IHE and CPOE: The Twine Shall Meet for Healthcare

By Pankaj Gupta

Integrated Healthcare Enterprise is required to leverage the benefits of CPOE

One of the major concerns plaguing the healthcare industry is medical errors. A Computerized Physician Order Entry (CPOE) offers the prospect of reducing medical errors and is seen by most healthcare organizations worldwide, as a major breakthrough in the area of patient safety. Adoption of CPOE has resulted in little benefits so far, as the computer systems in hospital environment need to be fully integrated, in order to realize the full potential of CPOE. Therefore the skepticism against CPOE still remains. The biggest challenge to the success of CPOE is the integration of clinical data across the enterprise. This paper discusses how to deliver the CPOE promise by Integrated Healthcare Enterprise (IHE).

HOW OFTEN DO PHYSICIANS USE IT SYSTEMS?

It has been ascertained that a lot many fatal incidents occur due to human error at the physician's order entry stage itself. CPOE systems are IT systems aimed at alerting the physician about potentially dangerous/erroneous orders before the orders are actually executed, thereby facilitating a solution for this long-standing issue in medical set up. Institute of Medicine's (IOM) report of 1999 stated that 44,000 - 98,000 people die in the USA hospitals each year as a result of medical errors that could have been prevented [1]. The Leapfrog Group was created in response to the IOM report to focus on patient safety [1, 2].

On the other hand, only 24% of physicians practice in a high-tech office setup. Physicians in groups of fifty or more are significantly more likely to use an IT tool and practice in a high-tech office, as compared to physicians in individual practice [3].

Physicians who use IT systems have the problem of disparate systems existing in silos for their clinical practice and most often use IT only for billing. For clinical management, the most common tool is computerized access to laboratory results and this constitutes 59% of the respondents. 27% of respondents use EMRs routinely or occasionally; 27% prescribe or order tests electronically; and 12% receive electronic alerts about potential drug-prescribing problems [3].

The biggest obstacle to the adoption of CPOE is the communication gap that exists between the vendors of different clinical systems. That is the reason why IHE is laying down the framework for passing vital health information seamlessly from application to application, system to system and setting to setting — across the entire healthcare enterprise. IHE is a US national vision of a connected and interoperable healthcare infrastructure. It is one of the most significant healthcare industry efforts of the 21st century. Healthcare Information and Management Systems Society (HIMSS) has taken a leadership role in making this vision a reality [4].

The top 3 barriers to adoption of IT are start-up costs (56%), lack of uniform standards (44%), and lack of time (39%) [3]. In spite of all odds, the testimony to the benefits of CPOE is that more than 10% of U.S. hospitals now have CPOE [5, 6].

Fully integrated CPOE systems can be remarkably effective in reducing the amount of serious medication errors. A study led by David Bates MD, Chief of General Medicine at Boston's Brigham and Women's Hospital, demonstrated that CPOE reduced error rates by 55% — from 10.7 to 4.86 events per 1000 patient days. Preventable Adverse Drug Events (ADEs) declined 17% from 4.69 to 3.88 per 1000 patient days, while non-intercepted potential ADEs declined 84% from 5.99 to 0.98 per 1000 patient days. The prevention of errors was attributed to the CPOE system's structured orders and medication checks [5, 6].

Errors can best be avoided by designing the healthcare systems in a way that makes it difficult for people to commit mistakes and easier for them to do it right. For instance, implementing early warning systems in medication process will yield better human performance and reduce errors.

CPOE SYSTEMS INTERCEPT ERRORS

One of the IOM report's main conclusions is that the majority of medical errors do not result from individual recklessness or the actions of a particular group – this is not a "bad apple" problem. Most often, errors are caused by faulty systems, processes and conditions that lead people to make mistakes or fail to prevent more such mistakes [1].

Errors happening due to illegibility of physician's notes in the clinical setting have been a long-standing and recurring complaint from the paramedical staff (pharmacists, nurses and other ancillary staff). Electronic Medical Records (EMR) solves the issue of illegible physician notes to a large extent. However, EMR leaves scope for human error at the stage of physician order entry itself. This is where CPOE standards fill the gap to prevent erroneous or dangerous orders to get past the physician stage.

CPOE systems are electronic prescribing systems that intercept errors when they most commonly occur — at the time medications are ordered. Through CPOE, physicians enter orders into a computer rather than on paper -- these orders are then integrated with patient information, including laboratory and prescription data. The order sets are automatically checked for inappropriate/ dangerous orders before they are executed.

Over a period of time many clinical decision support systems have come up with CPOE concepts. However, The Leapfrog Group has now laid down a set of standards for the computer programs for alerting health care providers to potentially harmful therapeutic decisions before orders are processed.

The Leapfrog Group says that in order to fully meet the CPOE Standard, hospitals must:

1. Assure that at least 75% of medication orders are entered by the physicians via a computer system that includes prescribing error prevention software;
2. Demonstrate that at least 50% of common and serious prescribing errors are caught by the in-patient CPOE system and relevant alerts are given to the physicians
3. Require that a reason for overriding an interception has to be electronically documented by the physicians, prior to doing so [7].

CPOE standards recommend that alerts be given to the physician for basic to expert where an integrated system like IHE comes in.

CPOE REQUIRES ENTERPRISE LEVEL INTEGRATION

Decentralized and fragmented nature of healthcare delivery system has been the oft-cited problem that has contributed to medical errors. When there are multiple providers in different settings, none of whom has access to complete information, things often go haywire [1]. IHE – including IT infrastructure, EMR, computer-based data capture, data storage and data retrieval are pre-requisites for institutionalizing CPOE standards.

CPOE decisions cannot be made in isolation. They need to be supported with data from various hospital systems. This is where the need for IHE is deeply felt

level warnings. The range of alerts varies from the drug allergy and drug overdose (basic alert) to contra-indication based on individual's laboratory studies (expert alert). Basic level alerts are simple alerts, e.g., allergy to penicillin and overdose of antihistamine. Whereas, alerts for unusual drop in blood clotting time and prothrombin laboratory values in patient's charts due to increasing dose of anti-coagulant like warfarin, is an expert level alert.

CPOE systems need a fully integrated data to be available for the decision making as CPOE decisions cannot be made in isolation. It requires data from numerous systems such as EMR, past prescriptions, orders, lab, pharmacy, in-patient record and drug index etc. This is

Computer systems have evolved in the hospital environment over a period of time. The early computer systems in the hospitals were essentially standalone islands of patient data that could not communicate with other systems in the same department, let alone the other systems in the hospital. Nowadays, most hospitals are investing time and effort for integrating various standalone systems across departments to reduce errors during dual entry of patient data and enable physician order execution in near real-time.

Figure 1 overleaf shows that the computer systems in hospitals are evolving from standalone data collection mode to an IHE [8]. Once the systems are integrated, the stage is set to
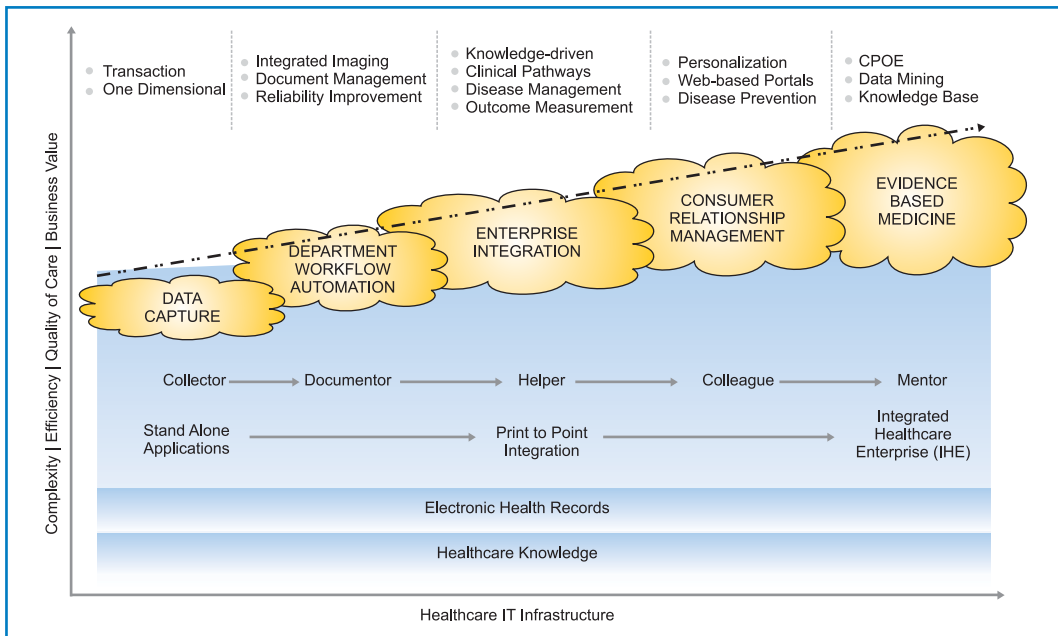
Figure 1: *Evolution of IHE*   **Source:** *Infosys Analysis*

institutionalize CRM, evidence based medicine and the topmost layer of patient safety — CPOE.

The challenge before IHE is the lack of a uniform standard for integrating all the pieces of a healthcare delivery organization. HL7 Standards are available for integrating most of the hospital systems such as - clinical, lab, pharmacy, administration, etc. Similarly, DICOM standard is being used for integrating radiology and imaging systems. However, there are major gaps between radiology/imaging workflows and rest of the hospital workflows because DICOM and HL7 are two different standards and do not interact with each other. Nevertheless HL7 3.0 is making an effort to provide DICOM support also. On top of that HL7 2.x series and HL7 3.0 series are very different from each other and do not offer any backward and forward compatibility.

To complicate the issue further, end-to-end integration becomes more distant dream due to lack of integration standards for medical devices e.g., ICU monitoring devices, bedside monitoring devices, homecare and remote monitoring devices. Each manufacturer has his own standards and the industry is yet to reach a uniform standard for medical device integration.

Though all the large clinical systems vendors are making sincere efforts to make their products CPOE compliant, the reality is that hospitals usually have islands of computer systems installed/ built at various periods of time by different product vendors. Enterprise wide CPOE will remain a distant dream unless large IT and Healthcare-IT vendors come out of business silos and move to open standards to help health delivery industry to integrate the standalone systems and tide over the chasm.

CPOE AND IHE

CPOE alerts need a huge enterprise-wide knowledge base to operate at the backend. Some

of the medical knowledge is readily available whereas some of it is still state, region and hospital specific. Expert/ Advance level alerts e.g., drug-lab-document alert will need data from across different hospital systems. These systems need to be integrated to yield full benefits of CPOE.

Some examples of the system integration required for CPOE include:

■ Prompts that warn against the possibility of drug interaction, allergy, overdose, etc. – Need integration of prescription, orders, pharmacy, in-patient EMR and drug index

■ Modify prescriptions timely and in quick response to changes in lab values of the patient – Need integration of orders, EMR, pharmacy and lab

■ Accurate, current information that helps physicians prescribe the new or alternative drugs when required – Need integration of orders, EMR, drug index and publication reference database

■ Drug-specific information that eliminates confusion among drug names that sound alike – Need integration of orders, drug index and publication reference database

■ Improved communication between physicians and pharmacists – Need integration of orders, in-patient EMR and pharmacy

■ Reduced healthcare costs and hospital stay due to improved efficiencies. – Need integration of orders, EMR, pharmacy, labs, billing, etc.

THE MID-WAY SOLUTION

The mid-way solution is to build an IHE platform that integrates all the different silos systems of the physician, hospital, administration, billing, lab, radiology, pharmacy and the community around.

The IHE solution should have built-in healthcare systems integration protocols and standards such as HL7 2.x, HL7 3.0, DICOM, CCR, ASN.1, X12, EDI etc. The solution should also go beyond existing standards and provide integration capability with commonly used medical devices and drug clinical trial systems. It should serve a purpose such that a universal database can be built to pool metadata from all the source systems and make the complete transaction data available on demand. Also the transaction data needs to be loaded into datawarehouse cubes for reporting. Finally, the solution should have a decision support engine to enable the implementation of CPOE rules that span data sets, sitting in different systems across the hospital like physician's office, lab, radiology section, pharmacy, etc. Some CPOE rules are generic and some are region/location/ site/specialty and physician specific.

The icing on the cake is when the end-users are able to get onboard a single system and view the data from the source systems with a single sign-on capability. The system recognizes the end user e.g., physician, nurse, medical staff, patient, etc. and shows only the relevant information based upon personal preferences.

Such a solution will bridge the gap between what is available and what is desired, without the hospitals having to rip and replace the existing systems. Although such a solution will be an interim one, it will fill the gap until larger fully integrated CPOE compliant Hospital Information Systems (HIS) become ubiquitous and affordable.

CONCLUSION

To derive the true benefits of CPOE the challenge is to create user-friendly, seamless systems that integrate all critical disparate systems throughout the enterprise, including patient records, order

entry, pharmacy, radiology and lab.

It is difficult to completely replace legacy clinical systems with a single, monolithic solution in terms of time and expense. A more prudent and less disruptive approach is by taking the application integration route to meet CPOE requirements. Although such a solution will be an interim solution, it is likely fill the gap until larger fully integrated CPOE compliant HIS becomes ubiquitous and affordable.

Errors can happen anywhere in the clinical workflow e.g., orders, labs, dispensing or drug administration. CPOE systems can not only check repetitive orders but can also significantly cut down the delays between writing and complet-ing orders. CPOE can cut staff costs directly by reducing the time spent by nursing, pharmacy and other ancillary services on understanding and filling orders such as labs, dispensing and drug administration. So, health care institutions have much to gain in efficiency and cost savings from integrating the systems across the hospital to enable a CPOE system.

REFERENCES

1. LT Kohn et al., To Err is Human: Building a Safer Health System, Institute of Medicine Committee on Quality of Health Care in America, USA National Academy Press, 1999. Also available at http://www.nap.edu/html/to_err_is_human/exec_summ.html

2. Robert G Berger et al., Computerized Physician Order Entry: Helpful or Harmful? Journal of American Medical Informatics Association, Vol 11, 2004, pp 100-103. Also available on http://www.jamia.org

3. A M Audet et al., Information Technologies: When Will They Make It into Physicians' Black Bags? MedGenMed, Vol 6, No 4, 2004. Also available at http://www.pubmedcentral.nih.gov/articlerender.fcgi?tool=pubmed&pubmedid=15775829

4. IHE: Integrated Healthcare Enterprise. Available at http://www.himss.org/ASP/topics_ihe.asp

5. Fact Sheet: Computerized Physician Order Entry (CPOE), The Leapfrog Group for Patient Safety, Available at http://www.leapfroggroup.org/media/file/Leapfrog-Computer_Physician_Order_Entry_Fact_Sheet.pdf

6. D W Bates et al., Effect of Computerized Physician Order Entry and a Team Intervention on Prevention of Serious Medication Errors, Journal of American Medical Association, Vol 280, 1998, pp 1311-1316. Also available at http://jama.ama-assn.org/cgi/content/full/280/15/1311

7. J S Ash et al., Some Unintended Consequences of Information Technology in Healthcare: The Nature of Patient Care Information Systems-related Errors, Journal of American Medical Informatics Association, Vol 11, 2004, pp 104-112. Also available on http://www.jamia.org

8. Pankaj Gupta, CPOE: Way Forward, ICMIT-IIT Conference, Kharagpur, 2005

9. C J McDonald et al., Physicians, Information Technology and Healthcare Systems: A Journey, Not a Destination, Journal of American Medical Informatics Association, Vol 11, 2004, pp 121-124. Also available on http://www.jamia.org.

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