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

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

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

- **HL7**
  - v2.x, v3 messaging
  - CDA: Structured documents
  - SPL: Structured product labels
  - CCOW: Desktop interoperability
  - FHIR: Data specification

- **Others**
  - Terminology: SNOMED, LOINC, ICD, etc
  - KR: GEM, others
  - Organizations: CDISC (SDTM, etc)
Putting HL7 CDS Standards Together for CDS

- **Knowledge Transfer**
  - Procedural/Executable: Arden Syntax, Clinical Quality Language (CQL)
  - Declarative: HQMF

- **Infrastructure**
  - vMR, QUICK, FHIR

- **Knowledge Access**
  - Infobutton, FHIR Clinical Reasoning, CDS Hooks
Arden Syntax for Medical Logic Modules

• Procedural representation of medical knowledge (ASTM 1992)
• Share & reuse medical knowledge as independent, modular knowledge bases
• Discrete units of knowledge = Medical Logic Module (MLM)
• Explicit definitions for data elements
• HL7 / ANSI / ISO Standard
• Incorporated by several vendors
• Current version: 2.10 (published 2014)
Arden Syntax:
Evolving with User Demand

- Moving away from relatively simple, clinician-friendly expressions to more powerful computability
- v2.8 (2011): Switch statement, complex list operators
- v2.9 (2012): Fuzzy logic
- v2.10 (2014): Robust XML representation
- Current: Work on v3 (standard data model), IG R2 (2017)
- Examples: Health maintenance reminders, infection control, clinical practice guidelines, dynamic forms
Clinical Quality Language (CQL)

• Expression language tailored for representation of quality measures
• Based in large part on Arden Syntax
• Use a new data model = QUality Improvement and Clinical Knowledge (QUICK) = vMR + QDM
  – Being aligned with FHIR quality profiles
• Status: Active projects, no standards finalized
• Goal: Represent eCQMs using QUICK as a data model
  – Role previously served by HQMF, though still supported (e.g., QDM-based HQMF)
CQL/HQMF: eCQM Representation
QUICK

- Quality Improvement and Clinical Knowledge model = successor to vMR
- Goal: Create a common data model for CDS & CQM (QUICK = vMR + QDM)
- Provide common information model upon which (along with standard terminologies) interoperable clinical decision support resources (e.g., rules) can be developed
- Parallel work on FHIR Profiles
QUICK

- Inspired QICore FHIR® profiles
- Now refers to a logical view of the QICore profiles
- QICore itself is being harmonized with US Core profiles (successor to DAF profiles)
- Clinical Information Modeling Initiative
- Goal: Consolidate data models for health care and create a repository of models
- Work on CDS-specific data models (QUICK) occurs collaboratively in this context
- http://www.opencimi.org
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 Pearls

- Observations (e.g. renal function, vital signs, allergies, problems)
- Drug-Drug Interactions
- Send context without main search criteria (user enters search term at destination)
FHIR® PlanDefinition

- Successor to Health eDecisions Use Case 1
- Goal is to create sharable CDS artifacts
- Common format for three types of knowledge artifacts: Event/Condition/Action Rules, Order Sets, Protocols
PlanDefinition Components

- Artifact Identity
- Metadata (e.g. publisher, status)
- Action Definitions (actions to be taken)
- Trigger Definitions
- Expression Logic (often in a CQL library)
PlanDefinition Example

```xml
<PlanDefinition>
  <id value="chlamydia-screening-intervention"/>
  <identifier>
    <use value="official"/>
    <value value="ChlamydiaScreening_CDS_UsingCommon"/>
  </identifier>
  <version value="2.0.0"/>
  <title value="Chlamydia Screening CDS Example Using Common"/>
  <status value="draft"/>
  <description value="Chlamydia Screening CDS Example Using Common"/>
  <publicationDate value="2015-07-22"/>
  <topic>
    <text value="Chlamydia Screening"/>
  </topic>
  <library>
    <reference value="Library/ChlamydiaScreening_CDS_UsingCommon"/>
  </library>
  <actionDefinition>
    <title value="Patient has not had chlamydia screening within the recommended timeframe..."/>
    <triggerDefinition>
      <type value="scheduled-event"/>
      <eventTimingDate>10/12/2015</eventTimingDate>
    </triggerDefinition>
    <condition>
      <expression value="NoScreening"/>
    </condition>
    <dynamicValue>
      <path value="-"/>
      <expression value="ChlamydiaScreeningRequest"/>
    </dynamicValue>
  </actionDefinition>
</PlanDefinition>
```
library ChlamydiaScreening_CDS_UsingCommon version '2'

using QUICK

include ChlamydiaScreening_Common version '2' called Common

codesystem "SNOMED": 'http://snomed.info/sct'

valueset "Reason for not performing Chlamydia Screening": 'TBD'

context Patient

define "In Demographic":
    AgeInYears() >= 16 and AgeInYears() < 24 and "Patient"."gender" in Common."Female Administrative Sex"

define "Sexually Active":
    exists (Common."Conditions Indicating Sexual Activity")
    or exists (Common."Laboratory Tests Indicating Sexual Activity")

define "No Screening":
    not exists (Common."Results Present For Chlamydia Screening" S where S."issued" during Interval[Today() - 1 years, Today()])
    and not exists (["ProcedureRequest": Common."Chlamydia Screening"] P where P."orderedOn" same day or after Today())
    and not exists (["Observation": "Reason for not performing Chlamydia Screening"])

define "Need Screening": "In Demographic" and "Sexually Active" and "No Screening"

//The following used to read "ProcedureRequest" where it now reads "Tuple"

define "ChlamydiaScreeningRequest": Tuple {
    type: Code '422487003' from "SNOMED" display 'Screening for Chlamydia trachomatis (procedure)',
    status: 'proposed'
    // values for other elements of the request...
}
CDS Service

- Successor to Health eDecisions Use Case 2
- Defines an approach to implement CDS via web services
- Evaluates patient data using knowledge modules and returns machine-interpretable conclusions
CDS Service Components

- ServiceDefinition (data requirements, input and output parameters)
- Uses $evaluate operation
- Request contains parameters (including FHIR® data) as defined by the ServiceDefinition
- GuidanceResponse
CDS Hooks

Source: http://cds-hooks.org/

(not currently an HL7 standard)
CDS Hooks

- Alternative to FHIR® ClinicalReasoning for the CDS services use case
- January 2017 WGM: Agreement to harmonize CDS hooks with ClinicalReasoning for this use case
- Uses FHIR® for patient data, but not for other elements of request and response
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