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

• **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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Adam Wright
Don E. Detmer, MD, MA

CDS National Roadmap: Three Pillars

Enhanced Health and Health Care Through CDS

Best Knowledge Available When Needed

High Adoption & Effective Use

Continuous Improvement of Knowledge & CDS Methods

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
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,
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)
Welcome to HealthVault
Be well. Protected.

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.]

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 [Learn more]
  onlinePHR [Learn more]
- From MySelfHelp
  MySelfHelp.com [Learn more]
- From HealthVault
  HealthVault Connection Center [Learn more]
- From Healthy Circles
  Healthy Circles [Learn more]
- From LifeScan, Inc.
  Blood glucose monitors [Learn more]
- From Microlife
  Blood pressure monitors [Learn more]
  Peakflow meters [Learn more]
Standard KR: Arden Syntax


- 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

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

Select context that applies:

- **positive**

Normal | Negative
---|---
Positive results are reported as +, ++, +++

- Ascorbic acid in urine can cause false-negative result
- Oxidizing agents (e.g., iodides, bromide) can cause false-positive results.

References


<table>
<thead>
<tr>
<th>Test</th>
<th>Result 1</th>
<th>Result 2</th>
<th>Result 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Glucose</td>
<td>100 mg/dL</td>
<td>120 mg/dL</td>
<td>140 mg/dL</td>
</tr>
<tr>
<td>Ketones</td>
<td>2+</td>
<td>3+</td>
<td>4+</td>
</tr>
<tr>
<td>Bilirubin</td>
<td>trace</td>
<td>trace</td>
<td>trace</td>
</tr>
<tr>
<td>Hemoglobin</td>
<td>10.4 g/dL</td>
<td>10.6 g/dL</td>
<td>10.8 g/dL</td>
</tr>
<tr>
<td>Leukocyte Esterase</td>
<td>2+</td>
<td>3+</td>
<td>4+</td>
</tr>
<tr>
<td>Cells</td>
<td>9 / mcL</td>
<td>12 / mcL</td>
<td>15 / mcL</td>
</tr>
</tbody>
</table>
Decision Support Services

Patient data, knowledge modules to use

Conclusions about patient

Decision Support Service

Knowledge Modules

Trigger

Queries for required pt data

Client Decision Support Apps

Patient Data Sources

Institution A

Client Decision Support Apps

Queries for required pt data

Patient Data Sources

Institution B
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

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
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
<table>
<thead>
<tr>
<th>Category</th>
<th>Data Elements</th>
<th>Relevant Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eligibility/Inclusion-related data</td>
<td>Demographic</td>
<td>For PQRI 112 to which this logic statement is related, age high limit = 69</td>
</tr>
<tr>
<td></td>
<td>• Target gender: F</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Target age low limit: 50</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Target age high limit: 74</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Condition</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• [not relevant to mammography example]</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Risk</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• [not relevant to mammography example]</td>
<td></td>
</tr>
<tr>
<td>Exclusion criteria-related data</td>
<td>High risk patients</td>
<td>High risk patients may require a different screening protocol. The USPSTF</td>
</tr>
<tr>
<td></td>
<td>&lt;Value set: History of chest radiation &gt;</td>
<td>recommendation states that a known genetic mutation or a history of chest</td>
</tr>
<tr>
<td></td>
<td>• Quality data type: Procedure Result</td>
<td>radiation puts a woman at an increased risk for breast cancer and excludes this</td>
</tr>
<tr>
<td></td>
<td>• Code set: (CPT 4, ICD9, SNOMED)</td>
<td>group from the screening recommendation. The recommendation implies that a</td>
</tr>
<tr>
<td></td>
<td>• Code list: {list of relevant codes relating to Hx of chest radiation}.</td>
<td>different screening/treatment recommendation/protocol applies to this high</td>
</tr>
<tr>
<td></td>
<td>&lt;Value set: Known genetic mutation, BRCA1, BRCA2, [possibly others]&gt;</td>
<td>risk group, although it does not make explicit such a recommendation/protocol.</td>
</tr>
<tr>
<td></td>
<td>• Quality data type: Laboratory test result</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Code set: (LOINC, SNOMED)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Code list: {list of relevant codes for genetic tests}</td>
<td></td>
</tr>
<tr>
<td></td>
<td>&lt;Value set: mammogram results documented within 2 years &gt;</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Quality data type: Diagnostic study result</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Code set: (CPT, LOINC, SNOMED)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Code list: {list of relevant codes}</td>
<td></td>
</tr>
</tbody>
</table>
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


- **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](http://www.himss.org/cdsworkbook)

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 (HQMIF), “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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