

Measure Background

More than one million serious medication errors occur every year in US hospitals.¹ The errors include administration of the wrong drug, drug overdoses, and overlooked drug interactions and allergies. They can occur for many reasons, including illegible handwritten prescriptions and decimal point errors.

Medication errors often have tragic consequences for patients. Many serious medication errors result in preventable adverse drug events (ADEs), approximately 20% of which are life-threatening.^{2,3} According to the Institute of Medicine's report, *To Err is Human*, medication errors alone contribute to 7,000 deaths annually.⁴

Medication errors also result in tremendous financial costs. One ADE adds more than \$2,000 on average to the costs of hospitalization⁵; this translates to over \$7.5 billion per year nationwide in hospital costs alone.⁶ Furthermore, this figure excludes other important costs of medication errors, such as malpractice insurance premiums and losses in worker productivity.

What is Computerized Physician Order Entry?

Computerized physician order entry (CPOE) systems are electronic prescribing systems that intercept errors when they most commonly occur — at the time medications are ordered. With CPOE, orders are entered into a computer rather than on paper. Orders are integrated with patient information, including laboratory and prescription data. The order is then automatically checked for potential errors or problems. Specific benefits of CPOE include:

- Prompts that warn against the possibility of drug interaction, allergy or overdose;
- Accurate, current information that helps physicians keep up with new drugs as they are introduced into the market;
- Drug-specific information that eliminates confusion among drug names that sound alike;
- Improved communication between physicians and pharmacists; and,
- Reduced long-term healthcare costs.⁷

Effectiveness of CPOE in Reducing Errors

CPOE systems can be remarkably effective in reducing the rate of serious medication errors.⁸ Research has found that hospitals that have fully implemented CPOE outperform hospitals that have not fully implemented CPOE on multiple measures of medication error.⁹

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 4.9 per 1000 patient-days.² Rates of serious medication errors fell by 88% in a subsequent study by the same group.³ The prevention of errors was attributed to the CPOE system's structured orders and medication checks.^{2,3} Another study conducted at LDS Hospital in Salt Lake City by David Classen, MD, demonstrated a 70% reduction in antibiotic-related ADEs after implementation of decision support for these drugs.¹⁰

CPOE has paid other dividends. Length of stay at Wishard Memorial Hospital in Indianapolis fell by 0.9 days, and hospital charges decreased by 13% after implementation of CPOE.¹¹ A study at Ohio State University also identified substantial reductions in pharmacy, radiology and laboratory turn-around times, as well as a reduction in length of stay in one of the two hospitals studied.¹²

Research estimates that implementation of CPOE systems at all non-rural U.S. hospitals could prevent three million adverse drug events each year.⁶

The Leapfrog CPOE Standard

Given the potential benefits for both patients and payers, national experts in health care quality and patient safety advised The Leapfrog Group to select CPOE as one of its initial safety standards. The Leapfrog Group's original CPOE standard was based on extensive review of published research and consultation with leading experts in medication errors and CPOE. This standard has since been reviewed and revised, incorporating even more current data and input from the hospital and physician communities.

In order to fully meet The Leapfrog Group's CPOE standard, hospitals must:

- Assure that at least 85% of inpatient medication orders are entered via a computer system that includes prescribing-error prevention software; and
- Demonstrate, via a test, that their inpatient CPOE system can alert prescribers to at least 60% of common, serious prescribing errors. (Applies to adult hospitals only.)*

*Note: For the 2021 Hospital Survey, the CPOE Adult Inpatient Test is optional. Hospitals can achieve the CPOE standard by assuring that at least 85% of inpatient medication orders are entered via the CPOE system. This change reflects Leapfrog's recognition that many hospitals continue to have bandwidth issues due to COVID-19.

Leapfrog's CPOE Evaluation Tool

Developed by First Consulting Group and the Institute for Safe Medication Practices, The Leapfrog Group's CPOE Evaluation Tool provides hospitals with an assessment of the adequacy of their CPOE system alerts for common, serious prescribing errors. The tool requires hospitals to download a series of simulated patients and medication orders and to input those patient/medication combinations into the hospital's CPOE system.¹³ Hospitals submit a report to Leapfrog on the alerts received at point of order-entry. The reported alerts are compared against the expected alerts identified by a national research and development panel. A hospital's score on the tool is the percentage of correct alerts they received in specific categories. Hospitals are required to test their CPOE system utilizing the tool and score well on the test in order to fully meet Leapfrog's standard.

Challenges to CPOE Implementation

Despite the considerable benefits, some US hospitals have not implemented CPOE systems. What are the challenges?

- Installation of even "off the shelf" CPOE packages requires a significant amount of customization for each hospital and can be very expensive.²
- Cultural obstacles to CPOE implementation. For example, some physicians resist utilizing

computerized decision-support tools, relying instead on practice experience.

Why Purchasers Need to Get Involved

Given the prevalence of medication errors and potential for significant harm, it is critical that purchasers send a signal to hospitals that they expect hospitals to implement CPOE systems throughout their facility as well as test and monitor these systems via the Leapfrog CPOE Evaluation Tool. The CPOE Evaluation tool is the only known tool of its type that tests CPOE systems to determine if they are working as they should to prevent harmful and fatal medication errors. Hospitals that have CPOE implemented throughout their facility and have passed the CPOE Evaluation Tool are less likely to commit errors in the medication ordering process. Purchasers should look for those facilities that have achieved Leapfrog's CPOE standard and encourage their employees to consider those facilities for care. The potential cost savings to an employer of reducing ADEs are tremendous, though pales in comparison to the potential for reduced harm to employees.

References

1. Birkmeyer J, Dimick J. Leapfrog safety standards: potential benefits of universal adoption. The Leapfrog Group. Washington, DC: 2004.
2. Bates D, Leape L, Cullen D, et al. Effect of computerized physician order entry and a team intervention on prevention of serious medication errors. *JAMA*. 1998;280:1311-1316.
3. Bates D, Teich J, Lee J, et al. The impact of computerized physician order entry on medication error prevention. *JAMIA*. 1999;6:313-321.
4. Kohn L, Corrigan J, Donaldson M. *To err is human: building a safer health system*: a report from the Committee on Quality of Healthcare in America, Institute of Medicine, National Academy of Sciences. National Academy Press, Washington, DC, 1999.
5. Classen D, Pestotnik S, Evans R, Lloyd J, Burke J. Adverse drug events in hospitalized patients: excess length of stay, extra costs, and attributable mortality. *JAMA*. 1997;277:301-306.
6. Bates D, Spell N, Cullen D, et al. The costs of adverse drug events in hospitalized patients. *Adverse Drug Events Prevention Study Group*. *JAMA*. 1997;277(4):307-311.
7. Nuckols T, Asch S, Patel V, et al. Implementing computerized provider order entry in acute care hospitals in the United States could generate substantial savings to society. *Jt Comm J Qual Patient Saf*. 2015;41(8):341-351.

8. MacKay M, Anderson C, Bochme S, Cash J, Zobell J. Frequency and severity of parenteral nutrition medication errors at a large children's hospital after implementation of electronic ordering and compounding. *Nutr Clin Pract.* 2015 Jul 24 [Epub ahead of print].
9. Yu F, Menachemi N, Berner E, Allison J, Weissman N, Houston T. Full implementation of computerized physician order entry and medication-related quality outcomes: A study of 3364 hospitals. *Am J Med Qual.* 2009;24(4):278-286.
10. Evans R, Pestotnik S, Classen D, et al. A computer assisted management program for antibiotics and other anti-infective agents. *N Engl J Med.* 1997;338(4):232-238.
11. Tierney W, Miller M, Overhage J, McDonald C. Physician inpatient order writing on microcomputer workstations: Effects on resource utilization. *JAMA.* 1993;269:379-383.
12. Mekhjian H, Kumar R, Kuehn L, et al. Immediate benefits realized following implementation of physician order entry at an academic medical center. *J Am Med Inform Assoc.* 2002;9(5):529-539.
13. Kilbridge P, Welebob E, Classen D. Development of the Leapfrog methodology for evaluating hospital implemented inpatient computerized physician order entry systems. *Qual Saf Health Care.* 2006;15(2):81-84.

For a comprehensive list of references please review the Computerized Physician Order Entry Bibliography, available here:

<https://ratings.leapfroggroup.org/measure/hospital/safe-medication-ordering>