Leapfrog Computerized Physician Order Entry (CPOE) and Electronic Health Record (EHR) Evaluation Tools

Project Overview and Discussion

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Presented by David Classen, Chief Medical Officer, First Consulting Group, and moderated by Carol Cain, Senior Manager Health IT Portfolio, AHRQ, as part of the AHRQ HIT Web Teleconference Series.

Acknowledgments

- **This project was done for The Leapfrog Group**

- **Funding in Phase 1**
  - California Healthcare Foundation
  - Robert Wood Johnson Foundation

- **Funding in Phase 2**
  - Agency for Healthcare Research and Quality

- **Project Staff**
  - Core FCG Team: David Classen, Jane Metzger, Emily Welebob, Fran Turisco, and Peter Kilbridge (Phase 1)
  - Primary Advisors: David Bates, Mark Overhage, Allen Vaida, Stuart Levine, Andy Spooner, Mark Frisse, and Paul Nichol

Teleconference Purpose

- To present project background and an overview of a self-assessment methodology developed for The Leapfrog Group

- To review how the work can guide hospitals and physician practices in implementing medication-related clinical decision support in inpatient CPOE and ambulatory EHR

- To have an open discussion

Today's Teleconference

- Project Background and Overview

- What the Evaluation Methodology Does and How It Works

- Implications for Implementing CDS for Medication Checking

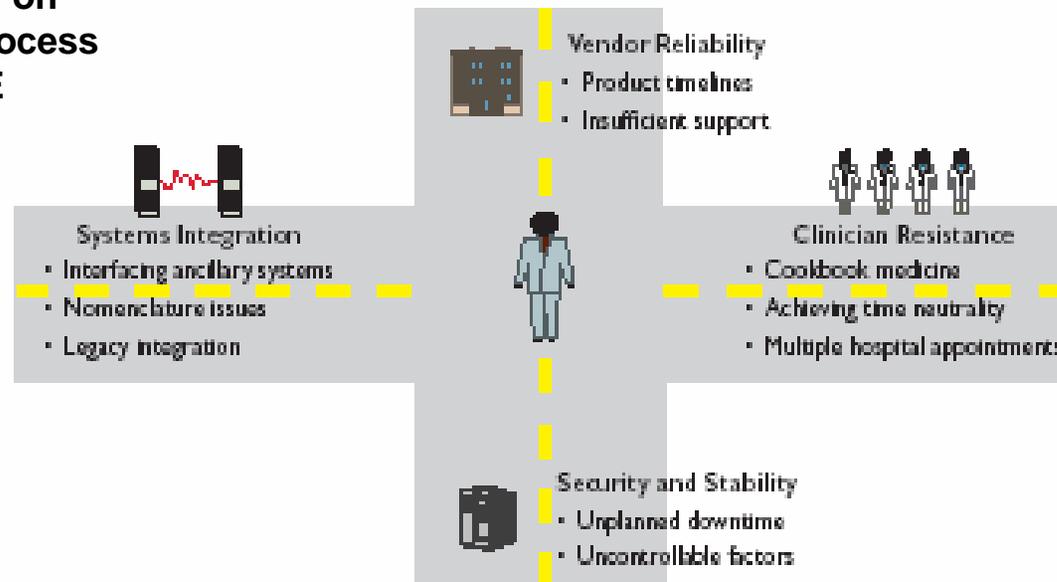- Discussion and Questions

Project Overview and Background

CPOE Adoption Growing Despite Barriers

- **15% US Hospitals**
- **10% Ambulatory Clinics**
- **Increasing at 50% year on year as many are in process of implementing CPOE**

Trouble at Every Turn

Vendor Reliability
- Product timelines
- Insufficient support

Systems Integration
- Interfacing ancillary systems
- Nomenclature issues
- Legacy integration

Clinician Resistance
- Cookbook medicine
- Achieving time neutrality
- Multiple hospital appointments

Security and Stability
- Unplanned downtime
- Uncontrollable factors

CAUTION FROM CPOE VETERANS

"CPOE is the most difficult technology implementation I can think of in the acute care setting."

John Glaser
VP and CIO, Partners Healthcare

"An incredible number of stars need to align for you to be able to pull this [CPOE] off. And even if the stars are aligned, it's almost impossible to describe the amount of work that's required to succeed to those institutions that haven't started it yet."

Jim Turnbull
VP and CIO, Children's Hospital of Denver; Chair, CHIME Board of Trustees

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Source: True North interviews and analysis.

True North 2003

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The Leapfrog Group: Background

- IOM I: To Err is Human – recommended that purchasers provide market incentives for improved patient safety

- The Leapfrog Group: Launched in November, 2000 by the Business Roundtable

- Over 100 of the largest public and private corporations in America

- Purchase benefits for 31 million Americans (1 in 9!)

- Goal: safer care for employees through "Giant Leaps" in patient safety

- Approaches:
  – Reward hospitals for improving patient safety
  – Educate employees, retirees, families about hospital efforts

Sources: The Leapfrog Group, www.leapfroggroup.org; U.S. Census 2001

The Leapfrog Group

Leapfrog is an initiative driven by organizations that purchase healthcare to improve safety, quality, and affordability.

- **Focus has been on hospital-based care to date**
  - Intensivist coverage in ICUs
  - Computerized physician order entry (CPOE) to reduce serious medication ordering errors
  - Evidence-based hospital referrals
  - NQF Safe Practices

- **Next focus area is Ambulatory IT standards:**

  - **Call for:**
    - ▸ **An electronic health record (EHR)**
    - ▸ **Prescription checking to avoid preventable medication-related adverse events**
    - ▸ **Basic disease and wellness management prompting**

  - **Are being coordinated with:**
    - ▸ **Commission for Certification of Healthcare Information Technology**
    - ▸ **Measures for large-scale P4P initiatives**
    - ▸ **NCQA Physician Practice Connection v.2**

- **Clinical decision support testing for physician medication ordering and e-prescribing in *implemented* systems**
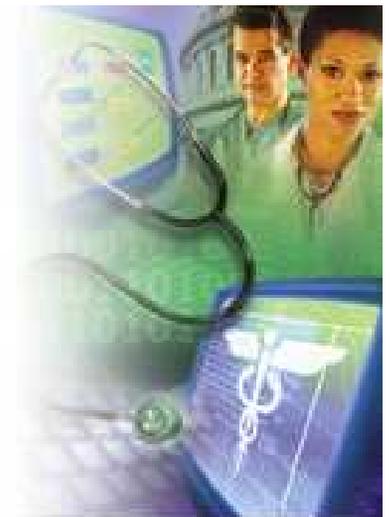
Leapfrog's Inpatient CPOE Standard

- Hospitals that fulfill this standard will:

  - Require physicians of patients in hospitals to enter medication orders via a computer system that is linked to prescribing error prevention software

  - Demonstrate that their CPOE system can intercept at least 50% of common serious prescribing errors, utilizing test cases and a testing protocol specified by The Leapfrog Group

  - Require documented acknowledgment by the prescribing physician of the interception prior to any override
    post the test case interception rate on a Leapfrog-designated web site

COE in Pharmacy Computer Systems - ISMP 2004

Source: ISMP Medication Safety Alert! August 25, 2005		Unsafe order NOT detected	Able to override
Varivax 0.5 mL subcutaneously	**Female; pregnant**	**81%**	**89%**
methotrexate 7.5 mg PO daily	**Rheumatoid arthritis**	**71%**	**87%**
Lantus 25 units IV now	**Diabetes**	**70%**	**61%**
carbamazepine 400 mg PO BID	**4 year old child**	**68%**	**89%**
vincristine 2 mg intrathecally today	**Acute leukemia**	**65%**	**60%**
Fluzone 0.5 mL IM	**Allergy to eggs**	**57%**	**84%**

Leapfrog Ambulatory Standard (2007)

- Physician practices that fulfill this standard will use an EHR with:

  - Information on age/gender diagnoses, medications, allergies, weight, and laboratory test results

  - Clinical decision support based on drug reference information that can intercept at least 50 percent of common prescribing errors

  - Reminders to aid clinicians in basic health maintenance guidelines of the U.S. Preventive Services Task Force and other widely-adopted sources

Purposes of the Evaluation
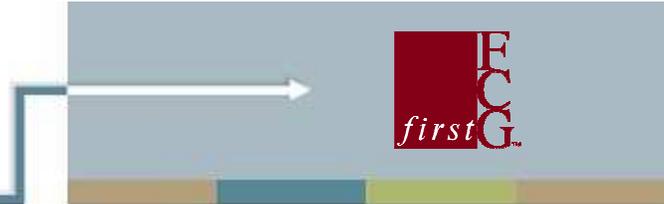
The Leapfrog Group needed a way to evaluate how software is actually being used from two perspectives.

Purchasers **The Public**	■ How far along is this organization in using CPOE or ambulatory EHR to help improve medication safety and quality?
Hospital and Medical Practice Leadership	■ Now that we have implemented CPOE or ambulatory EHR, how well are we doing in using it to help avoid harm and improve quality?

Leapfrog CPOE / EHR Testing Standard Complements Other Initiatives

- **CCHIT ("on the shelf")**
  - Certification of vendor EHR products
    - ✓ Ambulatory, Inpatient, Network
- **Pay-for-Performance Initiatives ("outcomes of IT and QI")**
    - ✓ IHA, BTE, Others
    - ✓ Ambulatory clinic site-specific reporting of select EHR functionality
- **National Quality Forum ("after implementation")**
  - Hospital safe practices survey
    - ✓ Voluntary hospital site-specific certification
    - ✓ Includes several aspects of EHR including CPOE
    - ✓ **Now directly linked to Leapfrog CPOE Standard**
- **Leapfrog Group ("how *implemented* software is contributing")**
  - Voluntary reporting with site-specific scoring
    - ✓ Hospital evaluation
    - ✓ Physician practice evaluation

What the Evaluation Methodology Does and How It Works

Principles Behind the Evaluation Methodology

- **Principle #1: Target the Harm**
  - Common sources of ADE's (not errors)
  - Sources of severe harm (existing literature and expert consensus)

- **Principle #2: Encourage Quality Improvement**
  - Categorize test set by type of error
  - Provide feedback to the provider organization for each category
  - Provide advice about nuisance alerting

- **Principle #3: Accentuate the positive**
  - Encourage care quality, as well as ADE reduction
    - ‣ **Address errors of commission and omission**
    - ‣ **Include corollary orders and duplicate interventions**

Web-Based Evaluation Tool

- Self-administered testing managed by a Web application

- Separate tests for pediatric and adult, inpatient and outpatient

- Test order set

  – To be entered into the site's CPOE system or EHR, against Leapfrog-supplied "test patients"

  – System responses recorded and reported back to Leapfrog (Overall score) and to the organization taking the test (detailed feedback)

- Test orders representing nine categories of potentially dangerous errors developed by FCG and ISMP

- Three additional order categories developed based on literature and advisor experience

  – Corollary

  – Cost of care

  – Nuisance (important feedback)

Web-Based Evaluation Tool (cont.)

- **For ambulatory test: additional capability to test basic health maintenance prompting**

- **Outputs received immediately after submitting results**
  - Individual site performance feedback
    - ‣ Indicating performance in each medication order category
    - ‣ Indicating performance for health maintenance (ambulatory only)
      - Sensitivity = the ones that you got right (percentage)
      - Specificity = how many did you get that you should not have (percentage)
  - Aggregate score for public reporting - similar to the Leapfrog Hospital Quality and Safety Survey

Web-Based Evaluation Tool

Select Evaluation Type

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Download Patient Descriptions

Download Orders and Worksheet

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Submit Responses

View Results
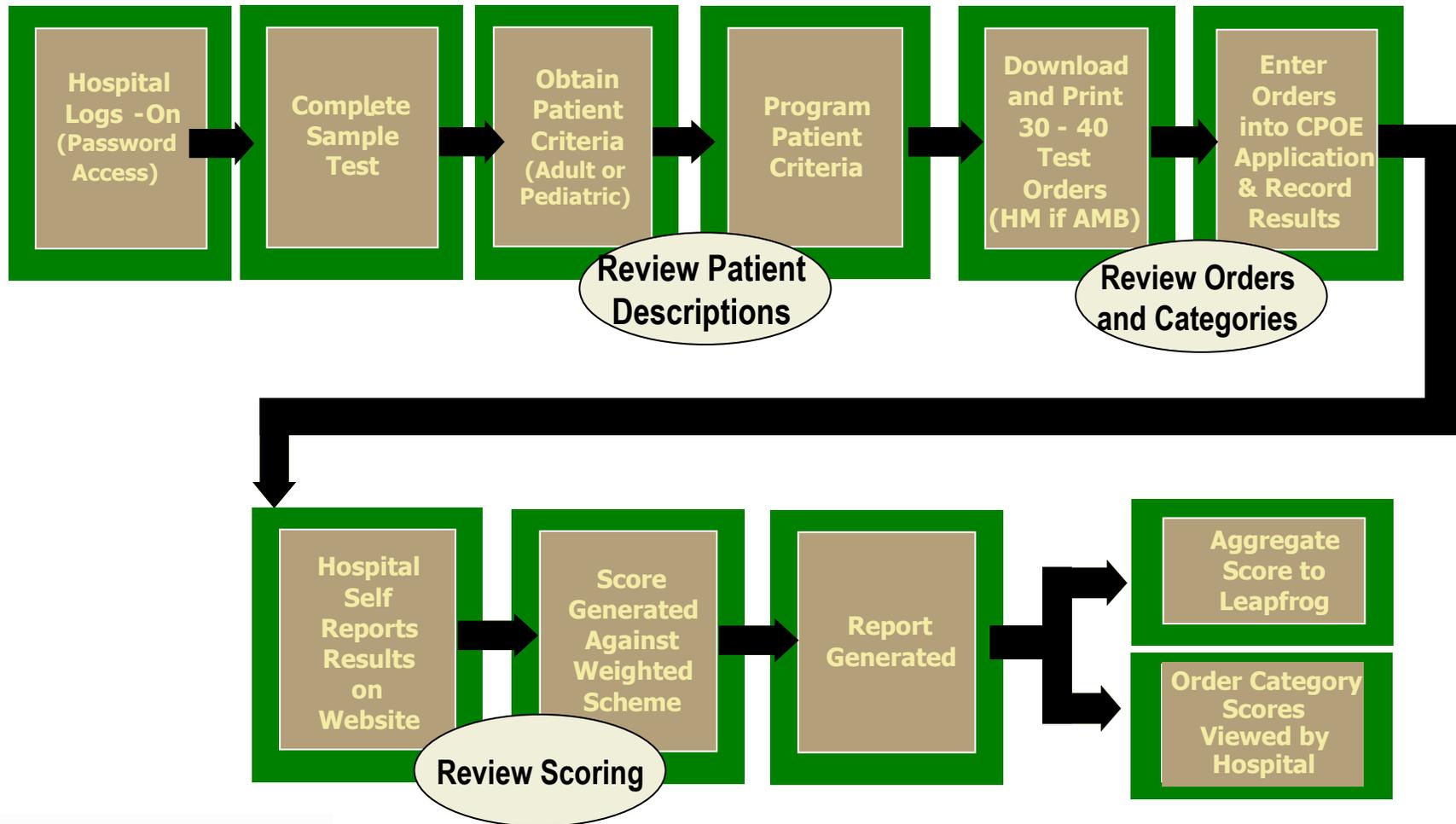
http://61.14.8.113/leapfrog/user/SumitHealthResults.asp?Count=5 - Microsoft Internet Explorer

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Getting Health Care Right.

Medication Checking	Score (in percent)
Therapeutic Duplication	88.00
Single and Cumulative Dose Limits	14.00
Allergies and Cross Allergies	67.00
Drug:Drug interactions	50.00
Drug:Diagnosis interactions	100.00
Contraindication / Dose Limits Based on Age and Weight	64.00
Contraindication / Dose Limits Based on Laboratory Studies	33.00
Corollary Orders	50.00
Deception Analysis	33.00
Nuisance Orders	100.00

Health Maintenance Checking	Score (in percent)
Sensitivity	24 %
Specificity	85 %
	73 %

Your TOTAL score reflects:

Medication Checking: Good prog... ...ended safety practice

Note: Medication checking Total score... ...and Deception Analysis categories

Legend	Description
	Did not meet criteria
	Good early stage... ...mended safety practice
	Good progres... ...ed safety practice
	Fully impleme... ...y practice
	Did not complete t... ...did not report results

*The order entry system accepted the following order(s) that could have caused severe harm:

Category	Order Description
Single and Cumulative Dose Limits	Vicodin ES one tablet every 6 hoursTylenol 500mg po every 4 hours prn

FOR ADDITIONAL INFORMATION, REVIEW THESE LINKS

EXAMPLE

Implications for Implementing CDS for Medication Checking

Implications for Implementing CDS for Medication Checking

1. Become an expert in the CDS Toolset you have available

2. Integrate order categories into your patient safety program

3. Develop a CDS strategy for CPOE rollout

4. Plan to manage CDS on an ongoing basis

1. Become an Expert in the CDS Toolset You Have Available

Sources of Clinical Decision Support

Predefined Lists:
-- allowable entries
-- alert override reasons
-- clinical indications

Predefined Groups of Orders:
- common orders
- order sets

Order Form/Template
-- required fields
-- data format and type
- default values
-- calculator

Rules Engine:
-- diagnosis-based protocols
-- surveillance for need to re-evaluate orders
-- suggested clinical indications

CPOE Order File:
-- display of relevant data
-- complex orders – TPN, insulin, taper doses, IVs, PCAs
-- conditions for laboratory duplicate checking

Programmed Logic:
-- patient-specific dose calculator
-- conditional orders

Formulary:
-- medications in stock
-- medication cost
-- counter signature requirements
-- appropriate diagnoses
-- suggested alternative medications

Knowledge Bases:
-- research basis for CDS prompts

Drug Reference Files:
-- drug/drug interaction
-- drug/allergy
-- duplicate therapy
-- dosing parameters
-- drug-procedure

Source: Clinical Decision Support: Finding the Right Path, FCG, September 2002

1. Become an Expert in the CDS Toolset You Have Available
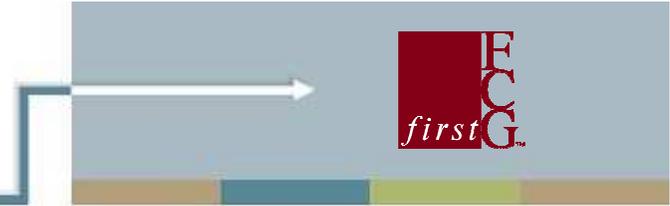
CDS is a toolkit with multiple options that do not require a rules engine and special programming skills to implement.

Category of CDS for Medication Ordering	Description
Basic field edits	Avoids inappropriate field entries (route, etc.)
Structured orders	Ensures complete, actionable orders
Groups of predefined orders (order sets, corollary orders)	Provides appropriate orders for a given situation
Order checking	Uses knowledge about possible problems to guide ordering
Complex orders with specialized tools	Assists order writing with special templates, calculators, or suggested doses
Order-relevant patient data display	Displays relevant patient information to be considered
Order-relevant patient data capture	Provides additional information needed for order checking or QA
Rules-based prompting and alerts within order entry	Applies rules-based logic to orders and patient information (age, wt) to identify problems
Rules-based surveillance with alerts outside of order entry	Reduces delays in responding to new information about patients that affects orders

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2. Integrate Order Categories Into Your Patient Safety Program

Key questions to consider:

- What are the highest priority targets in our organization (types of errors, specific medications)?

- How do we best utilize CDS to reinforce current efforts to reduce ADEs?

- Where will CDS allow us to target additional types of potential ADEs?

- How do we accommodate the added tool of CDS for medication checking into how we organize and conduct our patient safety program?

2. Integrate Order Categories Into Your Patient Safety Program

Order Category	Description	Example
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	Codeine AND Tylenol #3
Single and cumulative dose limits	Medication with a specified dose that exceeds recommended dose ranges or cumulative dose	Ten-fold excess dose of methotrexate
Allergies and cross-allergies	Medication (or medication class) for which patient allergy has been documented	Penicillin prescribed for patient with documented penicillin allergy
Contraindicated route of administration	Order specifying an inappropriate route of administration (e.g., oral, intramuscular, intravenous)	Tylenol to be administered intravenously
Drug-drug interaction	Medication that results in known, dangerous interaction when used in combination with a different medication in a new or existing order for the patient	Digoxin AND Quinidine

2. Integrate Order Categories Into Your Patient Safety Program

Category	Description	Example
Contraindication/dose limits based on patient diagnosis	Medication either contraindicated based on patient diagnosis or diagnosis affects appropriate dosing	Nonspecific beta blocker in patient with asthma
Contraindication dose limits based on patient 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	Adult dose of antibiotic in a newborn
Contraindication/dose limits based on laboratory studies	Medication either contraindicated for this patient based on laboratory studies or for which relevant laboratory results must be considered in appropriate dosing	Normal adult dose regimen of renally eliminated medication in patient with elevated creatinine
Corollary	Intervention that requires an associated or secondary order to meet the standard of care	Prompt to order drug levels when ordering Dilantin
Cost of care	Test that duplicates a service within a timeframe in which there is typically minimal benefit from repeating the test	Repeat test for Digoxin level within 2 hours

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# 3. Develop CDS Strategy for CPOE / EHR Rollout

- **Set CDS agenda according to the patient safety / clinical quality agenda and priorities of the organization.**

- **Develop a CDS strategy that is built upon:**

  - A focus on the areas of risk for patient *harm*

  - A realistic appraisal of the readiness for adoption (how much, how soon)

  - Policies and consistent approach about guiding versus direct care (especially "hard stops" and CDS alerts that require clinician response)

  - Physician leadership and heavy involvement of physicians and including involvement of P&T and Patient Safety Committee

4. Plan to Manage CDS on an Ongoing Basis

- Assign individual and group responsibilities to set priorities and guide the process

- Create a small group (including physicians) that understands the goals and means to get there to manage CDS day-to-day: set-up, testing, rollout, monitoring, and updates

- Review each application of CDS periodically (reports on when alerts fire and how physicians respond *are essential*)

- Worry about nuisance alerting and actively solicit physician feedback

- Ensure timely updates of third-party reference data bases

4. Plan to Manage CDS on an Ongoing Basis (cont.)
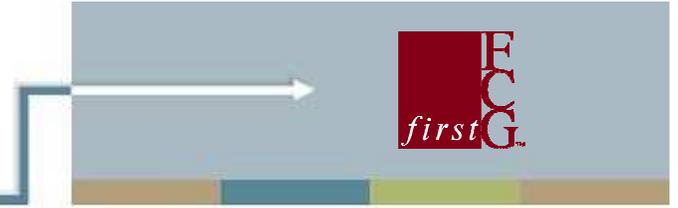
■ Collect metrics on targets of CDS (ADEs, inappropriate use of medication or dosing) and make changes as appropriate based on findings

■ Test every new application of CDS and retest whenever the application is upgraded

■ Insist that your vendor address gaps in scope, flexibility, and usability of the CDS toolset you have at your disposal

4. Plan to Manage CDS on an Ongoing Basis

There is still much to learn about effectively applying CDS; toolsets and knowledge bases consulted are still evolving.

Order Category	Availability and Use
Therapeutic duplication	■ Generally available; often not used
Single and cumulative dose limits	■ Generally available; often not used
Allergies	■ Generally available; generally used
Contraindicated route of administration	■ Not available; requires fully codified script
Drug-drug interaction (DDI)	■ Generally available; generally used
Drug-food warning	■ Generally available; often not used

4. Plan to Manage CDS on an Ongoing Basis (cont.)

| Order Category	Availability and Use
Contraindication based on patient dx	■ Sometimes available; not used (lack of current problem list in inpatient)
Patient-specific checking: age and weight	■ Not available
Patient-specific checking: lab studies	■ Not available
Patient-specific checking: radiology studies	■ Sometimes available; generally not used
Corollary Orders	■ Sometimes available for individual med orders; generally not used. ■ Some use order sets
Lab Duplicate Checking	■ Sometimes available ■ Generally not used

Teleconference Purpose
Any Questions?

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For More Information
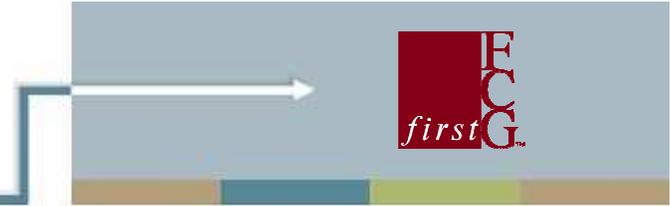
- For additional information, visit:
  - www.leapfroggroup.org
  - www.ismp.org

- Other documentation available:
  - Overview of the Leapfrog Evaluation Tool for CPOE – December 2001
  - Development of the Leapfrog Methodology for evaluating hospital implemented inpatient computerized physician order entry systems. Qual. Saf. Health Care, 2006;15:81-84.
  - Medication-related CDS in Computerized Provider Order Entry Systems: A Review. JAMIA, 2007;14:29-40.
  - Evaluation and Certification of Computerized Provider Order Entry Systems. JAMIA, 2007;14:48-55.
  - The National Quality Forum (NQF) Safe Practice Standard for CPOE: Updating a Critical Patient Safety Practice. J. Pat. Safety, 2007 (In Press).

- For more information, visit AHRQ's National Resource Center, which has links to more than 6,000 health IT tools, best practices, and published evidence online at: http://healthit.ahrq.gov.