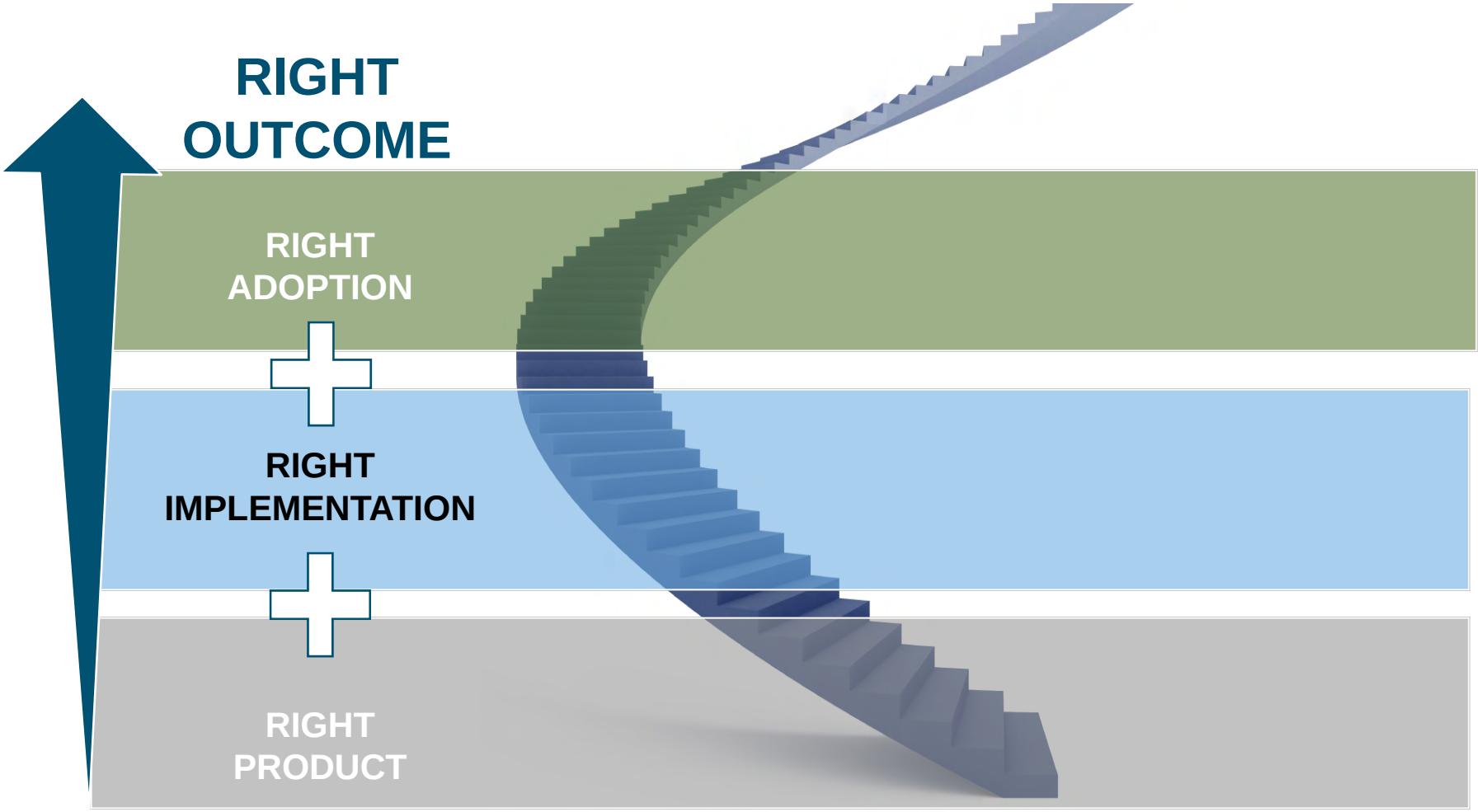
Meaningful Use Capacity/Functionality in Electronic Health Record Systems

Presentation to the NCVHS

David Classen MD MS
University of Utah and CSC

April 28, 2009

Elements of Meaningful Use of EHRs



The Right EHR Product

- **A "certified" EHR product contains the engineering requirements for a point of care workstation by:**
  - Anticipating the needs of users (system adapts to clinician)
  - Incorporating "thought flow" of the clinician
  - Containing diverse input and output capabilities
  - Providing ubiquitous access
  - Ease of use and customization
  - Providing ability to work with emerging and existing systems
  - Allowing the user to manage multiple tasks and patients
  - Accepting information and transferring it to the point of care at different phases of care delivery
- **Meets or exceeds the standard certification requirements for interoperability, privacy, and functionality (e.g., CCHIT)**

The Right Implementation of EHR with Essential Capabilities

Hospitals

- Medication reconciliation
- Computerized physician order entry system (CPOE) and robust clinical decision support (CDS) tool set
- Integrated electronic medication administration record (eMAR) with bar coding
- Integrated pharmacy (CPOE and eMAR)
- Results reporting and management
- Quality and pay-for-performance metrics reporting from the EHR
- Clinical documentation (includes physician)
- Single source electronic problem and allergy list
- Consultations and transfers of care
- Capability for Two way exchange of laboratory and other diagnostic test results, medication lists, problem lists other information such as CCD compatible documents
- Quality measure collection and reporting from the EHR for specified conditions

Ambulatory

- e-Prescribing including CDS for medication safety
- Results reporting and management
- Clinical documentation (with coding assistance)
- CDS for patient tracking for disease and wellness management
- Tools for managing chronic care
- Capability for Two way exchange of laboratory and other diagnostic test results, prescription data, and other information between providers such as CCD compatible documents
- Quality measure collection and reporting from the EHR for specified conditions

The Right Adoption

- **To meet Meaningful Use Requirements all organizations must implement the EHR to the extent that it is incorporated into the routine care process and adopted by care providers:**
  - The product and/or system and critical care applications are deployed in such a way to support the work and “thought flow” of the care delivery team
  - All information can be reviewed and shared with the entire team at the point of care
  - Role-based direct use by clinicians (MDs write electronic orders, RNs document med administration-- etc)
  - Physicians, Nurses and the rest of the clinical team demonstrate 75 percent use of documentation or order entry in the inpatient EHR while performing care-related activities
  - Physicians demonstrate 50 percent use of documentation of order entry in the ambulatory EHR while performing care-related activities
  - HIT-enabled processes to monitor and ensure compliance with above

The Right Outcome

- **To meet Meaningful Use Requirements all organizations must implement the EHR so that they are delivering high-quality, safe, and effective care**
- **Meaningful use has to be demonstrated by attestation and that evidence can be found in several ways:**
  - Use Existing Billing Process
  - Use Existing Accreditation Process
  - Use Existing Quality Reporting Process
    - Process and clinical outcome measures verify that the combination of clinical practice and use of HIT is delivery care according to standards
    - Determined by submission of performance measures and benchmarking against peer performance
    - Already in place in public reporting and pay-for-performance programs and HIT-enabled processes to monitor and ensure compliance with above
  - The EHR after implementation is subjected to simulation testing using a tool such as the AHRQ/NQF /Leapfrog EMR/CPOE flight simulator

Leapfrog and NQF Inpatient EHR/CPOE Standard

Hospitals that fulfill this standard will:

Have physicians entering **at least 75%** of medication orders into 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 a testing protocol under development by FCG?

The NQF adopted the standard in 2006. The assessment portion of the standard became a reality in 2008.

Many groups and individuals contributed to the development of the testing protocol.

- **Core team: Welebob, Classen, Turisco, Kilbridge**
- **Advisors: Bates, Overhage, Spooner, ISMP, Nichols, Frisse, Seger, Delbaccaro**
- **Funders: AHRQ, CHCF, RWJ**
- **Many hospitals and physician practices**
  - Initial surveillance on implemented CDS (test methodology)
  - Trial run of methodology
  - Reliability testing
  - Pre-launch pilot of inpatient tool
  - Initial use of inpatient tool during 2008
- **EHR vendors (inpatient CPOE and ambulatory EHR)**
  - Demonstrations of CDS capabilities
  - Assistance in identifying customers making advanced use of CDS
  - Home Grown Sites including VA
- **The Leapfrog Group**
  - Standard
  - Insight: EHR out of the box ≠ used

Purposes of the AHRQ/NQF/Leapfrog Assessment

A way was needed 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/Medical Practice Leadership

Now that we have implemented CPOE or the ambulatory EHR, how well are we doing in using it to help avoid harm and improve quality?

AHRQ/NQF/Leapfrog Assessment Process

- **Hospitals self-administer the assessment**
- **Certify that they have followed instructions (same as safe practices survey)**
- **Separate assessments for:**
  - Pediatric and adult,
  - Inpatient and ambulatory
  - Medication Safety, Quality, Health Maintenance Modules
- **Medication Safety Assessment simulates medication order entry taking place in the hospital**
  - Production system used or mirror (replicates production system)
  - About 10 – 12 test patients set up with minimal demographic and clinical data
  - Physician who normally writes inpatient orders follows usual and customary process to enter about medication 50 orders (or order pairs)
  - System responses recorded and then analyzed (% of potential ADEs identified)
  - Results reported back to Leapfrog (overall score) and to the organization taking the test (detailed feedback by ADE category)
  - Steps in assessment process are supported by a web application

Many Research Databases Used

Research background, combined with the practical experience of the EHR pioneers, was first used to define the focus.

Preventable ADEs in 10.4/100 admissions to six community hospitals

Types of CPOE-preventable ADEs	Percentage*
Patient Diagnosis	1
Duplicate Med Check	1
Drug-drug	2
Drug Frequency	3
Drug Allergy	4
Drug-specific Guidelines+	7
Drug-age	9
Drug dose Suggestion (typical)	9
Renal Check	19
Drug-lab Check (not creatinine)	27

* All sites
\+ Ondansetron
Source: Bates et al. “Saving lives, Saving money: The Imperative for Computerized Physician Order Entry in Massachusetts Hospitals.” The Clinical Baseline and Financial Impact Study. MTC and NEHI. February 2008.

The team of advisors helped to define the order categories in the assessment to reflect the sources of common, preventable ADEs identified in research.

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

The team of advisors helped to define the order categories in the assessment to reflect the sources of common, preventable ADEs identified in research. cont.

Order 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

Simulations of EHR Use with CPOE

The assessment pairs medication orders that would cause a serious adverse drug event with a fictitious patient.

A physician enters the order …

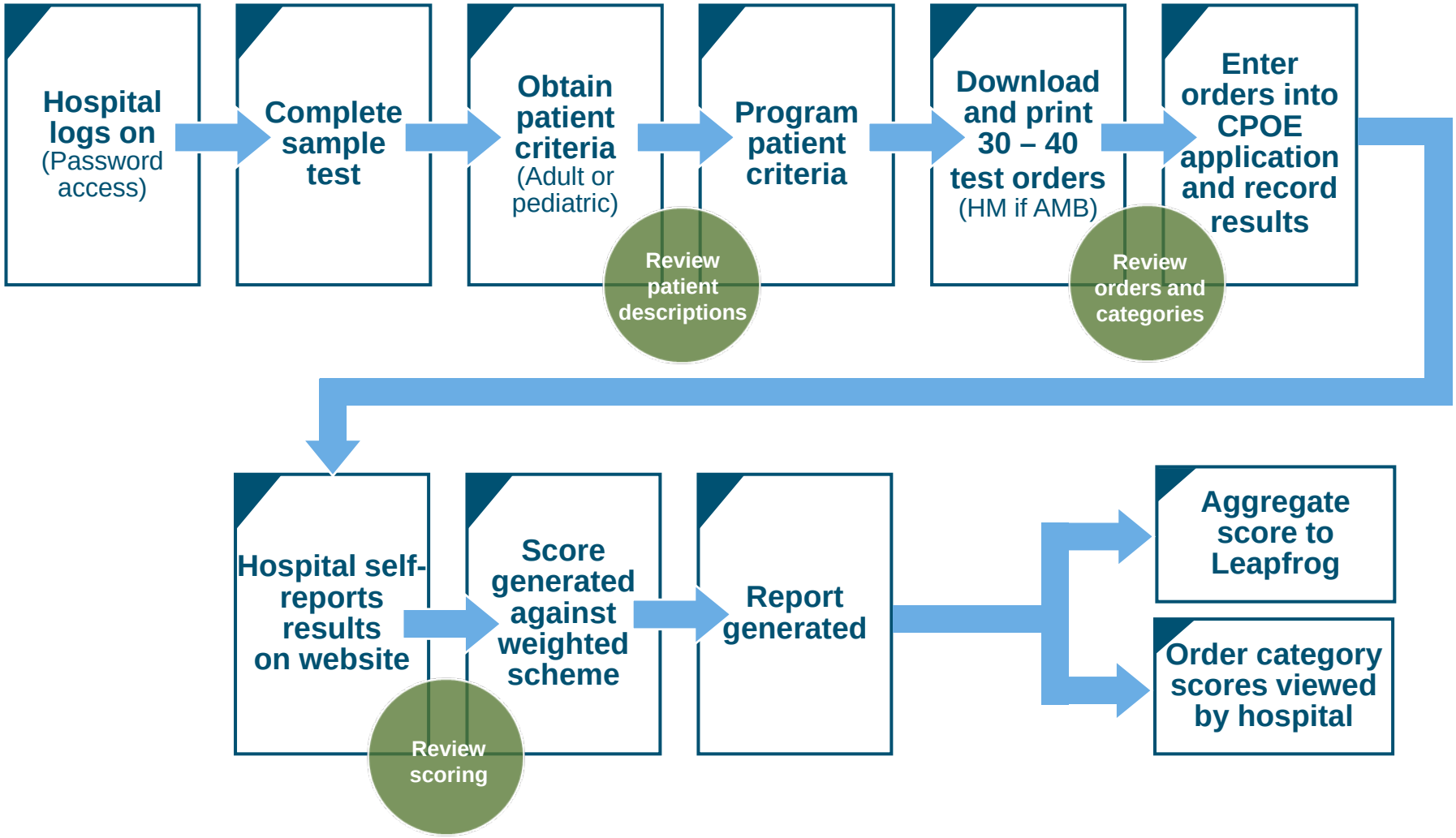
Patient AB

Female
52 years old
Weighs 60 kg
Allergy to morphine
Normal creatinine

and observes and records the type of CDS-generated advice that is given (if any).

Coumadin (Warfarin) 5 mg po three times a day.

AHRQ/NQF/Leapfrog Assessment Tool (cont'd)



Hospital feedback report is available immediately

Pediatric Inpatient	
Test Date-Time: 02/08/2008 8:59AM	
Medication Checking: Category	**Score (in percent)**
Therapeutic Duplication	60.0%
Single and Cumulative Dose Limits	85.7%
Allergies and Cross Allergies	100.0%
Contraindicated Route of Administration	75.0%
Drug:Drug interactions	83.3%
Drug:Diagnosis interactions	75.0%
Contraindication / Dose Limits Based on Age and Weight	100.0%
Contraindication / Dose Limits Based on Laboratory Studies	100.0%
Corollary Orders	100.0%
Cost Of Care	100.0%
Deception Analysis	25.0%
Nuisance Orders	0.0%

Medication Checking OVERALL score does not include Nuisance Orders or Deception Analysis categories.

Your OVERALL Score for Medication Checking

Fully implemented

The OVERALL Score is based on a composite of Scores for each of the Medication Checking categories above. See Understanding Test Results for definitions of these categories and how the overall score was derived.

This score will NOT be released by The Leapfrog Group during the 2008 Leapfrog Hospital Quality and Safety Survey cycle. Hospitals will be given credit toward meeting the CPOE Leap merely by successfully completing a test.

For More Information

The Leapfrog Group. (n.d.) *Fact sheet: Computerized physician order entry.* http://www.leapfroggroup.org/media/file/Leapfrog-Computer_Physician_Order_Entry_Fact_Sheet.pdf (Retrieved 4/7/09)

Kilbridge, P, E. Welebob, and D. Classen, "Overview of the Leapfrog Group Evaluation Tool for Computerized Physician Order Entry", December 2001. http://www.leapfroggroup.org/media/file/Leapfrog-CPOE_Evaluation2.pdf (Retrieved 4/7/09)

Kilbridge PM, Welebob EM, Classen DC. Development of the Leapfrog methodology for evaluating hospital implemented inpatient computerized physician order entry systems. Qual Saf Health Care 2006;15(2):81-84. http://qshc.bmj.com/cgi/reprint/15/2/81 Retrieved 4/7/09)

Classen D, Avery J, Bates DW. Evaluation and Certification of Computerized Provider Order Entry Systems. J Am Med Inform Assoc 2007;14(1):48-55.

•Kilbridge P, Bates DW, Classen DC, Denham C. The National Quality Forum Safe Practice Standard for Computerized Physician Order Entry: Updating a critical patient safety practice. JPat Saf. 2006;2:28 –34.

Kuperman, G., Bobb, A., Payne, T. H., *et al.* Medication-related clinical decision support in computerized provider order entry systems: A review. J. Am. Med. Inform Assoc 2007;14(1), 29-40.

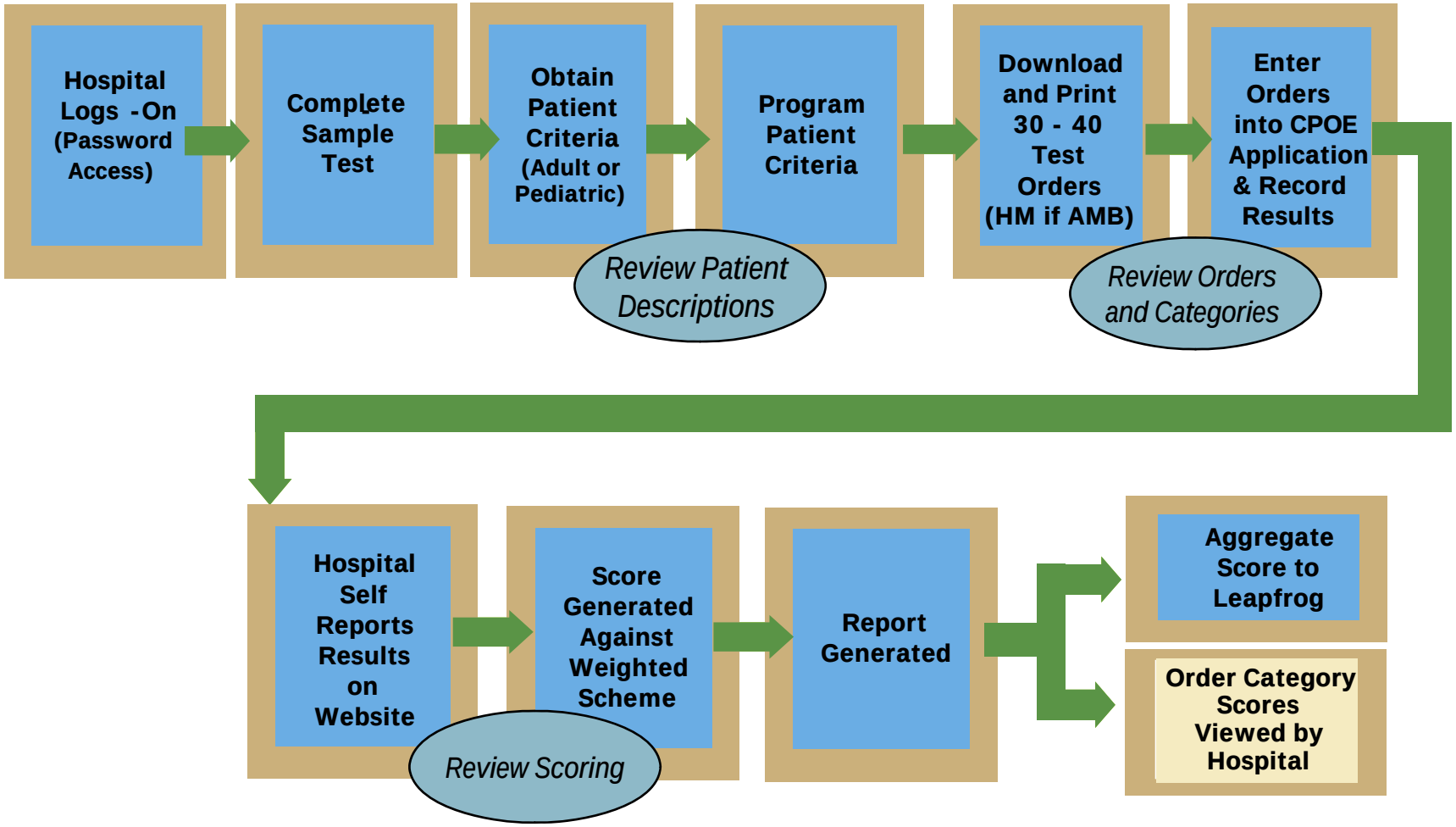
Adams, M., Bates, D. W., Coffman, G., & Everett, W. (2008). Saving lives, saving money. The imperative for computerized physician order entry in Massachusetts hospitals. Massachusetts Technology Collaborative and New England Healthcare Institute. http://web3.streamhoster.com/mtc/cpoe20808.pdf Retrieved 4/7/09)

Metzger JB, Welebob E, Turisco F, Classen DC. The Leapfrog Group's CPOE standard and evaluation tool. Patient Safety and Quality Healthcare , July / August, 2008. http://www.psqh.com/julaug08/cpoe.html (Retrieved 4/7/09)

Metzger, J., E. Welebob, F. Turisco, D. Classen. Effective Use of Medication-Related Decision Support in CPOE. Patient Safety and Quality Healthcare. September/October 2008. *http://www.psqh.com/sepoct08/cpoe.html*

Appendix

AHRQ/NQF/Leapfrog EHR/CPOE Web-Based Evaluation Tool Testing Flow



Leapfrog CPOE Evaluation Tool

Login using your security code

To log into the system, please provide your hospital's 16-digit security code.

Enter your security code here: - - - -

The 16 digit security code is the same as that used to access the Leapfrog hospital Survey. Get it from your hospital's survey contact/coordinator or see the link at the home page of the online survey: Need a security code to login?

Login

WARNING: Once logged in, don't close the browser until you have Logged Out, otherwise you will be locked out for 20 minutes.

Leapfrog CPOE Evaluation Tool

Organization and Contact Information

Update as needed then Save & Continue

MPN	00-040M
Hospital Name	Test Hospital #40
Street Address	125 Anystreet
City	Washington
State	DC

This information is based on your hospital's current Organization Information in the Leapfrog Hospital Survey. If it is incorrect, please Logout of this Evaluation Tool and change it in the Survey.

* Required fields

Additional Facility Information

* 1. Hospital type
- ○ Both
- ◉ Adult/general
- ○ Pediatric

* 2. Academic teaching facility?
- ◉ Yes
- ○ No

CPOE Application Information

Leapfrog CPOE Evaluation Tool

Previous Tests

Test Date-Time	Test Type	Test Status	Score
5/8/2008 10:25:23 AM	Sample Test	Completed	View Results

Click on View Results for any completed test to see a scoring summary.

Select a Test

To begin a CPOE Test, you first must obtain the patient descriptions (criteria) that must be programmed into your ADT, Laboratory, and CPOE applications as appropriate. Once you download the patient descriptions, you will have up to **four hours** to print them, program the patient descriptions into the appropriate applications in your CPOE test or mirrored production environment , return to this site and download the order set for testing.

Please select CPOE Evaluation Type:

This selection determines the type of CPOE Test that you will receive. You can select and conduct only one type of test at a time.

--Select One--
--Select One--
Sample Test
Adult Inpatient
Pediatric Inpatient

Logout without Testing

Download Patients

Leapfrog CPOE Evaluation Tool

You are about to start a CPOE test: Pediatric Inpatient

You will have **four hours** to complete this phase of the test. During that time you must:

- print a list of patients and their characteristics (Step 1),
- load the patient information into your hospital system(s) (Step 2),
- login again to this site, and
- print a set of orders (Step 3) to continue to the next phase of this test.

If you do not complete this phase of the test, the test will be marked as incomplete for your hospital and you will not be able to take this test again for six months for this hospital.

Are you sure you want to start this test?

Yes, Continue the Test | No, Logout & Return Later

Leapfrog CPOE Evaluation Tool

Patient Descriptions

Do not logout, close this window or browser, or navigate elsewhere, until you have printed these patients and confirmed that all patients and all eight columns have successfully printed.

Do so within 20 minutes to avoid timing out, after which these patients can no longer be retrieved.

The four-hour clock is now running to complete Steps 1-3.

Patient Descriptions for Sample Test

Print Patient Descriptions

If problems printing:

- *set your browser to print in Landscape page-orientation (on Internet Explorer browser menu, click File (or use Alt-F)-> PageSetup... -> set Orientation=Lanscape), then*
- *use your browser print button.*

Patient ID	Age	Sex	Weight	Severe Allergies	Diagnosis/ Problems	Lab Values	Specifics
1	52 years old	Male	73 Kg	Penicillin	None None	Potassium = 4.0 mEq/L	No medications on medication list
2	43 year old	Male	75 Kg	No Known Drug Allergies	None	None	Completed an iodinated contrast head CT three hours ago. No medications

Leapfrog CPOE Evaluation Tool

Medication Orders

- **Do not logout, close this window or browser, or navigate elsewhere, until you have printed these orde and confirmed that all orders and all four columns have successfully printed.**
- **Do so within 20 minutes to avoid timing out, after which these patients can no longer be retrieved.**
- **The two-hour clock is now running to complete Steps 3-5.**

Please print the orders shown below and enter the orders into your CPOE application for the appropriate patients. Record t results of each order including the alert message then return to this site to submit the results.

Medication Orders for Sample Test

Do not logout, close this window or browser, or navigate elsewhere, until you have confirmed that all orders and all columns have successfully printed.

Print Orders

If problems printing:

- *set your browser to print in Landscape page-orientation (on Internet Explorer browser menu, click File (or use Alt-F)-> PageSetup... -> set Orientation=Lanscape), then*
- *use your browser print button.*

Patient ID	Order ID	Order(s)
1	1	Ampicillin 500 mg IV every 6 hours

◯ Signed order and did not receive advice or information

◯ Could not order . . . ☐ with this dose ☐ with this route ☐ not in formulary

◯ Received advice or information on: *(type(s) of advice/info received -- check all that apply*)*

☐ Therapeutic dup ☐ Dose limits ☐ Dose adjustment ☐ Age contraindication ☐ Drug route

☐ Drug-drug interaction ☐ Drug allergy ☐ Drug-food interaction ☐ Diagnosis contraindication

☐ Co-orders ☐ Dup orders ☐ Other: _____

Definitions of checkbox terms used above:	
Therapeutic dup	Therapeutic duplication
Dose limits	Single or cumulative dose limits
Dose adjustment	Suggested patient-specific dose or information on age, weight, or labs
Age contraindication	Medication contraindication for patient age
Drug route	Inappropriate route of administration
Drug-drug interaction	Interaction with another drug ordered for patient
Drug allergy	Interaction with allergy documented for patient
Drug-food interaction	Food advisory
Diagnosis contraindication	Contraindication with patient diagnosis/condition
Co-orders	Order suggested to accompany medication order
Dup orders	Order duplicates current order (appropriateness)

Once you have printed these Patient Descriptions and have confirmed that they printed successfully, please logout and enter the descriptions into your test or mirrored production environment (Step 4).

Logout

When you are finished that Step, return to this site, log in, and download the orders (Step 3) within **four hours**.

Leapfrog CPOE Evaluation Tool

Submit Answers

Complete your answers within 20 minutes to avoid timing out, otherwise your entries may be lost.

The two-hour clock is still running to complete this Step 5.

You are now ready to submit your answers based on your CPOE systems responses to the the medication orders in this test. Please take your time and carefully enter your responses. Only one result per order can be entered. Once you have completed entering all results, click on the bottom of this page to record your results.

Pharmacy Orders for Sample Test		
** where more than one Order, enter Results for Order marked with asterisk (*)*		
Order ID	**Order(s)**	**Results from Answer Sheet (check one)**
1	Ampicillin 500 mg IV every 6 hours	○ Received advice or information on allergies to medication ○ Placed order and did not receive advice or information on allergies to medication ○ Medication Not on Formulary
2	1)Biaxin 500 mg (Clarithromycin) po twice daily, 2)Coumadin 5 mg (Warfarin) po daily	○ Received advice or information on drug-drug interactions ○ Placed order and did not receive advice or information on drug-drug interactions ○ Medication Not on Formulary

EHR/CPOE Evaluation Tool – Scored Results, Sample

Leapfrog CPOE Evaluation Tool

Test Results

Pediatric Inpatient	
Test Date-Time: 02/08/2008 8:59AM	
Medication Checking: Category	**Score (in percent)**
Therapeutic Duplication	60.0%
Single and Cumulative Dose Limits	85.7%
Allergies and Cross Allergies	100.0%
Contraindicated Route of Administration	75.0%
Drug:Drug interactions	83.3%
Drug:Diagnosis interactions	75.0%
Contraindication / Dose Limits Based on Age and Weight	100.0%
Contraindication / Dose Limits Based on Laboratory Studies	100.0%
Corollary Orders	100.0%
Cost Of Care	100.0%
Deception Analysis	25.0%
Nuisance Orders	0.0%

Medication Checking OVERALL score does not include Nuisance Orders or Deception Analysis categories.

EHR/CPOE Evaluation Tool – Scored Results, Sample (cont'd)