Executive Summary

Computerized physician order entry (CPOE) systems are designed to reduce medication errors. The best evidence to date demonstrates that patients who experience adverse drug events (ADEs) that are preventable have, on average, longer hospital lengths of stay (by approximately two to four-and-a-half days) and higher hospital costs (between $2,000 to almost $5,000). Researchers and practitioners have demonstrated impressive reductions in ADE costs when a CPOE system is used in conjunction with clinical decision support systems, such as prescribing cheaper but equally effective drugs, reducing unnecessary lab tests, and using evidence-based treatment guidelines.

Purchaser Tips

In To Err is Human (www.iom.edu/iom/iomhome.nsf/Pages/2000+Reports), the Institute of Medicine reports that adverse drug events are the leading cause of avoidable death and disability in American hospitals. The Leapfrog Group, an organization of large health care purchasers that works to reward higher standards for patient safety, has set the following standards for hospital-based CPOE:

1. Require physicians to enter medication orders via a computer system that is linked to prescribing error prevention software;
2. Demonstrate, via a test now under development by the Institute for Safe Medication Practices and First Consulting Group (http://www.leapfroggroup.org/CPOE/CPOE_Evaluation.pdf), that their inpatient CPOE system can intercept at least 50% of common serious prescribing errors; and
3. Require documented acknowledgment by the prescribing clinician of the interception prior to any override.
Best Practices

A computerized physician order entry (CPOE) system is designed to reduce medication errors in several ways. First, a CPOE system can provide physicians with a menu of medications from the formulary, complete with default doses and a range of potential doses for each medication. It also ensures that all drug orders are legible and can display patient-specific, relevant laboratory results on the screen at the time of ordering. It can also check for drug-allergy contradictions and drug-drug interactions.

Impressive cost savings have been demonstrated when a CPOE intervention is used in conjunction with such clinical decision support systems as:

- Using the less expensive medication within a class of drugs, or using a lower dose or a lower frequency, when such suggestions are supported by the medical literature;
- Using less expensive laboratory tests; and
- Encouraging patients’ placement on critical pathways or science-based treatment guidelines (Bates, 2001).

A test of a CPOE system at Brigham and Women’s Hospital in Boston determined that it reduced drug-related preventable adverse events by 17 percent and serious medication errors by 55 percent. The researchers estimated net savings of CPOE that includes decision supports to be between $5 million to $10 million per year. This net figure includes implementation costs of $1.9 million and $.5 million per year in maintenance costs (Bates et al. 1998; Bates, 2001).

Synthesis of Research

How frequently do errors occur?

In health care, an adverse event refers to an injury that is caused, not by an underlying condition of a patient, but by medical management (Kohn et al., 1999). Although health care professionals and institutions aim to provide safe care, some injuries are unpredictable and inevitable. It has been estimated that in hospitals alone, 1.3 million injuries occur each year and that a sizable proportion (between 20 percent to 70 percent) are preventable (Leap et al., 1995 and Bates et al., 1998).

Medical errors are a leading cause of death in this country. Americans who were not familiar with the research discussed in the recently published report by the Institute of Medicine, To Err is Human, were surprised to learn during the subsequent media blitz that medical errors are responsible for more deaths in this country than car accidents, breast cancer, or AIDS (Kohn et al., 1999). The failure to ensure appropriate medication use is the most common type of medical error. Perhaps for this reason, the research on medication-related errors and adverse drug events (ADEs) is the most extensive.
What do we know about medication errors?

Medication errors occur frequently in hospital and ambulatory settings. They do not often lead to death or serious injury, but such outcomes are on the rise. For example, throughout much of the 1980s and into the early 1990s, inpatient deaths attributable to medication errors more than doubled (Kohn et al., 1999). In outpatient settings, they increased more than eightfold (Kohn et al., 1999). The best available evidence indicates that although a sizeable percentage of ADEs in hospitals are preventable, relatively few medical errors are detected using today’s common but relatively ineffective paper-based detection methods (Bates et al., 1998 and Kohn et al., 1999). The best evidence to date demonstrates that, on average, preventable ADEs increase hospital lengths of stay by 2 to 4.5 days and increase hospital costs by $2,000 to $5,000 (Bates et al., 1997).

Cost estimates of preventable ADEs range from $0.5 million annually at a 520-bed teaching hospital in Utah to $2.8 million annually at a 700-bed teaching hospital in Massachusetts (Classen et al., 1997 and Bates et al., 1997). If the latter estimate is generalized to all inpatients, preventable adverse drug events cost the nation $2 billion a year (Bates et al., 1997 and Kohn et al., 1999).

An intervention that works: computerized physician order entry (CPOE) systems.

Compared to manufacturing, the health care industry has been slower to structure quality improvement (QI) processes using a systems approach. With respect to medication errors, QI approaches that focus solely on paper and pencil inspection protocols and sanctioning individual providers are much less effective than those based on the analysis and correction of underlying systems faults. Systems analyses of ADEs lay the foundation for interventions that work. These interventions help reduce preventable ADEs. They save money.

Systems analysis reveals four distinct stages of the drug ordering-delivery system: physician ordering, transcription and verification, pharmacy dispensing and delivery, and nurse administration to the patient. Further research shows that most preventable ADEs occur during the first (physician ordering) and final (nurse administration) stages of the drug ordering-delivery process (39% and 38% of preventable ADEs, respectively) (Leape et al., 1995). We also know that the two most common causes of medication errors are lack of knowledge of the drug (which, according to Kohn et al. (1999) led physicians to prescribe potentially inappropriate drugs to nearly one-quarter of all non-institutionalized elderly patients nationwide), and lack of information about the patient (such as lab results) (Leape et al., 1995).

A CPOE system is designed to reduce errors caused by these problems (Leape et al., 1995). For example, CPOE systems provide physicians with a menu of medications from the formulary, complete with default doses and a range of potential doses for each medication. They can ensure that all drug orders are legible. They can display patient-specific, relevant laboratory results on the screen at the time of ordering. They can check for drug-allergy contradictions and drug-drug interactions (Bates et al. 1998).
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**Purchasers support purchasing through implementing CPOE systems.**

Recently, a group of large health care purchasers founded The Leapfrog Group. With the sponsorship of the Business Roundtable, The Leapfrog Group encourages purchasers to implement a set of purchasing principles to drive improvements in the safety and overall value of health care for Americans. One of the health care system improvements The Leapfrog Group feels is likely to yield significant safety gains is the use of CPOE systems in hospitals. The rationale is simple. First, there is reasonable scientific evidence that it works. Second, near term implementation by the health industry is feasible. Third, consumers can readily appreciate its value. And fourth, plans, purchasers, and consumers can discern its presence or absence in selecting among providers (The Leapfrog Group, 2000).

**Definitions**

**Adverse events:** injuries caused by medical management rather than the underlying condition of the patient.

**Adverse drug events (ADEs):** injuries caused by medications.

**Computerized physician order entry (CPOE) system.** A computerized system for making drug orders that includes medication error prevention software. CPOEs can provide physicians with a menu of medications from the formulary, complete with default doses and a range of potential doses for each medication. They ensure that all drug orders are legible. CPOEs can display patient-specific, relevant laboratory results on the screen at the time of ordering. They check for drug-allergy contradictions and drug-drug interactions.
**Error**: the failure of a planned action to be completed as intended (i.e., an error of execution) or the use of a wrong plan to achieve an aim (i.e., an error of planning).

*The Institute for Safe Medication Practices* ([http://ismp.org/](http://ismp.org/)) is a nonprofit organization that works closely with health care practitioners and institutions, regulatory agencies, professional organizations, and the pharmaceutical industry to provide education about adverse drug events and their prevention. It is dedicated to the safe use of medications through improvements in drug distribution, naming, packaging, labeling, and delivery system design. The Institute provides an independent review of medication errors that have been voluntarily submitted by practitioners to a national Medication Errors Reporting Program (MERP) operated by the United States Pharmacopeia (USP). The Institute is an FDA MEDWATCH partner and regularly communicates with the FDA to help to prevent medication errors. The Institute encourages the appropriate reporting of medication errors to the MEDWATCH Program.

*The Leapfrog Group*: Composed of more than 110 public and private organizations that provide health care benefits, The Leapfrog Group ([www.leapfroggroup.org](http://www.leapfroggroup.org)) works with medical experts throughout the U.S. to identify problems and propose solutions that it believes will improve hospital systems that could break down and harm patients. Representing more than 32 million health care consumers in all 50 states, Leapfrog provides important information and solutions for consumers and health care providers.

**Medical error**: is the “failure of a planned action to be completed as intended (i.e. error of execution) or the use of a wrong plan to achieve an aim (i.e. error of planning)” in the course of managing a patient’s medical condition (Kohn, 1999).

**Preventable adverse events**: are preventable injuries due to the management of a patient’s medical condition rather than to the patient’s underlying health condition.

**Systems analysis of adverse drug events**: is based on the understanding that although individuals can make errors, characteristics of the systems in which they work can make errors more likely and also more difficult to detect and correct. This approach assumes that individuals must take responsibility for the quality of their work, but more errors will be eliminated by focusing on systems than individuals. This approach can be distinguished from the “bad apple” or “outlier” approach that has characterized much of medical quality improvement. A system is an interdependent group of items, people, or processes with a common purpose.
Useful Links

The Leapfrog Group, http://www.leapfroggroup.org/
Institute of Medicine, http://www.iom.edu/
National Health Care Purchasing Institute, http://www.nhcppi.net

Related Topics

Link to Evidence-Based Hospital Referral (EHR)
Link to Intensivist Staffing in ICUs

Works Cited


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