient information and writing orders.

Most hospitals need to change the Help Desk function to support physicians when they need assistance. Staff who know and can fix or explain all of the functions of CPOE must be available 24 x 7.

No.	Initiative	Description	Major Activities
1	Network Assessment and Upgrade	Upgrades the capacity of the network infrastructure to support CPOE	•Assess network capacity including need for wireless access •Develop, test, and deploy the upgraded infrastructure •Acquire and implement network performance monitoring and management tools, as necessary •Monitor and maintain performance
2	Point of Care Device Plan/ Clinician Mobility	Analyzes the point-of-care access requirements for CPOE in clinical and support areas, as well as remote access	•Review implications of new processes and work flow for CPOE •Determine the appropriate devices (e.g., hand held, rolling carts, workstations, etc.) •Consider conducting a device fair for the presentation, review, and consideration of the various device types/models available •Determine the number and location of new devices throughout the hospital campus •Identify and address operational and facility issues (e.g., renovations to nurses stations to accommodate physician work space, locations for the charging of rolling carts, charging and check-in/out of wireless devices, etc.) •Develop documentation of the desired devices, types, and locations •Complete a deployment plan and schedule that will support rollout •Involve physicians in choices of end-user devices (among those that meet technical and cost criteria)
3	IT Service and Support Management/ Operations Service	Upgrade the Help Desk to add skilled resources to answer calls from physicians on a 24 x 7 basis	•Redesign Help Desk roles and responsibilities •Define policies and procedures for new areas of responsibility for Help Desk •Develop the call routing for physicians •Incorporate new processes into current Help Desk software management package •Identify staff with requisite knowledge and communication skills to provide user support to physicians
3	Continuous Computing Architecture Plan	Analyzes the systems architecture and implementation alternatives to meeting the reliability requirements of CPOE	•Identify system availability requirements •Review key operations and maintenance processes and technologies •Review current system architecture, including storage, backup, and recovery solutions •Identify system processor, peripheral, application, and network architecture and configuration alternatives aimed at meeting or exceeding the identified availability requirements •Evaluate most promising solution alternatives •Provide recommended systems architecture and configuration solution

No.	Initiative	Description	Major Activities
4	Disaster Preparedness Plan	Assesses the existing recoverability and coping strategies for information systems outages, including CPOE and addresses the gaps	•Define the impact of short-term and long-term outages on applications, data backup/restoration requirements, and application recovery priorities. •Evaluate the current documentation, policies, procedures, and the technologies for providing disaster recovery •Prioritize recovery requirements and develop a plan for developing new policies and procedures along with acquiring and implementing new technologies
5	Upgrade Clinician Sign-on	Designs and implements single sign-on to synchronize the logon process and support pass-through of authentication credentials to multiple information systems	•Define customer and security requirements •Research SSO frameworks offered by vendors •Develop a short-list of vendor products and select best fit using pre-established criteria •Conduct proof of concept in a lab environment •Build plan to migrate to standardized Identity Management across the entire organization •Conduct pilot implementation and full rollout

ADDITIONAL POINTS TO CONSIDER: INFORMATION TECHNOLOGY INFRASTRUCTURE

- Many components of the infrastructure take time to put in place. Vendors report that major contributors to long lead times to CPOE implementation are projects to upgrade networks and renovate facilities, either in the data center or on the nursing units.
- Whether actually working at the Help Desk or available by pager, in many hospitals the same clinical analysts who worked on system setup and training man the Physician Help Desk. E-mail and voicemail hot lines are other venues offered in some hospitals for non-urgent questions and suggestions from physicians. Timeliness and reliability of response to every inquiry are very important.
- Many hospitals now offer physicians access to images via PACS and the ability to review and sign dictated documents online. Multiple applications increase the value of single sign-on for both physician acceptance and security management.

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APPENDIX A. OTHER RESOURCES ABOUT IMPLEMENTING CPOE

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Appendix Eight
Final Standards for CPOE

A. Physician Acceptance

Requirement	Description	Implications	Priority
A1. Design of order screens and data entry for complex orders	Complex orders for some medications and other services require specialized designs to accommodate the content.	The design approach taken influences how much effort is required to learn and use the system to write actionable orders. It also determines whether it is possible for physicians to write all of their orders using CPOE. Without specialized support, physicians are required to resort to free text, which a human needs to interpret.	
A1a. Complex sig	Specialized design to accommodate a complex order such as one with dose based on physical status (sliding scale) and multiple daily doses of different types specified in the same order.	Physician can convey all of the necessary information clearly in a single order (e.g., insulin, heparin)	1
A1b. Taper dosing	Specialized design to accommodate dosing adjustments in a single order from the physician perspective (e.g., steroids)		1
A1c. Titrating dose	Specialized design to accommodate the instructions the physician needs to convey in the order as a function of patient attributes or status		1
A1d. TPN	Specialized template to accommodate order the way a physician writes TPN orders	Even if physician does not write TPN orders, they need to be accommodated.	1
A1e. Patient-controlled analgesics	Specialized template to accommodate necessary dosing limits and instructions		1
A1f. Dosing expressed as weight-based and BSA-based	Ability for physician to specify dose by product as a function of weight or BSA and for the dose to be automatically calculated based on known patient data.	Especially important for pediatrics. Important to display parameters used in calculation.	1
A1g. Blood products	Specialized template to accommodate the instructions the physician needs to convey in the order		1
A1h. Restraints	Specialized template to accommodate the instructions the physician needs to convey in the order	JCAHO requirements for documentation accompanying orders for restraints	1
A1i. Two-party orders	Design that accepts physician-appropriate input and holds order in an incomplete status until completed by an authorized user from nursing or an ancillary department	Some orders for medications (“pharmacy dosing”), certain diagnostic procedures (laboratory, radiology), require input from a second user before the order is actionable.	1
A1j. Intravenous admixture—custom	Specialized template that allows physician to express dosing w/o requiring details about preparation that are the responsibility of pharmacy		1
A1k. Free-form order for miscellaneous items	Ability to enter *miscellaneous* care orders that don’t fit typical categories or templates (e.g., patient needs a special mattress)	Needed for CPOE to capture all physician orders	1

Requirement	Description	Implications	Priority
A2. When writing orders, ease and speed of locating those of interest for each patient	Options are available for the physician to locate and call up individual and groups of orders in different ways.	The effort physicians must expend locating orders in the system contributes to the time required for writing orders.	
A2a. Ability to select patient of interest from lists based on relationship with patient	Patients on this unit, current inpatients for whom physician is attending, has written orders, or is a consultant. Options may include team/group and coverage.	Speeds patient identification for physicians and assists with identifying right patient	1
A2b. Frequently used orders and order sets	A short-cut to the orders/order sets a physician uses frequently—typically customized by the institution	Speeds up locating orders and order sets	1
A2c. Departmental frequently used (orders and institutional order sets)	Access distributed based on lists created by the institution for each clinical department		1
A2d. Diagnosis- and condition-specific order sets	Selection based on diagnosis or condition	Another means for locating orders	1
A2e. Use of type-ahead, "starts with," or other quick means to specify orderable item of interest	In response to user entry, display of possible orders that match type-ahead or other means for narrowing possible orders with a small number of keystrokes	Avoids the need to search in choice lists	1
A2f. Ability to map multiple short names to same orderable item	Includes ability to convert to, and retain as a preferred institutional term.	Supports broader range of short names in conventional use	1
A2g. Ability to attach text instructions to a short name for an orderable item	Notify physicians when naming convention changes or a new intervention becomes available	Tool for notifying physicians that the name applied to a test or other intervention has changed or they may want to consider ordering a newly available intervention instead	3
A3. Ability to accommodate all order types	All types of orders – including laboratory, radiology and pharmacy can be generated using the same orders module *and order sets*.	Extra navigation and orders that don't always appear the same add to lack of intuitiveness of electronic order entry and time to accomplish ordering.	
A3a. Different order types can be selected and entered for a patient w/o requiring knowledge of the order type or special navigation	All ordering for patients occurs seamlessly for the physician (i.e., doesn't require selecting another order type or entering another module)		1
A3b. Complex orders with specialized designs can be incorporated into order sets	All of the order types in A1 can be incorporated into order sets.	Necessary to fully leverage order sets as a tool for reducing undesirable variation	1
A3c. Orders incorporated into order sets appear the same as individual orders for the same intervention	From the physician perspective, orders for a particular intervention always look the same whether ordered individually or as part of an order set.		1
A4. Communication and information management	Design that organizes communications so that physician can easily identify and attend to outstanding *tasks* by type, by patient, by urgency.	For physicians, an important part of the value proposition for doing electronic ordering is assistance with handling patient management and communication tasks. Avoiding gaps in communication and delays in response also enhances safety and quality.	
A4a. Workflow management for communications	Inbox or other design for organizing and tracking pending laboratory test results and other communications regarding patients	Physician is assisted in knowing what needs to be reviewed	1

Requirement	Description	Implications	Priority
A4b. Flagging of communications regarding urgency	Designation of communications based on urgency or responding (e.g., abnormal laboratory test results)		1
A4c. Workflow management for patient-related outstanding tasks	Ability for physician to view pending tasks for each patient (e.g., outstanding alerts, consultation reports) as an aid to organizing the work and ensuring there are no loose ends	One design approach is an annotated patient list with designation of the numbers, types, and urgency of pending tasks such as lab results, alerts, expiring orders, orders to sign, etc.	1
A4d. Notification of orders to sign	Support to physician in knowing he/she has orders requiring signature		1
A4e. Notification concerning patients with expiring orders	Some designation of patients with expiring orders		1
A4f. Rounds report summarizing information on current care plan and patient status	Ability to *display or* print rounds report with current information about each patient (e.g., current meds, labs, vital signs)	A big win with physicians when they prefer a paper view of available information as they make rounds or do sign-out.	1
A4g. Ability to view patient information integrated into a flow sheet	e.g., ICU flow sheet with vital signs, med admin, lab tests, etc.		2
A5. Ease of navigation		Important to reduce learning and time required to write orders electronically	
A5a. Industry-standard, navigation	Standard GUI navigation, which is familiar to computer users (e.g., user does not have to close pull-down menus or use function keys)	Users familiar with standard applications should not have to relearn basic navigation.	1
A5b. Option for mouse-driven navigation as an alternative to keyboard navigation	Ability to offer multiple modes of navigation allows catering to different types of users.	Mouse is a universal interface, preferred by some users.	1

B. Critical CPOE Requirements for Implementability

Requirement	Description	Implications	Priority
B1. Physician portal technology that facilitates universal physician access to CPOE.	System offers a portal that provides a physician-appropriate entry into tasks and data access.	Physicians must be able to access CPOE whenever they are making decisions about their patients – in the hospital, at their office or from home.	
B1a. Single-point access to all supported electronic tasks	Physician can easily navigate across tasks and patients to do their work	Ease of navigation reduces time for training and accomplishing work during user sessions.	1
B1b. Includes connectivity for remote access to native form	Physicians can access the familiar functions and look and feel from external locations	Access whenever a physician is making care decisions is a prerequisite for fully leveraging the value of CPOE and other clinical applications	1
B1c. Options include Internet access	To facilitate access from home and other remote locations		1
B2. Integration with the pharmacy application, enabling the necessary two-way flow of data between the CPOE and pharmacy applications	When pharmacy application is not integrated, it is necessary to ensure that medication orders are seamlessly transmitted from the CPOE system to the pharmacy application so that patient care and pharmacy processes are based on the same information and orders need not be re-entered.	Physicians order medications a certain way, whereas pharmacists often need to process orders and prepare medications for distribution employing different units of measure. Making the necessary translations can be difficult.	
B2a. Physician view based on conventions for dosing		Physicians are not expected to write orders in dispensing units or select products based on dispensable forms	1
B2b. Pharmacy view based on units for dispensing			1
B2c. Order available electronically to pharmacy application	Real-time electronic transmission to pharmacy application so that re-entry is not required	Re-entry of orders in pharmacy results in delays and potential errors in transcription	1
B2d. Physician ability to obtain up-to-date view of medication orders following pharmacist completion or modification	Transmission of update back to physician view for orders completed (e.g., "pharmacy dosing) or approved modification of medication orders	Physician must be able to view actual current medication orders at all times or be made aware of any changes made by pharmacy	1
B3. Interoperability with the medication administration record (MAR) application.	Once an electronic MAR is in use, information regarding administration is available to physicians.	Without this interoperability, physicians can't be provided with a real-time view of administration status for their orders with pertinent nursing comments (patient response, vital signs taken at administration, etc.)	
B3a. Ability to view medication administration *status* as part of patient information on medications	Patient data available to physician for viewing and flowcharting including medication administration times, medications held or not administered.	Necessary for physician to obtain full range of patient information necessary for care	1
B3b. Ability to view patient response documented by nurse for medications administered	Physician can view patient response information	Information documented by the nurse as to patient response is important to the physician managing care.	1
B4. Ability to offer physicians mobile access	To fully support and encourage physician use, the hospital needs to be able to offer mobile devices to physicians who want mobile access on patient care units.	Mobile computing is a requirement for physician acceptance. The ability to write orders, as well as look at results, on the mobile device becomes essential once physicians are engaged in CPOE.	
B4a. Ability to offer multiple options for mobile devices			1

Requirement	Description	Implications	Priority
B4b. Ability to offer full-function mobile device	Sufficient screen real estate on mobile device to write orders, etc.		1
B5. Interoperability with ancillary department systems		Avoids need to re-enter orders with attendant delays and opportunities for error; if two-way, also allows clinicians to check on order status.	
B5a. Order available electronically to departmental application			1
B5b. Physician ability to view status of order completion	e.g., films taken, specimen accessioned	Essential for physician to obtain status of test, procedure, or nursing intervention	1
B6. Easy access to display of current orders during order writing	Physicians can easily view orders when taking actions regarding orders	Difficulty viewing all current orders was cited as one cause of errors in recent study from UPenn	
B6a. Ability to view current orders of all types in single display	Facilitating access and, to the extent possible, minimizing the need for multiple screens and scrolling		1
B6b. Ability to view all current, all current and one-time, all orders			1
B6c. Display of all current orders during signing of new orders	Easy access to all current orders		1
B6d. On-demand display and printing of patient orders by user-selectable criteria	All current, by category, etc.		1
B7. Auto-log-off	Required for HIPAA (patient privacy)		
B7a. Set timing for auto-log-off	Ability to set interval of time without user interaction for automatic log-off		1
B7b. Modify timing for auto-log-off for individual devices	E.g., MD office versus public area such as nurses station		2
B7c. Auto-save of orders and documentation written, but not signed, upon auto-log-off		Physicians are often interrupted. The ability to pick up computer tasks where they left off is a time-saver.	2
B8. Support to medication reconciliation upon change in patient level of care	During patient transfers from one level of care to another, special attention is now being focused on communicating information about medications and allergies because of the importance to safety and quality of care.	JCAHO requirement as to process in 2006; CPOE needs to facilitate and document med reconciliation	
B8a. At admission, ability to document patient outpatient medications and allergies	Documentation of information about active outpatient medications will be mostly manual at present. Sufficient information will not always be available to actually record the full details of the prescription.		1
B8b. At admission, ability to incorporate and amend outpatient medications from one or more external EMRs while documenting home meds	MAeHC requires •NCPDP Script for current exchange standard; RxNorm for future •NDC for vocabulary	When information is available from physician office EMRs, it is important to make this information available at admission and easily incorporated into documentation.	2

Requirement	Description	Implications	Priority
B8c. *At admission,* ability to incorporate and amend discharge meds from prior admission while documenting *outpatient* meds	Provide physician with view of discharge medications from prior admission, if applicable, to facilitate assembling list of patient home medications.		2
B8d. *At admission,* ability to *view, copy,* and amend patient allergy information from one or more external EMRs while performing med reconciliation	MAeHC requires •HL& version 2.x, AL1 Segment for current exchange standard; HL7 3.0 RIM for future •Allows free text for vocabulary	When information is available from physician office EMRs, it is important to make this information available at admission and easily incorporated into documentation.	2
B8e. *At admission,* ability to *view, copy, and* amend allergy information from prior admission while performing med reconciliation	Provide physician with information about patient allergies documented during prior admission, if applicable, to facilitate assembling list of patient home medications.		2
B8f. At each change in level of care, current medication orders available as input into transfer orders	Ability to designate from orders for prior level of care those to be continued as new orders for new level of care without necessitating rewriting of orders.		2
B8g. At each change in level of care, designation of which medication orders are being continued and which are being discontinued.			1
B8h. For each discontinued order at change in level of care, ability to select reason for not continuing			3
B8i. Retention of history of medication reconciliation at each change in level of care (each pre- and post)	Capture and maintain lists of medications reviewed and ordered at each change in level of care.	Provides documentation that prior medications were reviewed and taken into account in writing of new orders	2
B8j. For discharge orders, ability to integrate and amend *outpatient medications recorded* at admission	(In addition to current inpatient orders)		3
B8k. Ability to produce patient hand-out listing outpatient medications recorded at admission, inpatient medications, and discharge meds, as well as explanation of changes		For patient education at discharge	3

C. Critical CPOE Requirements for Achieving Value

Requirement	Description	Implications	Priority
C1. Drug contraindication screening	CPOE system links to the patient's current medication profile and automatically screens new orders for potential drug interactions.	These tools are necessary to perform basic checking of medication orders for interactions	
C1a. Drug-drug contraindication checking			1
C1b. Drug-drug contraindication checking including combination products			1
C1c. Drug-allergy contraindication			1
C2. Medication screening for therapeutic duplication			
C2a. Same component (drug)			1
C2b. Same drug class			1
C2c. Including components of combination products			1
C3. Single dose and cumulative medication dosage checking			
C3a. Single dose	Check of min-max range for patient based on age (pediatric, adult, geriatric)		1
C3b. Daily dose	System automatically factors into dosage checking the accumulated daily doses	This feature is necessary to include frequency in dosage checking.	1
C3c. Cumulative dose	For certain medications		3
C3d. Dosage checking incorporating patient specifics	For medications with weight-based dosing and chemotherapy, which Is usually dosed in M^2		2
C4. Medication contraindication screening incorporating patient-specific information	Screening incorporates relevant patient information to detect possible contraindications	Incorporating patient-specific information such as weight and age into the screening logic is necessary to avoid common adverse drug events for some medications.	
C4a. Warnings based on patient age			2
C4b. Warnings based on patient diagnosis			2
C4c. Warnings based on laboratory test results for patient	e.g., medication is contraindicated in patients with reduced kidney function		2
C5. Ability to manage rules for medication checking and other clinical decision support	Table-driven or other design, which simplifies establishing and maintaining the rules used to trigger decision support.	Writing individual rules (using a rules engine) is not practicable for the large number of situations involved.	
C5a. Table-driven management of parameters for medication checking incorporating patient-specific information	Design for recording ranges in patient age, weight, BSA, renal status, etc. to be used in patient-specific medication checking that does not require uniquely writing the logic for each medication to which the rule is applied.		2

Requirement	Description	Implications	Priority
C5b. Hospital control of drug classes checked for therapeutic duplication	Hospital can turn on/off duplication checking for classes of medications	This feature is important for sufficiently fine-tuning medication-related advisories and alerts so as to achieve an acceptably low level of "nuisance" alerts. The norm today—controlling checking only at the highest level (all/none) leads to an intolerable number of nuisance alerts and turning off of checking altogether in some cases.	2
C5c. Hospital control of level of checking for drug-drug interaction	Hospital can set different levels of severity alerting for *individual medications* and classes of medications.	See above	1
C5d. Ability to provide informational messages about apparent interactions or other contraindications	Messages displayed can contain text concerning the nature of the interaction and additional information on clinical consequences/severity in addition to the basic warning message.	Providing more information about the warning will increase the usefulness and acceptance.	3
C5e. Ability to manage laboratory duplicate checking	Table-driven design or other approach for identifying tests and time intervals to be used in checking that does not require writing unique rules (logic) for each set of conditions to be flagged.	One design approach is the ability to set conditions for checking in order master file (as opposed to requiring use of a rules engine to write each rule).	1
C5f. Ability to manage auto-display of relevant laboratory test results during medication ordering	Table-driven or other design for specifying pre-defined associations between medications and test results to be automatically displayed that does not require writing unique rules (logic) for each condition triggering auto-display.	One design approach is the ability to set lab result to display in medication order master file (as opposed to requiring use of a rules engine to write each rule).	1
C5g. Ability to control delivery of CDS by user class	Necessary to fine-tune decision support to achieve acceptable rate of relevant messaging (fellow versus medical student) and to manage responses to decision support		1
C5h. Ability to control delivery of CDS by user clinical department	e.g., Oncology versus Medicine		1
C5i. Ability to designate consequences of alerts	Ability to require user acknowledgment or limit user interactions for selected alerts based on hospital philosophy and policy. E.g., When conditions in the rule are met, physician not permitted to write this order (a "hard stop").	Clinical decision support can be informational /advisory or set up to require or preclude certain actions. Some hospitals wish to designate selected situations as prohibited because of the nature of the likely risk to patient safety.	1
C6. Delivery of prompts, alerts, and other decision support as the physician is considering what to order	The sooner decision support feedback is integrated into ordering tasks the better (e.g., not as the physician is signing orders for the patient)	Decision support is most useful to, and best accepted by, physicians when it is delivered during ordering.	
C6a. Patient allergy message triggered	Notification as order is written while selecting the medication or browsing		1
C6b. Display of dose calculator or calculated dose for medication requiring weight-based dosing	Proactive guidance as physician is considering dose	Especially important for pediatrics	1

Requirement	Description	Implications	Priority
C6c. Display of dose calculator or calculated dose for medication requiring consideration of renal status ("renal dosing")	Proactive guidance as physician is considering dose		1
C6d. Starter set of rules for top medications requiring consideration of renal status in dosing ("renal dosing")			1
C6e. Ability to use TALL MAN Lettering or other means to flag Look-Alike medications commonly confused	For certain pairs medications that have similar spelling and are often confused, leading to medication errors		2
C7. Ease of responding to clinical decision support.	Physicians can easily accept or reject prompts or alerts containing recommendations delivered via decision support.	This feature has not only an effect on time to accomplish ordering, but also acceptance of clinical decision support.	
C7a. Ability to accept recommended dose or other advice in prompt rather having to rewrite the order	When an alert is triggered, the user can take the actions suggested directly from the alert dialog box. Actions may include discontinuing, modifying, or canceling an existing order or the one in process or entering a new order.		1
C8. Corollary orders	*CPOE* can facilitate ordering of secondary orders that should accompany an order to put in place necessary preparation or monitoring.	Making it as easy as possible to place these orders during order entry improves compliance and saves physician time.	
C8a. Automatic display of linked secondary orders	Ability to have recommended secondary orders display with the primary order (e.g., lab test to titrate dosing)	Physician can easily add suggested secondary order with a simple click or selection.	1
C8b. Schedule-dependent corollary orders	For some procedures with timing of secondary orders based on schedule (e.g., stress test), completion of secondary orders once procedure is scheduled	Non-completion of an event (e.g., bowel prep) results in cancellation of order (e.g., colonoscopy).	2
C9. Automatic display of relevant laboratory test results or vital signs relevant to order	System can associate medications and relevant lab tests for automatic display with a medication order	This both reminds a physician to consider the relevant information and makes it easy to do so.	
C9a. Ability to auto-display relevant laboratory test result or trend in test results for patient when physician selects a medication order		A form of proactive decision support for medication orders for which patient status needs to be considered in determining appropriateness and dosing.	1
C9b. Starter set of medication orders for which displaying most recent relevant laboratory test is of high value			1
C10. Special features of order sets	Every CPOE solution contains sets of orders physician can select and edit as necessary for a particular patient before signing. Requirements listed below are design features of order sets.	Pre-defined orders are developed to incorporate recommended clinical practices. The design features listed enhance the ability of the hospital to guide ordering in a way that increases both the CDS value and physician acceptance.	

Requirement	Description	Implications	Priority
C10a. Ability to incorporate choices in an order set for a medication or other intervention	The intent is to propose alternatives in a given functional group, e.g., if order set includes a diuretic, physicians are presented with the most likely ones from which to choose one for the patient.		1
C10b. Ability to check that no more than one of multiple options presented for an order is selected	Either/or		2
C10c. Ability to incorporate text instructions or recommendations within order sets			1
C10d. Individual orders in order sets subjected to same order checking (all types) as individual orders	CDS applies to all orders, including those included as part of an order set	Necessary to extend safety net of clinical decision support to all orders written for patients	1
C10e. Starter set of order sets	Either a vendor-developed starter set or facilitated access to a library of customer order sets for common conditions	For jump-starting development of hospital-specific order sets	1
C11. Cost advisories	System messages that encourage selection of cost-effective and appropriate medications and other interventions	These are proven tools for encouraging cost-effective care management and reminding physicians of applicable recommendations of hospital committees.	
C11a. Ability to display orderable item costs as part of order template		To convey knowledge about costs. Note many hospitals use charges because of lack of information about true costs.	2
C11b. Ability to display recommended drug substitution		To recommend more cost-effective treatment	1
C11c. Ability to display indications for medication, test, or procedure use	For a particular medication, imaging study, etc., the ability to convey information to physicians about recommended practices for appropriate utilization	To discourage inappropriate use	1
C11d. Ability to *indicate* medication on the formulary of the patient's payer			3
C11e. Laboratory *test* duplicate checking	System flags laboratory tests as potentially unnecessary duplicates based on hospital-established time limits for prior tests.	This is a proven tool for reducing unnecessary testing.	1
C11f. Starter set of laboratory tests with high value of duplicate checking			1
C12. Use of defaults to encourage appropriate orders	Guide ordering by defaulting or highlighting order elements to the most likely correct content	Makes it easy to do the right thing	
C12a. Hospital formulary	Ability to have selected medication default to formulary options or have those listed first	Making the selection of formulary medications easy increases compliance with formulary management	1
C12b. Route of administration	For medications, ability to have route default to the most likely or only possible		1

Requirement	Description	Implications	Priority
C12c. Dose default	Based on min-max for patient age group (e.g., pediatrics, adults, geriatric)		1
C13. Ability to highlight most likely or recommended choices of orders and order components	Guide to likely appropriate choice		
C13a. Site-defined order of options in choice lists *for orders and order components*	Choice lists need not be organized alphabetically		3
C13b. Ability to highlight options in choice lists f*or orders and order components*	Site-defined highlighting of most likely appropriate or recommended choice		3
C14. Logging of clinical decision support functions	An audit trail on the firing and use of clinical decision support for viewing and printing	Needed for ongoing management of quality/safety and decision support tools. Also likely to be needed for performance reporting *for MTC/NEHI/CPOE project*.	
C14a. Use of order sets			1
C14b. Firing of alerts			1
C14c. Order changes following firing of alerts			1
C14d. Ability to require coded reason for overrides of selected alerts			1
C14e. Ability to display/print log for overrides including user-entered comments			1
C15. ISMP Guidelines for Safe Electronic Communication of Medication Orders	Relate to safe presentation of drug nomenclature and dose expressions in electronic systems and design features that support safe communication of orders [some already elsewhere in standards and some related to set up of order master files]	Many of these requirements are applicable to set up of data field specifications, allowable and pull-down entries, etc., that are followed by the hospital team implementing a vendor's application. For vendors, the requirement is to permit following these practices (i.e., not preclude doing so by a design feature in the CPOE application).	
C15a. Ability to list all products by generic name			1
C15b. Ability to list salt after drug name	e.g., warfarin Na		1
C15c. Ability to present brand names in upper case letters			2
C15d. Do not use trailing zeroes			1
C15e. Use leading zeroes for doses less than one measurement unit			1
C15f. Spell out UNITS			1
C15g. Ability to use commas in doses expressed in thousands			2

Requirement	Description	Implications	Priority
C15h. Ability to use "thousands" and "millions" as part of expressing dose for large doses			2
C15i. Ability to use USP standard abbreviations for dosage units			1
C15j. Provide adequate space for items in order data fields	> three characters so that dangerous abbreviations need not be used	For rare instances in which free-text might be used	2
C15k. For selected orders, ability to include a field for user to select purpose	All PRN meds, problematic look-alike name pairs, meds with different dosing for different indications or multiple indications not in approved labeling		1
C15l. Provide a field that requires entry of product's dosage form	e.g., tablets, capsules		1
C15.m Ability to require dose field after product strength has been selected			1