

Sustainable Clinical Decision Support: The Challenge of Knowledge Management

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**AHRQ CDS TEP
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Disclosure

“This material is presented from my own perspective and should not be taken as representing the viewpoint of DHHS, NIH or NLM.” (NIH Policy 1184, 10 March 2008)

Knowledge Management

- **“Traditional” CDS: Still work to be done**
 - KR for sharing = transfer + reuse
 - Data aggregation
- **Evolving CDS: Knowledge access + quality**
 - Access standards: Infobutton, DSS
 - Measuring quality: HQMF + more
 - “Intermediate” KR: eRecommendations
- **KM: Practical advice/tools re process**

CDS: The National Roadmap

**A Roadmap for National Action
on
Clinical Decision Support**

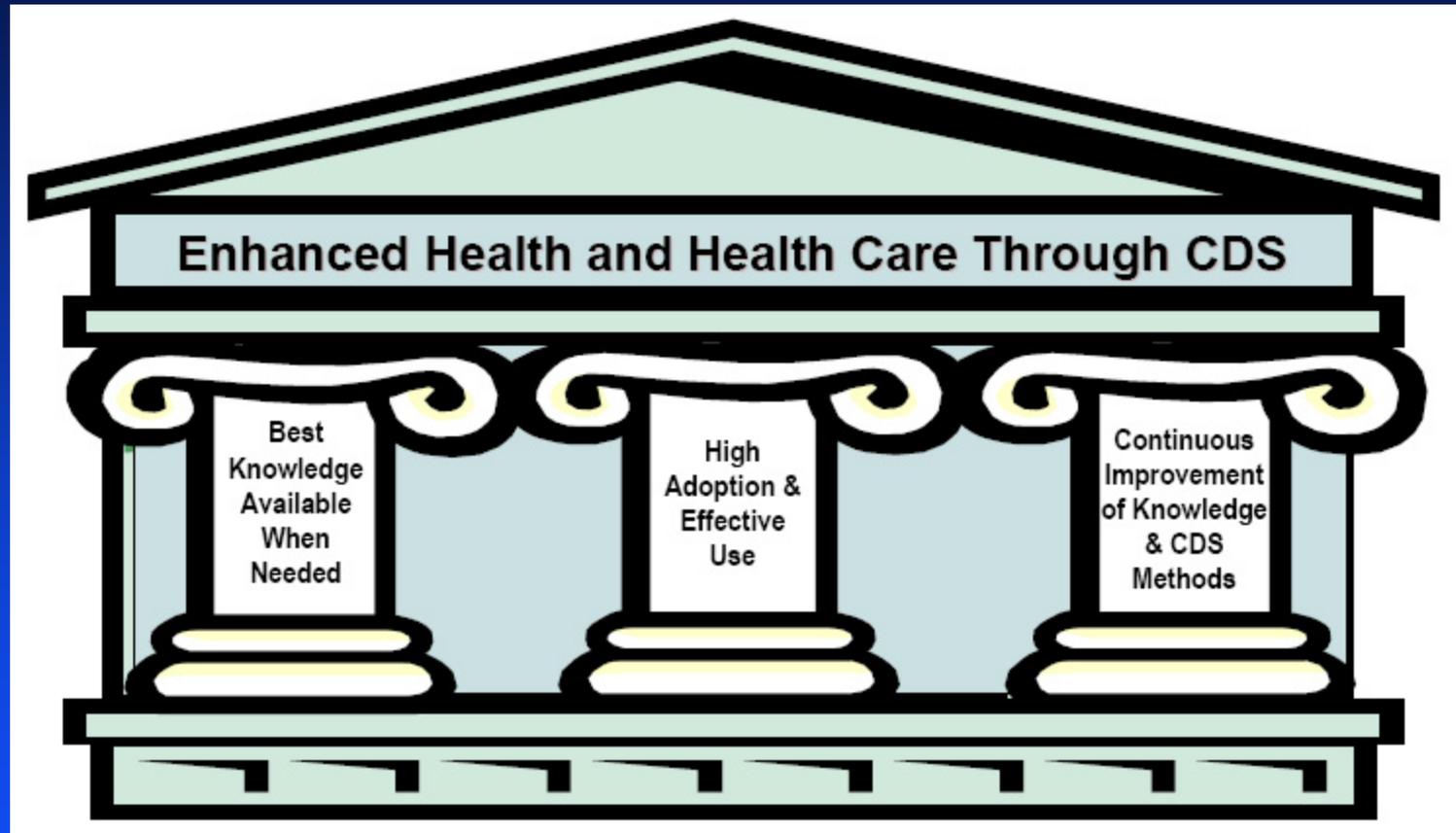
June 13, 2006

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Osheroff JA, Teich JM, Middleton B et al. A roadmap for national action on clinical decision support. *J Am Med Inform Assoc.* 2007 Mar-Apr;14(2):141-5.

CDS National Roadmap: Three Pillars

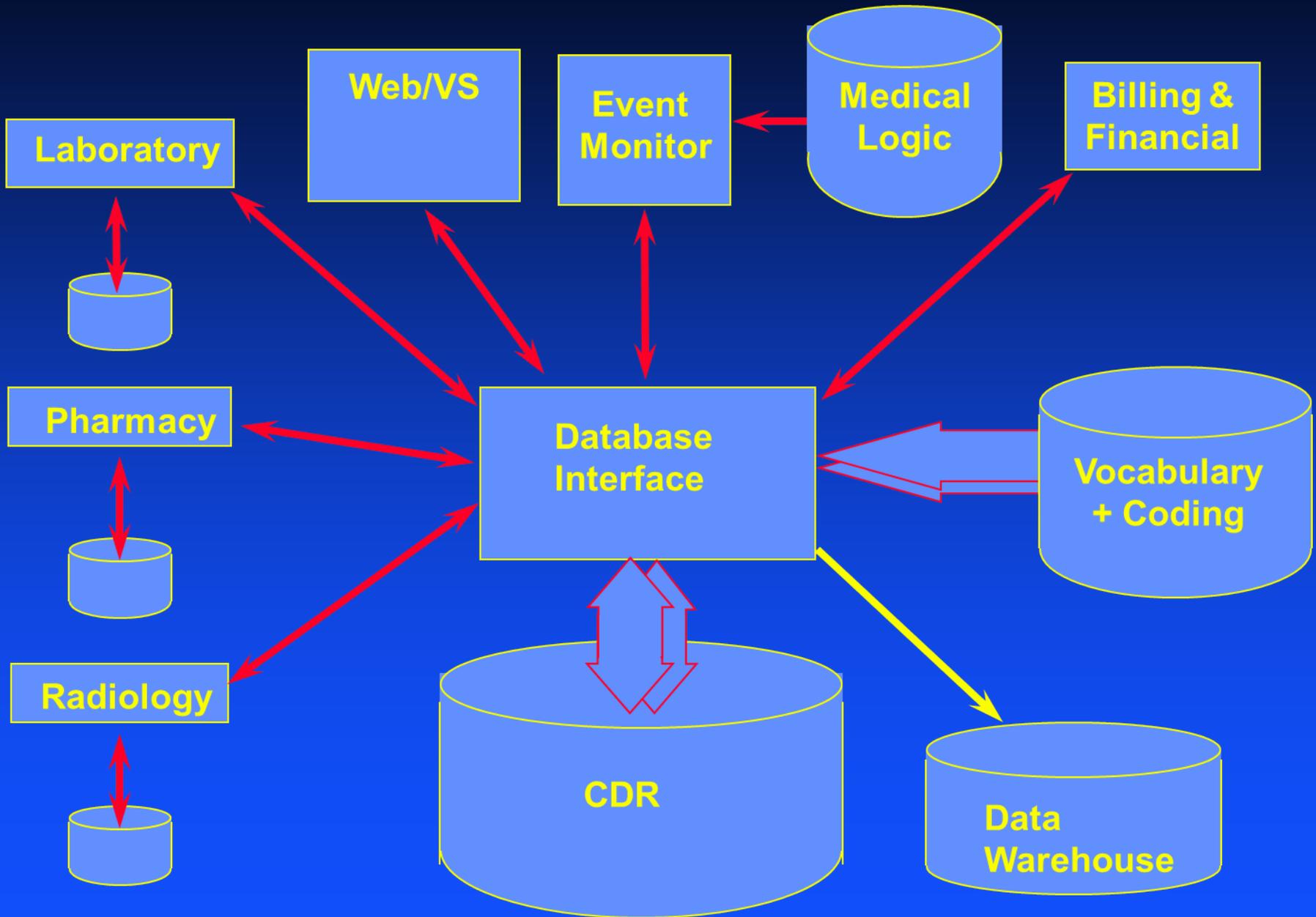


Jenders RA, Morgan M, Barnett GO. Use of open standards to implement health maintenance guidelines in a clinical workstation. *Comput Biol Med* 1994;24:385-390.

CDS National Roadmap: Strategic Objectives

- **Knowledge in standard format**
- **Collect, organize knowledge for importation**
- **Address policy & legal barriers to CDS**
- **Disseminate best practices for CDS implementation**
- **Collect, refine and disseminate CDS results**
- **Use EHR data to improve clinical knowledge**

CDS = Data + Knowledge



Getting More (Structured) Data: Standards

- **Work is not yet done**
- **Ongoing efforts**
 - UCUM
 - **Genetics: MFHP (+ associated HL7), NBS**
 - **Research studies: “CDEs” (+ associated LOINC)**
 - **Personalized medicine: PHRs (CCR, CCD)**
- **Challenge: Getting standards (and the systems in which they are embedded) used**

A close-up photograph of a newborn's feet, each wearing a white identification band. The feet are positioned at the top left of the page, partially overlapping the main title area.

Newborn Screening Coding and Terminology Guide

Data Standards for Electronic Reporting

[Home](#)[Views](#)[Downloads](#)[HL7](#)[Resources](#)[Code Standards](#)[About](#)[Updates](#)[Contact Us](#)

The goal of the Newborn Screening Coding and Terminology Guide is to promote and facilitate the use of electronic health data standards in recording and transmitting newborn screening test results. The Web site includes standard codes and terminology for newborn tests and the conditions for which they screen, and links to other related sites. The codes and vocabulary standards are provided in a series of tables that you can view on the Web and/or download for your own use. These tables cover conditions recommended for screening by the Secretary's Advisory Committee on Heritable Disorders in Newborns and Children (SACHDNC) or by a state within the U.S.

Use of these standards can speed the delivery of newborn screening reports, facilitate the care and follow-up of infants with positive test results, enable the use (and comparison) of data from different laboratories, and support the development of strategies for improving the newborn screening process.

This Web site also includes [draft guidance for creating an HL7 version 2.x message using these codes](#) with examples. If you would like us to notify you about updates to this guidance and other new content, please subscribe to the [RSS feed for Updates](#), or join the [NBS-Announcements](#) e-mail list from the U.S. National Library of Medicine.

You can reach these various resources by picking a choice below.

[Views](#): Generate customized Web views from the tables of conditions and analytes/measurements maintained by the U.S. National Library of Medicine (NLM®).

- **[Conditions](#)** — Conditions that are targeted by newborn screening
- **[Analytes/Measurements](#)** — Tests that are used as markers for newborn screening conditions
- **[Tailored Views](#)** — Specify subsets, or see relationships between conditions and analytes/measurements

[Downloads](#): Download the tables of newborn screening conditions, of markers for these conditions and/or of mappings between conditions and their markers.

[Resources](#): Find additional information about newborn screening and related codes and data standards, including the [Newborn Screening Draft Detailed Use Case](#) that was developed by the Office of the National Coordinator for Health Information Technology (ONC).

[Code and Terminology Standards](#): View terms of use and other information about codes and terminologies listed and referenced on this Web site,



- Reminders
- Printable View
- Flowsheet
- Due Dates
- Add Test & Measures
- Help

Expand All Collapse All

Medical Conditions [Research Studies](#)

Click the mouse's right button to edit previously saved rows.

	Medical condition ?	Status ?	Started ?	Stopped	Description/Comment ?
1	Asthma	Active	1982 May 01		Mild intermittent
2	begin typing condition...				

Drugs [Show All](#)

Click the mouse's right button to edit previously saved rows.

	Drug name ?	Status ?	Strength ?	Instructions ?	Started	Stopped ?	Why stopped ?	Resupply ?
1	BACTRIM (Oral-pill)	Active	800-160 mg Tabs	1 tab po bid				
2	XOPENEX (Inhalant)	Active	0.045 mg/puff MDI	2 puffs qid prn wheezing	2000 Oct 05			
3	begin typing drug name...							

Allergies and Other Dangerous Reactions ?

Click the mouse's right button to edit previously saved rows.

	Type ?	Name ?	Reaction ?	Started ?
1	Medication classes	Sulfa Drugs	Difficulty breathing	2010 Apr 01
2				

- Major Surgery and Implants ?
- Preventive Tests/Screening ?
- Immunizations ?
- Medical Contacts
- Questions to Ask Your Doctor ?

Save Save & Close Cancel



Reminders

High Cholesterol Warning

baggins's last recorded LDL cholesterol level was high, at 180 on Oct 01 2010. ... (more)

Pneumococcal Vaccine

According to his record, baggins has asthma, which is a risk factor for pneumococcal infection, but has not had the pneumococcal vaccine ("pneumonia shot"). CDC guidelines recommend the pneumococcal vaccine (PPSV) for all people between the ages of 19 and 64 who have asthma (see <http://www.cdc.gov/vaccines/pubs/vis/downloads/vis-ppv.pdf>). ... (more)

Influenza Vaccine

According to his shot record, baggins has not received his flu shot even though he has asthma. CDC guidelines recommend a yearly influenza shot for all adults, and especially for those with chronic conditions such as asthma (see <http://www.cdc.gov/vaccines/pubs/vis/downloads/vis-flu.pdf>). ... (more)

Tetanus booster

According to his shot record, baggins needs a tetanus booster. CDC guidelines recommend a tetanus booster every ten years for all adults (see <http://www.cdc.gov/vaccines/pubs/vis/downloads/vis-td-tdap.pdf>). ... (more)

Close





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Web Health Search Search Health

Microsoft® HealthVault™ is designed to put you in control of your health information. A free HealthVault account helps you collect, store and share information with family members and gives you a choice of applications and devices to help manage your fitness, diet and health. [Here's how it works.](#)



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2. You decide what goes into your HealthVault record.
3. You decide who can see and use your information on a case-by-case basis.
4. We do not use your health information for commercial purposes unless we ask and you clearly tell us we may.

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New from HealthVault

The Microsoft HealthVault Be Well Fund will support innovative new online health applications. [Get details.](#)

See [how hospitals will be able to connect with HealthVault in the future.](#)

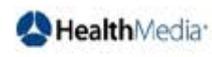
Web sites and programs that work with HealthVault



From the American Heart Association and American Stroke Association
Blood Pressure Management Center
[Learn more](#)



From CapMed
ICE: In Case of Emergency onlinePHR
[Learn more](#)



From MySelfHelp.com
MySelfHelp.com
[Learn more](#)



From HealthVault
HealthVault Connection Center
[Learn more](#)



From Healthy Circles
Healthy Circles
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From LifeScan, Inc.
Blood glucose monitors
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From Microlife
Blood pressure monitors
[Learn more](#)
Peakflow meters
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Standard KR: Arden Syntax

- **ASTM v1 1992, HL7 v2 1999, v2.1 (ANSI) 2002, v2.5 2005, v2.6 2007, v2.7 2008, v 2.8 2011**
- **Formalism for procedural medical knowledge**
- **Unit of representation = Medical Logic Module (MLM)**
 - **Enough logic + data to make a single decision**
 - **Generate alerts/reminders**
- **Adopted by several major vendors**
 - **Active use, e.g., CDC meeting re structured format for vaccination knowledge**

Jenders RA, Dasgupta B. Challenges in implementing a knowledge editor for the Arden Syntax: knowledge base maintenance and standardization of database linkages. Proc AMIA Symp 2002;;355-359.

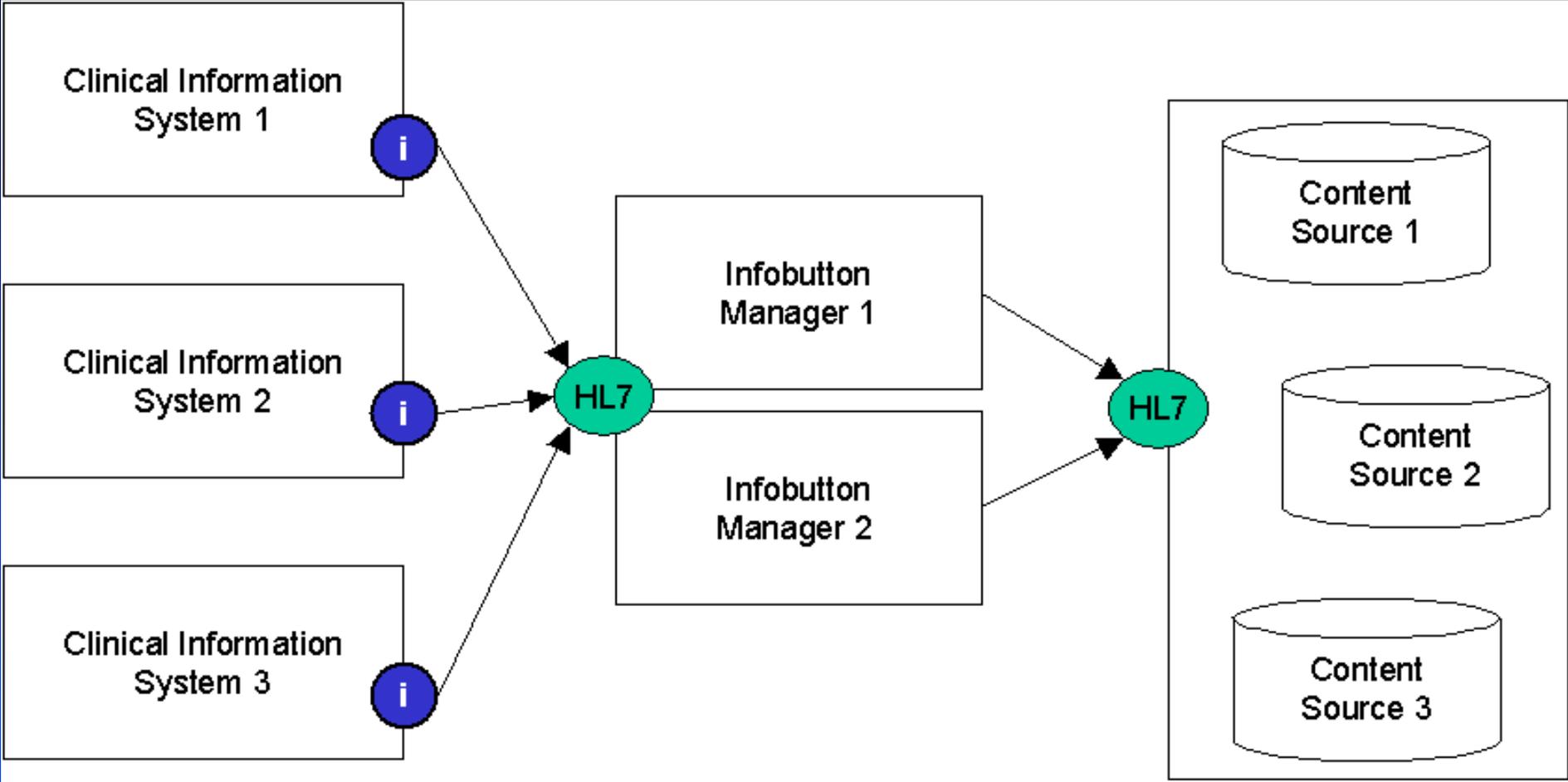
Challenge with “Traditional” CDS: Use

- **Adoption**
 - **Even some basic areas (lab observations, units) remain a challenge**
- **Interoperability**
 - **Mapping to local data (“curly braces problem”)**
- **Evolving mission of CDS**
 - **QI**

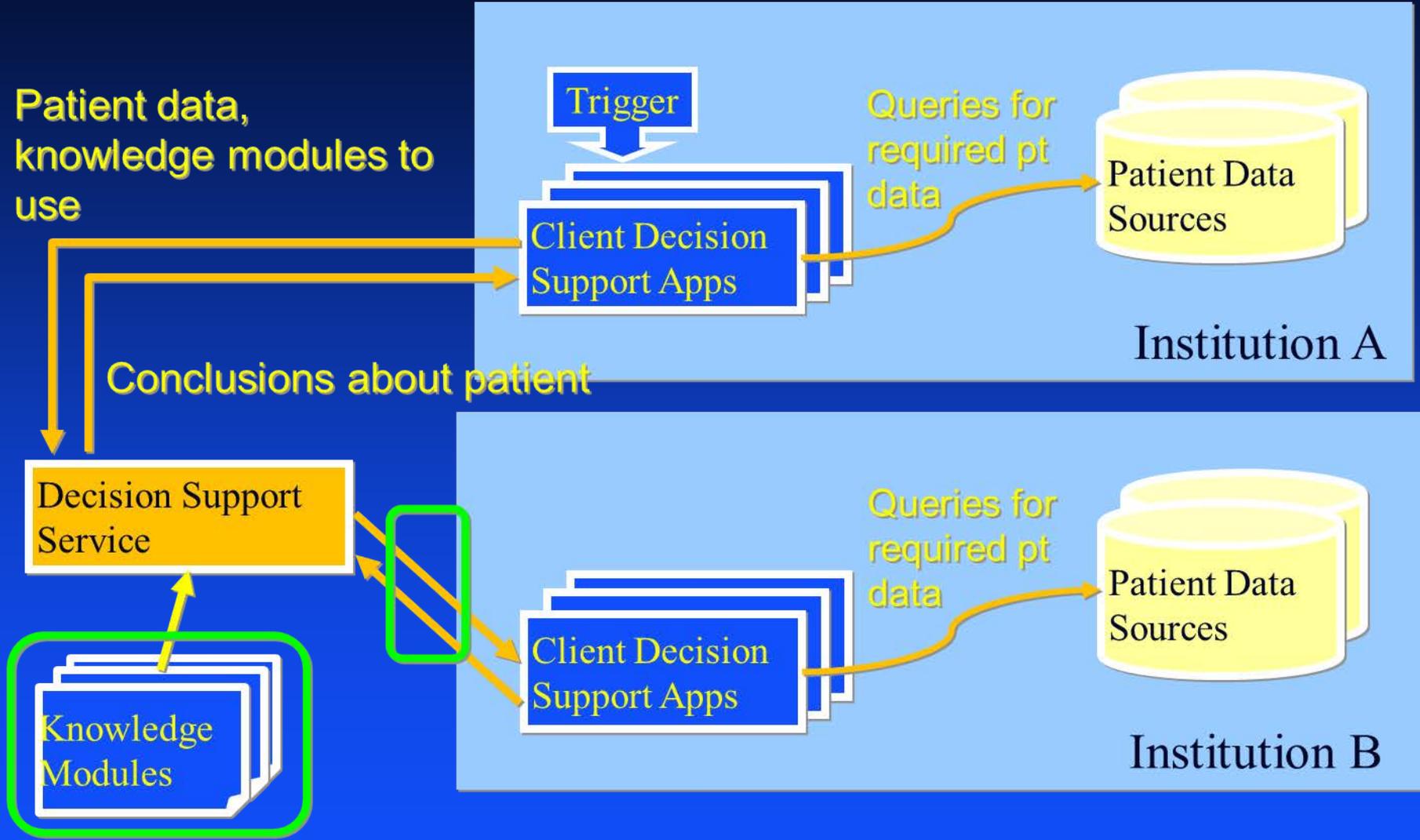
Access to Knowledge: Infobuttons

- **Infobutton**: Application that mediates queries of knowledge sources by clinical applications (EHRs, etc)
- **Process**
 - Clinical information system invokes infobutton manager (IM) with patient/user data
 - IM creates 1+ infobuttons, each = different kind of query
 - User chooses infobutton to execute query against a knowledge source, which displays response

Cimino JJ, Li J, Bakken S, Patel VL. Theoretical, empirical and practical approaches to resolving the unmet information needs of clinical information system users. Proc AMIA Symp 2002;:170-174.



Decision Support Services



Representation of Quality Indicators

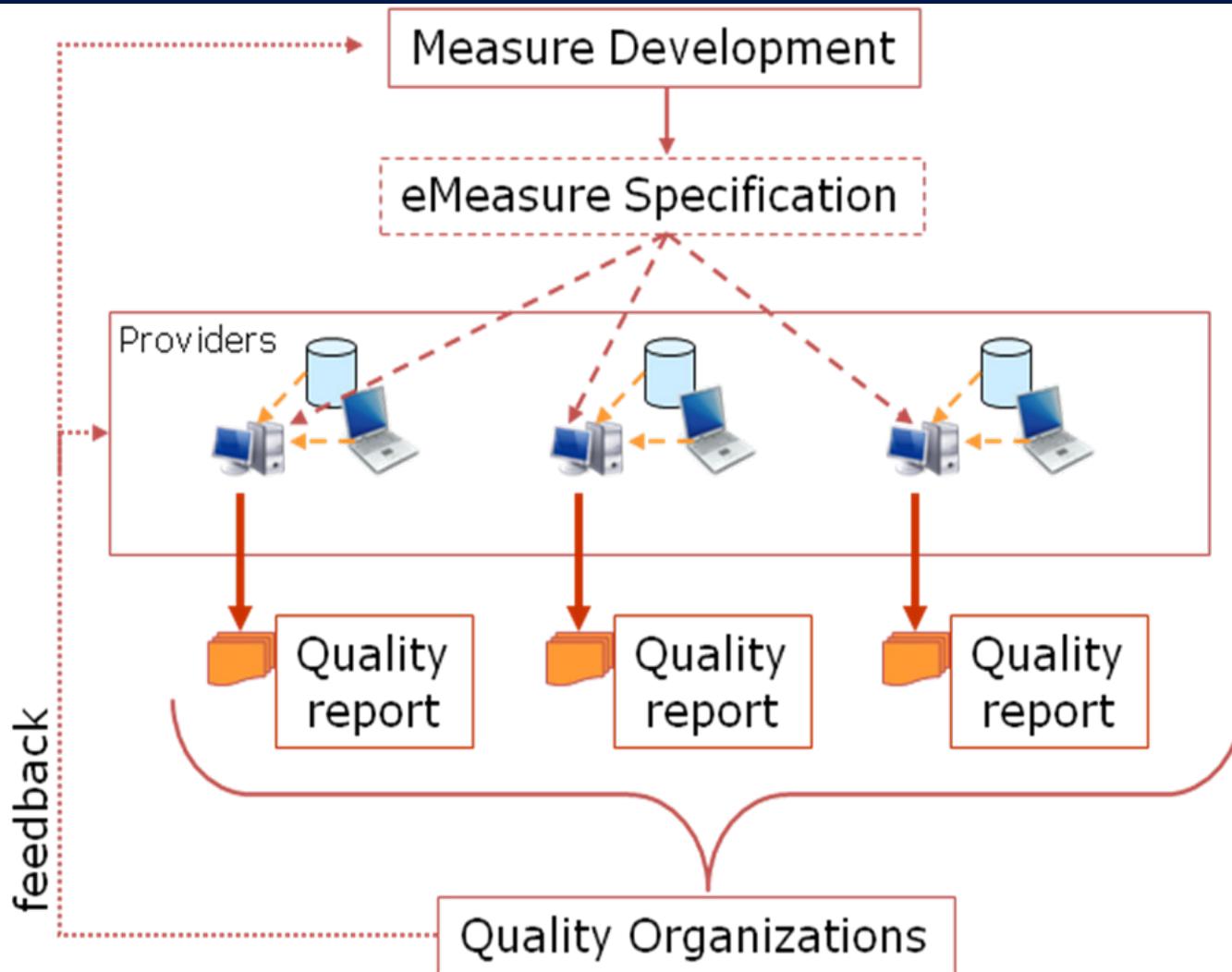
- **Subset of guideline challenge: Measures + decision support across a population**
- **Infrastructure: Data + Knowledge representation**
 - **Data: QRDA = Specification of HL7 CDA to represent data needed by quality measures**
 - **KR: Many possibilities, active work**
- **Example: Arden Syntax and ACOVE**
 - **N = 39 measures applicable to EHR/administrative data**
 - **Arden can represent logic of all**
 - **38% limited by lack of data in a typical EHR**

Jenders RA. Suitability of the Arden Syntax for representation of quality indicators. AMIA Annu Symp Proc 2008:991.

Healthcare Quality Measure Format (HQMF) DSTU

- **Increasing mandates for clinical performance measurement**
 - **Pay for performance**
 - **CMS: No payment for hospital-acquired conditions**
 - **Competitive measurement: hospitalcompare.gov**
- **Implementation of quality indicators (QIs) can be costly**
 - **Need to translate published QI to computable form**
 - **Need to collect digital data in structured format**
 - **Otherwise, paper-based collection is time- and resource-intensive**

HQMF



Intermediate KR: AHRQ eRecommendations

- **SCRCDS**
 - **Highly structured and implementable but not necessarily computable**
 - **Analogy: GLIF levels (conceptual, implementable, computable)**
- **Format**
 - **Header: Management of the eRecommendation**
 - **Data and Logic Specification**
 - **Data: Code sets and standards**
 - **Logic: Boolean, temporal, math operators (Arden, HQMF)**
 - **Implementation Considerations**
 - **Information useful for local implementation**

Category	Data Elements	Relevant Notes
Eligibility/Inclusion-related data	Demographic <ul style="list-style-type: none"> Target gender: F Target age low limit: 50 Target age high limit: 74 Condition <ul style="list-style-type: none"> [not relevant to mammography example] Risk <ul style="list-style-type: none"> [not relevant to mammography example] 	For PQRI 112 to which this logic statement is related, age high limit = 69
Exclusion criteria-related data	High risk patients <p><Value set: History of chest radiation ></p> <ul style="list-style-type: none"> Quality data type: Procedure Result Code set: (CPT 4, ICD9, SNOMED) Code list: {list of relevant codes relating to Hx of chest radiation}. <p><Value set: Known genetic mutation, BRCA1, BRCA2, [possibly others]></p> <ul style="list-style-type: none"> Quality data type: Laboratory test result Code set: (LOINC, SNOMED) Code list: {list of relevant codes for genetic tests} <p><Value set: mammogram results documented within 2 years ></p> <ul style="list-style-type: none"> Quality data type: Diagnostic study result Code set: (CPT,LOINC, SNOMED) Code list: {list of relevant codes} 	High risk patients may require a different screening protocol. The USPSTF recommendation states that a known genetic mutation or a history of chest radiation puts a woman at an increased risk for breast cancer and excludes this group from the screening recommendation. The recommendation implies that a different screening/treatment recommendation/protocol applies to this high risk group, although it does not make explicit such a recommendation/protocol.

Improving Outcomes with Clinical Decision Support: An Implementer's Guide

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HIMSS

Improving Outcomes with Clinical Decision Support: An Implementer's Guide

- **First edition (2005) = Product of HIMSS Patient Safety Task Force**
- **Second edition (2012): Sponsored by AHRQ**
- **Goal: Provide practical advice to health care organizations**
 - **Choosing decision support goals**
 - **Choosing technology to advance those goals**
 - **Developing a deployment strategy**

<http://www.himss.org/cdsworkbook>

Jenders RA, Osheroff JA, Sittig DF, Pifer EA, Teich JM. Lessons in clinical decision support deployment: synthesis of a roundtable of medical directors of information systems. AMIA Annu Symp Proc. 2007 Oct 11:359-63.

Implementer's Guide: KM

- **A comprehensive process for acquiring, adapting and monitoring information for use in clinical decision support that keeps it up-to-date with current clinical evidence, expert consensus and local conditions including pertinent health information system implementation(s).**

KM: Key Lessons

- A systematic, **cyclic process** for managing your CDS knowledge assets is essential and includes people, procedures and information systems.
- KM = an important subcomponent of your CDS program activities, and leverage **decision making and management approaches** and tools from those broader activities.
- A **knowledge management infrastructure** should be established before beginning any CDS implementation.
- **External support** for knowledge management activities may be available from vendor personnel or consultants and should be used to supplement internal staff efforts as needed.

KM: Key Elements

- **Knowledge sources = diverse**
 - **Vendor-supplied; locally-developed; sharing repositories (“pay to play”)**
 - **Repository/tools to track content (even nonlocal), local decisions and status**
- **Governance structure with clear accountability**
 - **Cycles systematically to acquire, review and update knowledge**
 - **Incorporates regulation, clinical goals, business needs, financial incentives (e.g., MU)**
 - **People + systems**
- **Emphasis on standards: Data + knowledge (and tracking these)**

Conclusions: KM for Sustainable CDS

- **Conventional CDS: Data standards, KR for knowledge transfer**
- **Evolving knowledge standards: Remote access (DSS, Infobuttons), QI (HQMF), “intermediate” KR (eRec)**
- **Process + tools to support the process: Knowledge repositories, tracking software, toolkits for local organizations**

Thank you!

- **Daksha Arora, PhD & Westat**

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