

CPOE for Medications: Leveraging Embedded Drug Content to Maximize Clinical Decision Support and Project Success



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Numerous consumer advocacy and industry watchdog organizations have prescribed computerized physician order entry (CPOE) as the remedy for improving patient safety and reducing medical errors, yet healthcare research firms report that only 2% to 5% of the nation's hospitals are currently using CPOE solutions¹. And while a great many healthcare organizations are considering the implementation of CPOE, reports on actual experiences with the applications are limited because few organizations have taken the CPOE leap. As a result, it is acknowledged that the CPOE “must-haves” and “must-dos” are still being determined in the market place, which creates challenges for early adopters.²

Several reports have clearly illustrated the need for this type of solution. More than 1 million serious medication errors occur every year in U.S. hospitals, according to the Leapfrog Group.³ And in its landmark 1999 report, the Institute of Medicine estimated that medication errors alone contribute to an estimated 7,000 deaths annually.⁴

While the potential benefits of CPOE solutions have been covered extensively by the media – such as cost savings, increased efficiency, improved patient outcomes, and reductions in medical errors – little has been written specifically about best practices for the drug content that resides within these solutions. It is this drug content, when integrated into a CPOE solution for medications, that enables healthcare organizations to substantially reduce adverse drug events (ADEs) and decrease costs.

Beyond addressing reductions in ADEs, properly integrated drug content can increase efficiency. For example, Ohio State University Medical Center, which implemented CPOE in early 2000, has documented that it has reduced medication-order processing time by 64%.⁵

But getting the data into the CPOE solution and integrating it into the workflow

of clinicians is only part of the battle. Maintaining the content and managing the frequent update cycles is a much larger challenge, especially for software developers and healthcare organizations that plan to manage the entire process themselves. In fact, some early CPOE adopters that took the “do-it-yourself” approach to developing clinical drug content are now looking to outsource this function to reduce the costs and labor associated with it. Drug content is dynamic and difficult to maintain, especially considering that the sheer number of drugs grew 500% during the 1990s alone, according to the Institute for Safe Medication Practices (ISMP).

This white paper highlights important considerations for software developers and healthcare organizations to evaluate when implementing drug content into CPOE. Particular attention is devoted to assessing the type and structure of drug content that is needed, as well as the issues related to integrating, using and maintaining the data.

Assessing Drug Content and Structure

Determining drug content requirements and how the data will be used can be an arduous task. It is important to leverage the experience of hospital pharmacists during this process. For more than 20 years, hospital pharmacists have used computerized medication information within their workflows. This enables hospital pharmacists to offer valuable insight into the implementation of CPOE systems.

The importance of initial planning, as well as the difficulties of it, was clearly articulated by two nursing executives that have experienced the process: “Upfront analysis is as imperative as effective project leadership. This somewhat abstract, seemingly interminable task is probably the most

difficult of all phases of the project. Yet without thorough consideration and detail given to this task, CPOE implementations could be fraught with obstacles and frustrations. It is, in the author's opinion, one of the least understood and poorly documented components of the CPOE implementation puzzle."⁶ Although not specifically addressing the assessment of drug content, the authors' description of the early CPOE implementation process helps set expectations.

During the assessment phase, evaluating how the drug knowledge base will be accessed by users is critical. The implementation of CPOE for medications dictates the need for a highly flexible underlying drug knowledge base for clinical-decision support that includes a drug dictionary, order components, and pre-defined orders. Items to consider include:

A Shared Drug Knowledge Base for Clinicians and Pharmacists Preserves the Value of CPOE – Integration problems can arise when the CPOE system accesses a different drug knowledge base than the pharmacy. For instance, best practices dictate that a structured medication order sent from the CPOE system be received directly into the pharmacy system in its codified form. However, disparate drug dictionaries may compel the transferred information be translated to text, losing the ability for automated clinical checks by the pharmacist. Since the pharmacist is the one party in the process dedicated solely to medication issues, this translation can result in the loss of significant value from CPOE.

Exchange of patient allergy information is another prime example. If the CPOE system transmits a patient allergy using an allergy term or grouping that is not recognizable to the pharmacy system, then the allergy may either have to be translated to text and re-captured, or mapped to the pharmacy system's allergy source. Either methodology introduces

complexity and an additional step in the process. Re-entering the allergy into the pharmacy system defeats much of the purpose of capturing clinical data directly from the physician, while mapping can require some manual intervention or potentially uncertain approximations. Comprehensive mappings and interfaces for this domain are still in their incipient stages and can add impediments to an already complex process. For instance, if one knowledge base defines an allergy grouping as "calcium channel blockers" and another defines the category as "calcium channel blocking agents-phenylalkylamines" then no precise, absolute match exists for automated information exchange from one system to the other. Only a "broader than" or "narrower than" relationship exists. The mismatch in definition compromises an exact, automated translation, potentially leading to false hits.

Consistent Drug Content Source for Clinicians, Nursing, Pharmacy and Patients Enhances Communication – Interpretation and communication problems can stem from inconsistencies between disparate databases as to the severity of drug interactions, allergy checks, therapeutic duplications, or the values used for dose-range checks.⁷ These disparities can extend to patient-oriented information when an institution reaches the point of extending medication information to the patient via an Internet-based patient health record, or prescription renewal process.

In the initial implementation stages it is important to anticipate future users, and ensure that drug information available to the patient, for instance, will correlate with that available to the healthcare professionals within the institution. As an example, drug-drug, drug-food interactions and drug-disease screening available to patients should reflect consistent editorial policies, though the information must be conveyed in significantly different language.

“Granularity” in Categorization and Attributes Enables Flexibility – Granularity brings flexibility and supports a variety of implementation options. When data structure is more specific, or “fine-grained,” there is greater opportunity to organize navigation, alerts, and analysis precisely as required by users. For purposes of illustration, consider the requirements of an outcomes study on the use of an expensive class of drugs, COX-2 inhibitors. Mining a clinical data repository for use of these drugs evolves into a more labor-intensive manual process if the drug knowledge base more broadly classifies drugs in this class as “NSAIDs” rather than the more specific grouping of COX-2. Further, if the body of knowledge on these drugs evolves so that the category is subsequently divided into more granular definitions of COX-2A and COX-2B, it’s essential that the drug knowledge base can accommodate such an advancement without impacting the existing, stable codes—confidence in study results will be dependent upon such consistent inputs. These granular details should include drug identifiers representing all the logical ways to think about a drug to enable the manipulation of data to fit user requirements for navigation and information access.

Patient Education and Patient-Directed Screening Improves Outcomes – Although clinicians realize tremendous benefits from CPOE solutions, many of these benefits can be extended to the patient by making drug information available through printed literature or via a Web portal.

It’s important that this content uses terminology and concepts specifically written with the patient in mind, rather than the clinician. When patients are successfully educated, it goes a long way toward encouraging compliance, improving care and reducing the costs associated with drug-related morbidity.

Preparing for Implementation

Implementing CPOE is a labor-intensive initiative. However, some well-planned decisions can deliver significant efficiencies and conserve project resources for where they are needed most. Even with CPOE solutions that contain a wealth of decision-support information, the challenge remains to provide quick access to relevant information, and allow clinicians to drill down into that information.

Leverage Existing Sources of Pre-Defined Orders – By starting with an extensive set of pre-built validated drug orders, healthcare organizations avoid the time and expense of building the databases themselves and keeping them updated. Without such a starting point, extensive pharmacist hours may be required to build orders from scratch right when a project is poised to go live. As an added benefit, pre-defined orders are codified to link to the rest of the database, and are seamlessly transmitted to the appropriate departmental systems, such as pharmacy, and the nursing department’s electronic medication administration record (eMAR). Additions and modifications to the pre-defined orders are probable, but the more comprehensive, thoughtful and precise the starter set, the fewer the editing and maintenance requirements will be.

Don’t Reinvent the Wheel – Use existing data sources to build customization rules whenever possible, rather than building entirely new clinical decision-support knowledge bases. For example, organizations may want to require users to provide a rationale for overriding just a handful of drug interactions. In this instance, organizations can designate this special alert level as a subset from the contraindicated drug pairs in the existing data source. Identification of a small subset of exceptions is almost always preferable to the development and

maintenance of an entire classification system. The latter method requires significant investment of resources, while the ability to handle the former is usually the most that is required for organizational buy-in.

Expect Some Customization – Not all users think alike, nor do all institutions think alike. How drug content is presented will need to be specific to the role of users and possibly even nursing units within the hospital. For example, Montefiore Medical Center (one of the first CPOE adopters) discovered during implementation that it had to do some customization for each nursing unit, from a workflow analysis, programming and screen-configuration perspective.⁸

Employ Variable, Drug-Specific Navigation to Reduce Clicking and Scrolling – With effective use of pre-built pick lists, ordering a medication can be reduced to a few keystrokes or as few as one or two clicks. Pre-defined pick lists that support variable access according to a specific drug make the most sense and improve the user experience considerably. For instance, drug and route is a common jumping off point for inpatient ordering (e.g. amoxicillin oral). For another drug, however, it is more efficient to expose additional attributes such as strength and dosage form right in the pick list to correlate with how a doctor orders (e.g hydrocortisone 1% topical cream).

Introduce Functionality Incrementally – Learning to use the system can seem overwhelming to many clinicians, and presenting users with “too much” information may actually slow the learning curve. Alerts for allergies, drug interactions, dose-range checking, duplicate therapy and others should not be activated all at once.

Include Off-Formulary Drugs – Organizations should be careful not to limit

their drug content to only the medications that are on the formulary. Drugs beyond the formulary are needed in the system to record and access clinical content when physicians order off-formulary drugs. In addition, it may be necessary to access off-formulary medications when recording patient histories. Separate drug lists can be managed, but it is usually more effective to partner with a vendor to build, import and maintain the additional lists.

Using Good Vocabulary Practices

Conforming to “good vocabulary practices” is recognized as the gold standard in integrated drug information. These industry-endorsed principles minimize change management issues and help to ensure integrity in the content over time. These good vocabulary practices are characterized by the following features:

- **Stable Identifiers** – Drug concepts need to be represented by stable numeric identifiers, which point to one and only one medication concept. Once an identifier is retired or replaced, it is never used again. This means users can confidently rely on recorded information, significantly reducing the usual burden of change management.
- **“Dumb” Numbers** – Best practices dictate that numbers used for representing concepts do not have meaning built into them. This recognized “dumb number” approach means numbers carry no significance beyond their literal values and do not need to be continually updated to keep up with drug information that is constantly changing. Following this methodology translates into stability and helps users avoid the change management headaches created when there are changes to a specific value or position that has meaning associated with it. The COX-2

inhibitor example above—describing the likelihood for therapeutic classifications to evolve over time—illustrates one very typical instance of the need for following such practices to ensure stability.

- **Single Purposed** – A third aspect of good vocabulary practice concerns the question of how many different concepts a single identifier should represent. Experience has shown that identifiers representing only one concept enhance meaning precision as well as stability.

Managing Message Overload

Much of the promise of CPOE lies in the alerts, reminders and clinical decision-support that can help prevent errors and optimize therapy decisions. However, it is widely acknowledged that over-alerting can erode that potential by damaging usability and numbing users so much that they miss those truly critical messages. The following tips help prevent message overload:

- **Not All Alerts Should Look Alike** – Alerts should be handled differently based on the severity or evidence level as well as type of user and context. Assessing the use of hard stops vs. soft stops, interruptions vs. side-bar displays, override justification required vs. acknowledgement impacts usability significantly. Explore the range of settings available for displaying alert levels and categories, so that lower significance messages can be manifested as a sidebar or drill down option as opposed to a message requiring an action on the part of the physician. For instance, drug interactions rated as both “contraindicated” and established in the literature may require physician rationale to proceed, whereas a contraindicated drug interaction established only in an animal study or manufacturer labeling may require acknowledgement but not rationale. Alternatively, a drug interaction

designated as “moderate” based on manufacturer literature may be best displayed as a sidebar message, or only to the pharmacy and medical students, and not to the physician at all. Alerts should be kept to a manageable level.

- **Understand and Take Advantage of Pre-Existing Filters** – Use the drug content’s filters and attributes to help minimize unnecessary alerts. Use threshold settings to further customize. For example, some therapeutic duplications are common practice, while others are potentially harmful and/or wasteful. Properly configured thresholds will ignore acceptable drug duplications and alert users to severe duplications.
- **Include Indications with Orders** – The Institute for Safe Medication Practices recommends that orders should include indications to reduce errors and enhance accuracy. This also helps to distinguish between drugs that are commonly confused because their names are “look-alikes” or “sound-alikes.” Each medication order should include the indication for the drug in order to avoid errors. This vital piece of information can also avoid dosing alerts that apply to one indication for a drug but not for another. However, the reality is that few CPOE deployments enforce this today. To provide additional flexibility, some organizations may want to include the option to allow order entry *without* an indication as well.
- **Use Pre-Defined Orders** – Pre-defined medication orders help guide the user to an appropriate choice of dose and frequency – rather than using an alert after an order has been chosen. In addition, fully qualified, clinically validated orders will increase efficiency and reduce errors, such as decimal point errors or incorrect doses for a given drug since doses that would never be appropriate are not presented.

- **Present Content in a Tiered Fashion for Drilling Down** – Users don't want to be barraged with a long narrative every time they order a drug. But when they need more detail, they want it right at their fingertips. A brief description of the problem in the message or alert should provide the user with enough information so they can decide if they want to drill down further. For example, an alert window can provide clinicians with a brief phrase and give the option to click for a longer "snippet" of information. Be aware that your drug content provider may offer alternatives for brief summary messages, and the default one you see in your system may not be the best one for your organization or environment. For instance, some institutions prefer to see a brief drug-drug interaction summary that focuses on clinical effects, but a patient management snippet is another alternative. For detailed information, clinicians also need convenient access to full-text clinical monographs.

Keeping the Content Current

Updating content remains an industry-wide challenge. Once an organization fully moves to online ordering, it is difficult to take the system offline for extended periods to update content. Plan for an update process before taking the system live, as drug data is highly dynamic. It's easy to defer development of an update plan when a scheduled go-live date looms, but there will be other priorities once the system goes live, and stale data issues can sneak up quickly and can cause the system to lose credibility with the users relatively quickly. The primary methods of content updates are:

- **Full File Refreshes** – Although this is the most time-consuming approach, this is often an easier method than incremental

updates, which require organizations to backtrack if they miss an update.

- **Incremental Updates Only** – This requires less time than full file refreshes, but every update must be loaded in order.
- **A Hybrid Approach** – This is typically the optimal approach, and includes scheduling incremental updates and periodic full refreshes of data. This method helps preserve the integrity of the data over the long term, and gains credibility among users if they know in advance that time offline will be limited.
- **Leverage Existing Tools** – A good incremental update utility from the content provider is the best-case scenario, performing most of the update work for users. Explore this option before expending resources on the "do-it-yourself" method.

Conclusion

For organizations that are looking to adopt CPOE solutions, beyond evaluating system functionality, purchasers need to be acutely aware of the content inside the solution, which is the key component that facilitates clinical decision-making. Electronic drug information – combined with messages and alerts – is the key to unlock methods that can improve patient safety, reduce costs and increase efficiency.

Footnotes

¹ The Leapfrog Group. Computer Order Entry Fact Sheet.

² Darves, Bonnie. CPOE: The Promise and the Pitfalls – Trinity Health System. HealthLeaders. 2004, January: 61-72.

³ Birkmeyer JD, Birkmeyer CM, Wennberg, DE, Young MP. Leapfrog safety standards: potential benefits of universal adoption. The Leapfrog Group. Washington, DC: 2000.

⁴ Institute of Medicine. To Err is Human: Building a Safer Health System. Washington: National Academy Press; 1999.

⁵ Darves, Bonnie. CPOE: The Promise and the Pitfalls – Ohio State University Medical Center. HealthLeaders. 2004, January: 61-72.

⁶ Sengstack, P, Gugerty, B. CPOE systems: Success factors and implementation issues. Journal of Healthcare Information Management. 2004, volume 18, No. 1: 36-45.

⁷ Chaffee, BW. Developing and assessing requirements for clinical decision support. Am J Hosp Pharm. 2003, 60: 1875-1878.

⁸ Darves, Bonnie. CPOE: The Promise and the Pitfalls – Montefiore Medical Center. HealthLeaders. 2004, January: 61-72.