Ten Lessons from Implementing a Computerized Provider Order Entry System

Steven J. Kravet, MD, MBA, Amy M. Knight, MD, and Scott M. Wright, MD

Abstract

Objective: To describe lessons learned implementing a computerized provider order entry (CPOE) system at an academic medical center.

Methods: Descriptive report.

Results: Potential barriers to successful CPOE implementation are identified, and specific approaches to managing and overcoming these barriers are described. The lessons focus on: guiding principles, process efficiency, institutional nuances, nursing buy-in, order sets, user support, protocols, training, transparency, and testing.

Conclusion: A successful CPOE implementation is the result of an arduous process of planning and building, followed by an equally challenging roll-out phase. Barriers to successful implementations can be overcome, especially if anticipated or recognized early.

Much has been written highlighting the institutional benefits of computerized provider order entry (CPOE), including improving clinical outcomes, efficiency, and resource utilization [1]. Although recent discussions have suggested some risks associated with these systems [2,3], national patient safety goals uphold CPOE as one of the cornerstones of patient safety. Currently, less than 10% of hospitals have fully employed this technology [4].

Organizations invest heavily in purchasing and building CPOE systems. After such a large investment, it can be frustrating and demoralizing to encounter barriers to implementation. Changes in the processes of clinical care when using electronic record environments have been noted to represent challenges [5]. Perhaps these process challenges are partially responsible for the gap in CPOE implementation.

Johns Hopkins Bayview Medical Center is a 335-bed academic medical center, one of 2 teaching hospitals in the Johns Hopkins Health System. Nearly 2 years after the signing of our vendor contract, a CPOE system was fully implemented between October 2003 and June 2004. Prior to the implementation, our ordering process was entirely paper-based. Our institution chose a fully integrated client/server information system solution. Simultaneously, we replaced our financial, admitting, pharmacy, and laboratory systems as well as several ancillary scheduling systems. This article describes key lessons from the integration of a CPOE system into an academic medical institution’s organization (Table).

Some of these lessons were anticipated in advance, based upon published literature [6,7] or vendor communication, while others were largely unanticipated. While each lesson may not ultimately be pertinent at every institution, each remains valuable for consideration. The lessons are supported by examples of how they manifested and were addressed in our organization.

The 10 Lessons

1. Develop Guiding Principles

We developed a set of basic principles upon which we based our entire project. These guiding principles served as a compass that helped to clarify the direction and choices in the face of competing obligations and interests. Three guiding principles were established:

- **Patient safety comes first.** The system could not, on balance with pre-CPOE, create a less safe environment.
- **Never need to take a step backward.** We knew if we ever had to take the system down it would be even harder to regain the confidence of users.
- **Effective governance drives buy-in and participation.** There were co-clinician/administrative module leaders as well as dedicated provider and nursing “process groups.” We engaged clinicians across multiple key specialties in mapping out pre- and post-CPOE processes of care.

Generating a culture of support for CPOE around these guiding principles required a coordinated effort. Early communication began heralding CPOE as a mechanism to improve safety and efficiency. To assure global provider input throughout planning and implementation, CPOE was...
Lesson in Action
An example of how these principles were tested was in the allergy checking in our system. We were not comfortable with the results of our preliminary testing and worked with our vendors to address the issue. Members of the faculty, housestaff, pharmacy, and nursing collaborated. We could not have gone live with this process below an acceptable safety threshold without risking the need to take the system down. We therefore invested an additional 12 weeks addressing this single issue, delaying our go-live date. Thus, following our guiding principles, we leveraged the buy-in and participation of our clinicians and accepted an implementation delay for the sake of patient safety.

2. Focus on System Efficiency, Not Speed
The need to address concerns about system speed is likely in any CPOE implementation. When the status quo is challenged, change management principles suggest the key is to focus on common interests rather than individual positions [8]. In CPOE, this means addressing conflicts about loss of speed by focusing on the common goal of efficiency.

Lesson in Action
Many of our providers initially vocalized concern that the system was slower than handwriting orders. We took this as an opportunity to engage in a discussion of the goals of a CPOE system in the broader context of medical care. We established that our goals are really efficiency of patient rounds, effectiveness of order communication, and minimizing prescribing errors. We were able to provide users with tools to improve their efficiency by changing the way they rounded or by creating mini-order sets to facilitate order entry. We also adapted policies and systems to allow nurses to override certain medications used in urgent situations, assuring the CPOE system would not delay access to critical medicines.

3. Know Your Institution’s Nuances
By understanding who most influences the decisions in an organization, it is easier to focus where to place the effort on process change. It is necessary to engage staff differently depending on their roles. In so doing, an organization can best leverage its assets and protect itself from vulnerabilities. Anticipating or recognizing resistance and adjusting the system and processes in advance will help facilitate implementation.

Lesson in Action
In our organization, we knew that the locally based internal medicine training program was very influential and could effectively have affected the system by complaining to their administration. Conversely, in other departments with rotating housestaff (not primarily based in our institution), we suspected house officers would more likely follow the suggestions of their attending staff. Thus, it was most important for us to engage the medicine housestaff and the attending staff of the noninstitution-based housestaff early on in development of policies and procedures.

4. Nursing Buy-In Is Critical to Physician Adoption
Critical to physician adoption is gaining the confidence of nurses. This tenet is particularly relevant as we work toward a culture of safety where every member of the team is accountable to each other [9]. We chose to implement CPOE prior to implementation of electronic nurse documentation. Our plan included the decision to have nurses learn the CPOE system and assist with entering written and verbal orders throughout roll-out, whereas many organizations avoid this for fear of physician’s prolonged dependency on nurses.

Lesson in Action
When we initially rolled out the system, we planned a fade-in period where doctors were using paper orders and nurses and unit secretaries would enter those orders into the system. The primary purpose was to have the nurses become familiar with the system so they could help with support once CPOE went live. This plan worked well on the general medicine units. Together the housestaff and nurses became more comfortable with the system, specifically understanding the flow of orders and communication required in the CPOE environment. Thus, when general medicine went live with CPOE, the doctors felt supported; they knew that their orders were being communicated to the nurses effectively.

Conversely, due to the pace of intensive care units (ICUs), the ICU nurses had not followed the designed protocol.
to enter paper orders for the physicians; they left it almost entirely to the unit secretaries. Therefore, when it came time to roll out CPOE in the ICU, the nurses were less familiar with the way that information was supposed to be entered in the new environment. When the physicians sensed that the nurses were not comfortable, they immediately raised a safety concern. In reaction to this reality, we delayed our next implementation and circled back into the ICU. Without needing to take the system down, we re-educated the nurses and demonstrated to the physicians their proficiency with the system. If we had not done this, it would have been difficult to continue to engage the physicians in the ICUs and may have resulted in the need to take the system down. Though having ICU nurses trained to enter orders has been largely successful, we continue to strive for an ideal balance between nurses’ assistance and physician dependence.

5. Order Sets Ease the Transition to CPOE
Successful CPOE implementation strategies require an abundance of diagnosis-specific order sets [10]. There needs to be an institutional strategy to both develop and maintain them. When we went live in July 2003, we had 150 order sets; we now have over 300. The 2 main purposes of order sets are to (a) minimize the number of clicks a provider needs to make when entering a set of orders into the system, and (b) ensure that the providers are reminded of the fundamental orders that should be considered for particular diagnoses. These sets can substantially increase speed, standardize clinical care, and positively impact safety. There are commercial vendors who specialize in providing and maintaining evidence-based order sets. Many CPOE systems partner with these content vendors to provide a seamless product. However, an advantage of developing one’s own sets is to have the process serve the hidden agenda of engaging departments and key providers in the transition to CPOE.

Lesson in Action
Designing order sets is labor intensive. We held every department accountable for designing their own order sets after establishing standardized templates. Our CPOE support staff coached them through the process. Once order sets were established, they were to be recertified by the originating providers once each year to be sure that evidence had not changed. The oversight of this process is a collaboration between the CPOE team and the pharmacy and therapeutics committee.

6. Establish Protocols to Simulate the Pre-CPOE Environment
In addition to order sets, the establishment of unit-specific protocols is critical. It is standard practice for nurses to respond to changes in a patient’s status by certain actions [11]. In a CPOE environment, nurses can be locked out of being able to initiate an order with out a provider’s authorization. Protocols are required to allow nurses to intuitively simulate safer processes of care.

Lesson in Action
When we initially rolled out the system, physicians were being interrupted regularly to enter orders for nurses who were trying to provide routine care as they had always done. Thus, we worked with our nursing units to establish protocols, for example, electrocardiograms for every episode of chest pain and arterial blood gases for every ventilator change. Thus, nurses can enter these orders based upon written protocols without a provider’s specific preauthorization. These protocols have empowered the nurses, removed unnecessary burdens from the physicians, and have recreated the work flow condition that existed and that all parties were comfortable with prior to the implementation of CPOE.

7. Adequate Go-Live Support Is Critical and Expensive
Clinicians want clinicians to be supporting them. Super-users, defined as those trained extensively to use the system and act as resources to others, are helpful in this regard. Health care providers such as nurses and pharmacists make ideal super-users. Training of these super-users is expensive (as their clinical time needs to be backfilled, often with overtime and agency staff). However, without super-users, it is less likely that the information services team will be able to sustain CPOE support while still preserving resources to develop and maintain other projects.

Lesson in Action
When we went live on each of our units, we provided 24 hour a day/7 day a week support for approximately 1 week. The providers needed both to see the support of the institution and to have their questions answered in real time. We created and staffed a call center until we saw the volume of calls diminish after every phase implementation. Even when a unit was successfully rolled out and we moved on to another unit, new providers to the previous unit still had to be trained and supported through the change. This is where our super-users became incredibly important. Our institution provided dedicated salary support for physicians, nurses, pharmacists, and other clinicians as super-users.

8. Training Requires a Multifaceted Approach
Training is best designed by clinicians in partnership with information services teams. In environments where multiple users are moving in and out of the system regularly, it is difficult for the information services department to completely manage the training. Because the schedules of physicians are generally maintained by the hosting department, it is logical that these departments would be responsible for assuring
that their users are trained. Creative approaches to training are required, as providers have little time available.

**Lesson in Action**

Our information services department was responsible for overseeing the development of a training plan. We anticipated and found that tracking transient users was difficult. We assigned the duty to track schedules and assure training to departments. Our CPOE team developed classroom training as well as computer-based training and made each mode ubiquitously available to help meet the needs of our complex user base. We kept the content simple so as to meet the basics of familiarity. We expected on-the-job training by super-users to augment our process. Ideally, we would have liked to have had a competency evaluation for all providers but found this to be logistically challenging due to additional time and cost.

9. Transparency Instills Confidence

When problems invariably arise, it is important to communicate effectively with users. The problem should be described and organizational processes to address the problem should be shared. This should ultimately result in more confidence in the system and organizational leadership. This follows basic principles of service recovery in service-based industries, including hospitality and health care [12,13]. It also parallels one of the important elements of patient safety [14], as transparency can help to enlist the support of the users when new obstacles arise.

**Lesson in Action**

We found an unusual software glitch that occurred in which orders were being transposed between patients if orders were being executed nearly simultaneously between floors. It took our software company and our internal information services department an entire night to isolate and fix the problem. In the morning, we sent a detailed communication to our users explaining the nature of the problem and how it was addressed. We felt providers needed to be reminded that the system was not perfect and that there was a well thought out structure in place to analyze and fix problems. This transparency resulted in positive feedback at multiple levels of users and administration.

10. Don’t “Test” in a Live Environment

Testing is critically important and must be thoroughly complete before going live with CPOE. If this is not done, testing will have to be done in a real-time environment. When testing in real-time, the organization runs the risk of having the system not work and having to take it down. Once a system is taken down, it is much harder to regain the confidence of the users (see Lesson 1).

**Lesson in Action**

Our testing was intense. We broke it down into unit testing (i.e., testing the individual module, such as pharmacy) and integration testing (i.e., testing how modules such as CPOE and pharmacy communicated with each other). Unit testing involved 2 phases, each 2 weeks long, with 1 week in between for fixes and re-testing. Integration testing also had 2 phases, each 3 weeks long, with 1 week in between for fixes and re-testing. We did our conversion testing (understanding how the system is going to roll out from a test environment to a live environment) in a controlled way so as to maximize our control of the testing process.

**Conclusion**

Organizations are making large investments in CPOE systems in an effort to meet the mandate of providing higher quality care and improved efficiency. Physicians must be involved in understanding how these systems are built and how the changes in process will affect the way they provide care. Although some barriers to process change cannot be predicted, many of the critical obstacles can be managed with careful anticipation. Ultimately, the success of a system depends largely on how well an institution plans, engages key stakeholders, and communicates throughout the implementation process.

Previous publications about the CPOE implementation process have been based on user surveys, interviews or observations [7,15–18], expert consensus or opinion [19–21], literature reviews [22], or first-hand descriptions of the process [6,10,23,24]. The current article is written entirely from the perspective of active physician-users of CPOE, unlike many prior efforts that have been led by informaticians and social scientists [7,10,15–17–20]. The value of physician-leadership in CPOE projects has been previously noted [10,20], and physicians working in a facility that is anticipating CPOE roll out may be particularly interested in our experiences.

The importance of having effective leadership [18,19,21], creating adequate numbers of order sets [10,19], exhaustively supporting the go-live process [10,19,24], and using creative approaches to user training [10,24] have been previously reported, and our exploration of these points complements these earlier discussions. There have been examples of institutions taking their newly implemented CPOE systems down in the wake of physician dissatisfaction [25], contrary to our own guiding principle of never taking a step back unless patient safety is being compromised. Other lessons learned from our implementation have not been extensively explored in the literature, such as the importance of recognizing the nuances of one’s institution, generating nursing buy-in, establishment of protocols, and maintaining transparent approaches to problems. The addition of these concepts to the toolboxes institutions use when implementing CPOE will likely result in additional success stories.
Effective organizations must lead change by establishing direction, motivating, and aligning goals [26]. They must also manage change through planning, organizing, and problem solving [26]. We hope by sharing examples of how we led and managed change, others may better plan successful CPOE implementations.

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Corresponding author: Steven Kravet, MD, MBA, Johns Hopkins Bayview Medical Center, 4940 Eastern Ave., Baltimore, MD 21224, skravet@jhmi.edu.

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References

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