More Than You Think

HL7 is people, HL7 is ideas, HL7 is collaboration
Getting the Most Out of Your Data Using HL7 Clinical Decision Support Standards
Speakers: HL7 CDS WG Co-Chairs

- Robert A Jenders, MD, MS
  Professor of Medicine & Co-Director
  Center for Biomedical Informatics
  Charles Drew University & UCLA

- Howard R Strasberg, MD, MS
  VP, Medical Informatics
  Wolters Kluwer Health
Standards Pertinent to CDS

- **HL7**
  - v2.x, v3 messaging
  - CDA: Structured documents
  - SPL: Structured product labels
  - CCOW: Desktop interoperability
  - EHR Functional Model & Specification

- **Others**
  - Terminology: SNOMED, LOINC, ICD, etc
  - KR: GEM, others
Putting HL7 CDS Standards Together for CDS

- **Knowledge Transfer**
  - Procedural/Executable: Arden Syntax, GELLO
  - Declarative: HQMF, Order Set

- **Infrastructure**
  - vMR, QIDAM

- **Knowledge Access**
  - Infobutton, Decision Support Services, Clinical Decision Support Knowledge Artifact Implementation Guide, etc
Arden Syntax for Medical Logic Modules

• Procedural representation of medical knowledge (ASTM 1992)
• Share & reuse medical knowledge
• Independent, modular knowledge bases
• Discrete units of knowledge = Medical Logic Module (MLM)
• Explicit definitions for data elements
• HL7 / ANSI / ISO Standard
• Current version: 2.9 (published 2012)
Arden Syntax: Evolving with User Demand

- Moving away from relatively simple, clinician-friendly expressions to more powerful computability
  - v2.7: Complex objects
  - v2.8 (2011): Switch statement, complex list operators
  - v2.9 (2012): Fuzzy logic
  - V2.10 (in progress): Robust XML representation
- Examples: Health maintenance reminders, infection control, clinical practice guidelines, dynamic forms
Healthcare Quality Measure Format

- Increasing mandates for clinical performance measurement
- Implementation of quality indicators (QIs) can be costly: Need to translate published QI to computable form
- Need to collect digital data in structured format
- **Solution:** HQMF (2009) -> R2 (QDM-based IG DSTU)
- **Now:** Harmonizing quality measures & CDS: Health Quality Artifact Reasoning & Expression Logic DAM
Virtual Medical Record

- vMR: Provide common information model upon which interoperable clinical decision support resources (e.g., rules) can be developed
- Overcome inadequacies re CDS in other models (e.g., CCD or even RIM)
- 2011: R1
- Now: Creating a common data model for CDS & QI (QIDAM = vMR + QDM)
vMR Problem Model

ClinicalStatement
- attribute :: CodedNameValuePair [0..*]
- comment :: Documentation [0..*]
- dataSourceType :: CD [0..1]
- documentationTime :: VL_TS [0..1]
- evaluatedPersonId :: II [0..1]
- id :: II [0..1]
- templateId :: CodedIdentifier [0..*]

ConditionBase
- affectedBodySite :: BodySite [0..*]
- conditionCode :: CD
- conditionEffectiveTime :: VL_TS [0..1]
- diagnosticEventTime :: VL_TS [0..1]

AbstractCondition
- ageAtOnset :: PO [0..1]
- certainty :: CD [0..1]
- conditionStatus :: CD [0..1]
- contributedToDeath :: BL [0..1]
- criticality :: CD [0..1]
- severity :: CD [0..1]
- wasCauseOfDeath :: BL [0..1]

Problem
- priorityInEncounter :: CD [0..1]

AllergyOrIntolerance
- agent :: CD [0..1]
- associatedReactionType :: CD [0..*]

AbstractDeniedCondition

DeniedProblem

DeniedAllergyOrIntolerance
- agent :: CD [0..1]
vMR: Tools and Use

• **Tools**
  – OpenCDS: open-source reference implementation

• **Known users of vMR standard (partial list)**
  – Alabama Department of Public Health
  – eClinicalWorks
  – HLN Consulting, LLC
  – HP Advanced Federal Healthcare Innovation Lab
  – Intermountain Healthcare Homer Warner Center
  – Medical-Objects
  – New York City Department of Health & Mental Hygiene
  – University of Utah Health Care
  – VHA Knowledge Based System’s Office
Infobutton

- Infobuttons are context-sensitive links from EHRs to knowledge resources
- Standard for context-aware knowledge retrieval
- Example – a standard way to express the request: Outpatient treatment of community-acquired pneumonia in a 67 yo male
Infobutton Components

MainSearchCriteria (required in most cases)
PLUS optional additional context:
- SeverityObservation
- Age
- SubTopic
- Gender
- TaskContext
- InformationRecipient
- Encounter
- HealthCareProvider
- Observation
Infobutton Example (URL)

- 6 yo male with high cholesterol

http://<knowledge_resource_Infobutton_URL>?
mainSearchCriteria.v.c=14647-2&
mainSearchCriteria.v.cs=2.16.840.1.113883.6.1&
mainSearchCriteria.v.dn=cholesterol&
severityObservation.interpretationCode.c=H&
age.v.u=a&
age.v.v=6&
patientPerson.administrativeGenderCode.c=M
Infobutton – SOA Implementation

- RESTful service with URL request and XML/Atom response
- Add knowledgeResponseType=text/xml to the request
- Common use case: Infobutton Manager, which queries multiple knowledge resources for available content
Infobutton – What's New?

- Observations (e.g. renal function, vital signs, allergies, problems)
- Drug-Drug Interactions
- Send context without main search criteria (user enters search term at destination)
Infobutton – 2014 EHR Certification Criteria

- Linked referential clinical decision support (capability must exist; use of Infobutton standard is optional)
- Patient education – use of Infobutton is required (along with one other method)
HeD Knowledge Artifact (Use Case 1)

- Recently published DSTU based on ONC’s S&I Framework’s Health eDecisions initiative
- HL7 IG: CDS Knowledge Artifact Implementations, Release 1
- Goal is to create sharable CDS artifacts
- Common format for three types of knowledge artifacts: Event/Condition/Action Rules, Order Sets, Documentation Templates
HeD Components

- Metadata (e.g. title, description, author)
- External data (patient data from EHR)
- Expressions (definitions for use in the artifact)
- Triggers (what will trigger the artifact)
- Conditions (is the artifact applicable?)
- Action Groups (e.g. order set, advice)
<conditions>
  <condition>
    <logic xsi:type="And">
      <description>Patient has breast cancer, is taking tamoxifen, the encounter type is outpatient or unknown, and the patient age is greater than or equal to 18 years.</description>
      <operand xsi:type="IsNotEmpty">
        <operand xsi:type="ExpressionRef" name="BreastCancerActive"/>
      </operand>
      <operand xsi:type="IsNotEmpty">
        <operand xsi:type="ExpressionRef" name="TamoxifenActive"/>
      </operand>
      <operand xsi:type="ExpressionRef" name="PatientGenderIsFemale"/>
      <operand xsi:type="Or">
        <operand xsi:type="ExpressionRef" name="OutpatientVisitTypeContext"/>
        <operand xsi:type="ExpressionRef" name="UnknownVisitTypeContext"/>
      </operand>
      <operand xsi:type="GreaterOrEqual">
        <description>Patient age greater than or equal to 18 years</description>
        <operand xsi:type="ExpressionRef" name="PatientAgeInYears"/>
      </operand>
    </logic>
    <conditionRole value="ApplicableScenario"/>
  </condition>
</conditions>
HeD CDS Service – Use Case 2

- Defines an approach to implement CDS via web services
- Evaluates patient data using knowledge modules and returns machine-interpretable conclusions
HL7 DSS IG - Scope
## HL7 DSS IG - Standards

<table>
<thead>
<tr>
<th>Transaction</th>
<th>Transport</th>
<th>Service Standard</th>
<th>Primary Content Standard</th>
</tr>
</thead>
<tbody>
<tr>
<td>CDS Request (including patient data and potentially context)</td>
<td>SOAP/REST</td>
<td>DSS</td>
<td>vMR</td>
</tr>
<tr>
<td>CDS Response (including CDS guidance and/or other response elements)</td>
<td>SOAP/REST</td>
<td>DSS</td>
<td>vMR</td>
</tr>
</tbody>
</table>
FHIR for CDS?

- Currently being explored
- QIDAM = VMR/QDM harmonization
- Gap analysis - QIDAM vs FHIR
- May need to develop a hierarchical, logical model for FHIR in order to use it optimally in CDS expressions
More Information

- Email: jenders@ucla.edu
- Email: howard.strasberg@wolterskluwer.com
- Twitter: @HowardStrasberg
- HL7.org
  - http://www.hl7.org/Special/committees/dss/index.cfm
  - http://www.hl7.org/Special/Committees/arden/index.cfm
- HL7 Wiki