

Leapfrog Group Report on CPOE Evaluation Tool Results June 2008 to January 2010

Executive Summary

Using The Leapfrog Group's web-based simulation tool, 214 hospitals tested their computerized physician order entry (CPOE) systems for their ability to detect common medication errors and errors that could lead to fatalities. The CPOE systems on average missed one half of the routine medication orders and a third of the potentially fatal orders. Nearly all of the hospitals improved their performance after adjusting their systems and protocols, and running the simulation a second time. The simulations were conducted from June 2008 to January 2010.

The Leapfrog simulation tool used to develop this report is the only one of its kind available to all hospitals through The Leapfrog Hospital Survey. Every hospital that employs a computer prescribing system should incorporate the Leapfrog simulation tool into their ongoing quality assurance and improvement processes.

For the sake of safe patient care, hospitals must test and monitor their CPOE systems on an ongoing basis to achieve true meaningful use. In addition, vendors and hospitals must collaborate more closely during the pre-implementation and implementation phases to ensure that best practices are shared and followed.

The Leapfrog Group is calling on the federal government to ensure that any definition of meaningful use employed as a requirement for federal financial assistance to hospitals to adopt CPOE and other health care IT systems require monitoring and improvement at implementation and on a long-term basis.

The Leapfrog Group

Summary of Results

Between June 2008 and January 2010, 214 hospitals from across the U.S. completed Leapfrog's CPOE evaluation tool. The 214 hospitals include urban, rural, and pediatric hospitals.

Each adult hospital was given a scenario of 10 test patients and 50 medication orders; pediatric hospitals received 10 test patients and 51 medication orders. Each of the orders in the test scenario would result in an adverse drug event, and some of the test orders would result in a potentially fatal medication error.

Hospitals receive medication orders in several categories, including:

Therapeutic Duplication

Medication with therapeutic overlap with another new or active order; may be same drug, within drug class, or involve components of combination products. Example: Codeine AND Tylenol #3.

Single and Cumulative Dose Limits

Medication with a specified dose that exceeds recommended dose ranges or that will result in a cumulative dose that exceeds recommended ranges. Example: Ten-fold excess dose of Methotrexate.

Allergies and Cross Allergies

Medication for which patient allergy has been documented or allergy to other drug in same category has been documented. Example: Penicillin prescribed for patient with documented Penicillin allergy.

Contraindicated Route of Administration

Medication order with an incorrectly specified route of administration (e.g., oral, intramuscular, intravenous) that is not appropriate for the identified medication. Example: Tylenol to be administered intravenously.

Drug-Diagnosis Interactions

Medication either contraindicated based on patient diagnosis or diagnosis affects appropriate dosing. Example: Nonspecific beta blocker in patient with asthma.

Contraindications/Dose Limits Based on Age and Weight

Medication either contraindicated for this patient based on age and weight or for which age and weight must be considered in appropriate dosing. Example: Adult dose of antibiotic in a newborn.

Contraindications/Dose Limits Based on Lab Studies

Medication either contraindicated for this patient based on laboratory studies or for which relevant laboratory results must be considered in appropriate dosing. Example: Normal adult dose regimen of renally eliminated medication in patient with elevated creatinine.

Contraindications/Dose Limits Based on Radiology Studies

Medication contraindicated for this patient based on interaction with contrast medium in recent

The Leapfrog Group

or ordered radiology study. Example: Medication prescribed known to interact with iodine to be used as contrast medium in ordered head CT exam.

Of the 214 hospitals analyzed for this report, 187 hospitals completed an adult CPOE test and 37 hospitals completed a pediatric test. Ten hospitals completed both an adult and pediatric test resulting in 224 total CPOE tests and 10,447 total medication orders processed through hospital CPOE systems.

Table 1: Results of Adult & Pediatric Medication Orders

	# of medication orders processed	% of medication orders that did not receive an appropriate warning
Adult Hospitals (n=187)	8,716	52%
Pediatric Hospitals (n=37)	1,731	42.1%

Table 2: Results of Adult & Pediatric Potentially Fatal Orders

	# of potentially fatal orders processed	% of potentially fatal orders that did not receive an appropriate warning
Adult Hospitals (n=187)	311	32.8%
Pediatric Hospitals (n=37)	62	33.9%

Recommendations

Leapfrog offers several recommendations based on CPOE Evaluation Tool findings. First, alongside federal investment in technology, and as part of the definition of meaningful use, there must be a testing and monitoring component for all technology adoption in hospitals.

Second, we must find a way to share information transparently about best practices for adoption of health information technology in hospitals. Competition is healthy, but in the case of IT adoption, collaboration is far better. Technology systems are not “plug and play.” They require thoughtful engagement by all stakeholders in the hospital system. Currently hospitals aiming to invest in CPOE or

The Leapfrog Group

other HIT systems either rely on their vendor to map an adoption process or invent their own. This is not efficient and results in the performance variation that these studies found. Leapfrog is working with the respected Health Information and Management Systems Society (HIMMS) to formulate a set of best practices and disseminate them publicly.

Third and most importantly, Leapfrog and our purchaser members will continue to push for more hospitals to adopt CPOE. The evidence that CPOE saves lives and prevents the most common adverse event in hospitals—medication errors—remains abundant and urgent. CPOE systems can reduce medical errors by up to 88%ⁱ and recent research estimates that implementation of CPOE systems at all non-rural U.S. hospitals could prevent three million adverse drug events each year.ⁱⁱ

As medicine grows more complex, it will not be adequate to rely on the individual memories of each and every clinician to assure a plethora of medication errors are avoided. We will need to rely on advancing technology to support clinicians, and we will need to improve on the performance of that technology over time.

Background

The Leapfrog Group and CPOE

The Leapfrog Group uses the collective leverage of large purchasers of health care to initiate breakthrough improvements in the safety, quality, and affordability of health care for Americans. The Leapfrog Group was founded in November 2000 by the Business Roundtable and is now independently operated with support from its members.

The Leapfrog Group, through The Leapfrog Hospital Survey has requested hospitals to report on their progress in implementing computerized physician order entry (CPOE) systems since the beginning of the Hospital Survey in 2001. CPOE implementation was one of the original three leaps that were measured and reported by Leapfrog. In 2008, for the first time, Leapfrog requested that hospitals with CPOE systems, in at least one inpatient unit, take the CPOE Evaluation Test. Hospitals were given credit for taking the test; Leapfrog did not include their actual performance score on the test in the scoring of the survey. In 2009, The Leapfrog Group began to include their performance score in the publicly reported composite score for CPOE. The composite score for CPOE is reported publicly on the Leapfrog Group website at www.leapfroggroup.org/cp. The number of hospitals taking the test has climbed to over 200 in 2009.

Purpose of the CPOE Evaluation Tool

The primary purpose of the evaluation tool is to assess the ability of implemented CPOE systems to aid in avoiding medication-related adverse events originating in orders for hospitalized patients. This is accomplished by evaluating how the system responds to medication orders entered that contain such errors. Most of the orders used in the evaluation are of this type. To perform well, the hospital must be using features of CPOE that detect situations that could lead to adverse drug events (ADEs) and respond to them (i.e., clinical decision support that advises the physician).

The evaluation also addresses two other aspects of the successful use of CPOE:

The Leapfrog Group

1. In implementing clinical decision support, a hospital must achieve the right balance between useful alerting and “over-alerting” or intercepting orders that have a very low risk of leading to ADEs. Such “nuisance” alerts can seriously impair physician acceptance of CPOE and, more importantly, lead users to ignore all alerts – thereby decreasing the value of clinical decision support. The reason for including orders that could generate nuisance alerts in the evaluation is to provide feedback to the hospital about this balance.
2. Although The Leapfrog Group is currently targeting medication orders, CPOE has value to the hospital beyond its ability to reduce adverse drug events. To encourage the use of other CPOE functions that improve care efficiencies, the evaluation includes two other types of orders. One is orders that require secondary or “corollary” orders (for example, recommending an order for drug levels when the user orders a medication for which the patient’s blood level should be monitored to titrate dosing). The other is duplicate orders that test the ability to alert the user that a particular diagnostic test has been ordered very recently, thus avoiding the cost and morbidity of duplicate testing. A small number of orders in the evaluation order set address these two issues.

It should be noted that the CPOE Evaluation Tool does not test every area of care delivery nor does it include all types of medications. It focuses on medications that could cause harm to patients and add excess costs to healthcare purchasers,

Development of the CPOE Evaluation Tool

The development of the CPOE Evaluation Tool and its accompanying order sets were funded under grants from the California Healthcare Foundation and the Agency for Healthcare Research and Quality. Order sets for pediatric and adult patients for the evaluation were developed, combining knowledge from published research with the experience and knowledge of the Institute for Safe Medication Practices and nationally recognized experts in the field of CPOE including Dr. David Bates (Partners Health care), Dr. David Classen (FCG, now CSC), Jane Metzger (FCG, now CSC) Dr. Marc Overhage (Regenstrief Institute), and Dr. Thomas Payne (University of Washington) among others.

The experts will continue to review results, order sets, scoring, and implementation instructions to assure that the tool remains relevant and current.

ⁱ [Van der Sijs H, Aarts J, Vulto A, Berg M.](#) Overriding of drug safety alerts in computerized physician order entry. *J Am Med Inform Assoc.* 2006 Mar-Apr;13(2):138-47. Epub 2005 Dec 15

ⁱⁱ Lwin AK, Shepard DS. Estimating Lives and Dollars Saved from Universal Adoption of the Leapfrog Safety and Quality Standards: 2008 Update. The Leapfrog group. Washington, DC: 2008. ing WJ, Paice N, Rangrej J et al. The effect of computerized physician order entry on medication errors and adverse drug events in pediatric inpatients. *Pediatrics.* 2003 Sep;112(3 Pt 1):506-9.