

Welcome to Workshop 4

**Standards in Clinical Decision Support:
Activities in Health Level Seven
And Beyond**

Background

- **Workshop**: A seminar, discussion group, or the like, which emphasizes exchange of ideas and the demonstration and application of techniques, skills, etc.

*Random House Dictionary of the English Language
College Edition*

New York: Random House, 1969



Discussants

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Co-Chair, HL7 Clinical Decision Support Work Group

Co-Chair, Arden Syntax Work Group

Discussant, Arden Syntax + GELLO



Discussants

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Overview of Workshop

- **Part 1: Overview of HL7 CDS (Jenders)**
- **Part 2: Proposed standards**
 - vMR project
 - Order Set project
 - HQMF project
- **Part 3: Current standards**
 - Arden Syntax (Jenders)
 - GELLO (Jenders)
 - Infobutton (Del Fiol)
 - DSS (Kawamoto)
- **Part 4: Your input**



HL7 Structure: Clinical Decision Support

- **Consensus-based, ANSI-accredited SDO**
 - **20+ international affiliates**
 - **Meetings (3/year): 400 participants**
- **Clinical Decision Support Work Group (Jenders, Greenes, Kawamoto, Parker)**
 - **Contribute to RIM, inform CDS aspects of other HL7 work, develop overall decision support system model**
 - **Related to Arden Syntax Work Group**



HL7 Structure: Clinical Decision Support

- **Interactions with other groups: EHR Work Group, Patient Care Work Group, etc**
- **Coordination via the Technical Steering Committee:**
 - **Structure and Semantic Design**
 - **Foundation and Technology**
 - **Domain Experts**
 - **Technical and Support Services**



HL7 CDS: External Relationships

- **HITSP**
 - Coordinate development of work products that fulfill HITSP use cases
 - Examples: Order set standard, Infobutton standard, guideline formalism
- **OMG**
 - DSS
- **ONC**
 - CDS Collaboratory



HL7 CDS: External Relationships

- **Morningside Initiative**
 - **Initiated 8/2007**
 - **Goal: Interoperable delivery of CDS at POC**
 - **Multiple participants: AMIA (umbrella), Partners, Intermountain, ASU, etc**
 - **Artifacts**
 - **Knowledge module repository**
 - **Editing, management tools**
 - **Current status: Draft bylaws written; committees organized; initial knowledge acquisition related to diabetes guidelines. KR formalism not yet selected.**



HL7 Contacts

- **<http://www.hl7.org>**
 - **Co-chair names/contact information**
 - **Mission statements**
 - **Meeting minutes**
 - **Official standards**















Aspects of Standardization

- **Structure: Knowledge representation**
 - Enable sharing
- **Messaging: Format, terminology**
 - Enable interoperability
- **Function: Services**



Work Product:

Proposed Virtual Medical Record (vMR) Standard

- **Definition**: Data model and implementation guide, based on the HL7 v3 RIM format, for representing clinical information *inputs* and *outputs* to/from clinical decision support services
 - Initial focus: Support POC chronic disease management
- **Functionality**: Clinical information systems use a standard model to represent data communicated with a clinical decision support system
- **Status**: Work started on creation of UML model = HL7 Domain Analysis Model in September, 2009



Work Product: Proposed Order Set Standard

- **An order set is a functional grouping of orders in support of a protocol that is derived from evidence based best practice guidelines.**
 - **Order sets have a purpose.**
 - **Order sets may contain conditional logic.**
 - **Some items in an order set may be fully specified, others may have more optionality.**
 - **Order sets may be part of a larger care plan.**



Order Sets

- **In Scope**
 - Create a structural and functional model to communicate order set content between content authors and those who will use the content.
- **Out of Scope**
 - The result of this project will NOT be a standard for messaging orders at the point of care.



Order Sets: Layers

- **I – Publish, Distribute and Track: Metadata for authoring, maintenance and dissemination by professional standards organizations**
- **II - Import: Full text order set content permits localization and use within vendor EHR: Order tests, treatments and procedures, set Goals, record Observations**
- **III – Presentation management: Organize and restrict order session content for maximum clinical utility**
- **IV - Manage as knowledge: Coded standards-based order content supports manipulation of order sets, order segments and order items by guideline decision support engine**



Order Sets: Structure

- **Order set = header + body**
- **Header: Attributes**
 - **Ownership**
 - **Authorship**
 - **Maintenance**
 - **Scope of Use**
 - **Related Order Sets (Nesting)**
 - **Description**
 - **Supporting Evidence**
 - **Use Cases**
 - **Authorship Milestones**
 - **Context for Use**



Order Sets: Status

- **September, 2008: Passed DSTU ballot**
 - **Had previously failed ballots because of disputes over the data model**
- **Current status: Regrouping to resume work on proposed standard**



Ancillary Work Product: Proposed HQMF

- **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**



Quality Indicators: Sample ACOVE QIs

- **IF a vulnerable elder has had a myocardial infarction, THEN he or she should be offered a beta blocker unless there is a contraindication**
- **IF an ambulatory vulnerable elder has an osteoporotic fracture diagnosed, THEN physical therapy or an exercise program should be offered within 3 months**
- **IF a vulnerable elder is taking warfarin for atrial fibrillation, THEN an INR should be checked at least every 6 weeks**

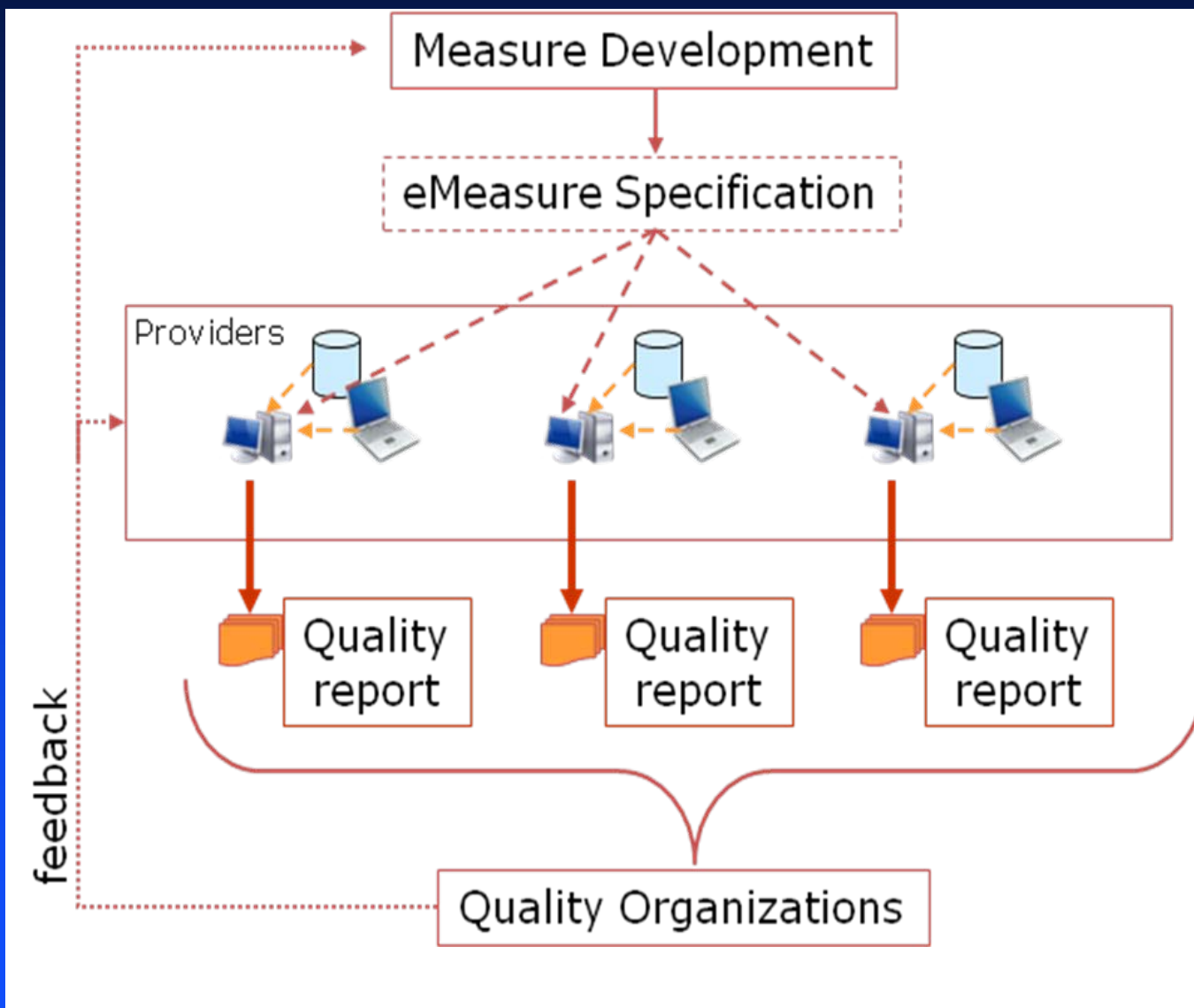


HQMF

- **No standard formalism for knowledge representation**
- **Standardization efforts underway**
 - **AMA Collaborative for Performance Measure Integration with EHR Systems**
 - **HL7: Healthcare Quality Measure Format (HQMF) being developed as a draft standard for trial use (DSTU) = v3 RIM-based XML**
- **Clinical guideline standards exist but may not be applicable**
 - **QIs are population-based, but guideline formalisms are applied to individual patients**



HQMF



HQMF: Status

- **Passed DSTU ballot September, 2009**
- **Extensive reconciliation undertaken**
- **Publication efforts underway**



Extant Standards

- Arden Syntax
- GELLO
- Infobutton
- DSS



Arden Syntax for Medical Logic Modules

- **Modular knowledge bases which are independent from one-another**
- **Share medical knowledge, not just reuse**
- **Procedural representation of medical knowledge**
- **Discrete units of knowledge = Medical Logic Module (MLM)**
- **Explicit definitions for data elements**
- **HL7 / ANSI / ISO Standard**
- **Current version: 2.7**



MLM Format

- **Three categories and a terminator**
- **Categories**
 - *maintenance:*
 - *library:*
 - *knowledge:*
 - *resources: (new in v2.6)*
- **Terminator**
 - *end:*



MLM Example

maintenance:

title: Admission Screen for Acute Coronary Artery Disease;;
filename: ACUTE_CAD_1;;
version: 1.09;;
institution: Columbia-Presbyterian Medical Center;;
author: Robert Jenders, MD, MS (jenders@cucis.cis.columbia.edu);;
specialist: Alan Simon, MD (ads5@columbia.edu);;
date: 1996-01-24;;
validation: research;;

library:

purpose: To notify investigators of the admission of a patient
whose admission diagnosis suggests acute coronary artery
disease. IRB number 7205;;
explanation: ;;
keywords: ;;
citations: ;;



MLM p. 2

knowledge:

type: data-driven;;

data:

```
admission := event {'32511','32467'; '32511','32472'};
inpatient_case := read last {'evoking','dam'="GYDAPMP",'constraints'=" I***";
                             "HCASE";"K"}; /* note blank as first constraint char */
email_dest := destination {'email',
                           'name'="rra2@columbia.edu"};
diagnosis_text := read {'evoking','dam'="GYDAPMP"; "HDIAGNOS"; "HDIAGTXT"};
target_diagnoses := ("MI","R/O MI","MYOCARDIAL INFARCTION",
                    "CARDIOGENIC SHOCK","CHEST PAIN","CP","ANGINA",
                    "CHEST PAIN NOS","INTERMED CORONARY SYND","UNSTABLE ANGINA","CAD",
                    "ANGINA PECTORIS NOS","CHR ISCHEMIC HRT DIS NEC",
                    "RULE OUT MI","R/O MYOCARDIAL INFARCTION","ACUTE MI",
                    "SUBENDO INFARCT","UNSTABLE ANGINA/MI",
                    "ANGINA PECTORIS","CORONARY ARTERY DISEASE");
mrn := read last {'pcodes'="now mrn "};
patient_name := read last {'dam'="GYDAPMP"; "HPBASIC"; "HNAME"};
location := read last {'dam'="GYDAPMP"; "HLOC"; "HLOCNURS"};
```

::



MLM p. 3

```
evoke: admission;;
logic:
  if inpatient_case is null then
    conclude false;
  endif;
  if any (diagnosis_text are in target_diagnoses) then
    conclude true;
  else
    conclude false;
  endif;
;;
action:
  write "ACUTE CAD ADMISSION NOTICE" ||
    "\n\nPatient Name: " || patient_name ||
    "\nMRN: " || mrn ||
    "\nLocation: " || location ||
    "\nAdmission Diagnosis: " || diagnosis_text ||
    "\n\n\n" || patient_name || " " || mrn || " " || location
  at email_dest;
;;
end:
```



System Vendors

- **Eclipsys**
- **McKesson**
- **Siemens**
- **Medexter**



Resources

- **Official Archive: www.hl7.org**
- ***HL7 Library or Book Store* to obtain authoritative copy of standard**
- ***Work Groups / Arden Syntax* for committee's homepage**



Arden Syntax v2.8

- Timeline: Normative ballot 1/2011
- 2 key advances
 - **Fuzzy logic**: Represent linguistic variables + operators to manipulate these
 - “moderately severe”; “potentially associated”
 - **XML** (“Arden ML”): Refine present non-normative XML version of Arden
 - Stepwise refinement of different levels of markup: MLM -> category -> slot -> statement -> operator



Arden Syntax v3.0

- **Timeline: Indefinite future**
- **Potential ingredients**
 - Further elaborate structured WRITE statement (i.e., expansion of the Action slot)
 - vMR
 - Support for complex guidelines, e.g., “master MLMs” that document packages of MLMs and their dependencies
 - Additional logics: Other methods for addressing uncertainty (e.g., probability constructs)
 - Workflow constructs, in part to enable an authoring/development environment



Arden Syntax v3.0

- Potential ingredients (continued)
 - Reference implementation + conformance model (in part as verification of particular implementations)
 - Authoring/maintenance environment syntactical constructs
 - Support for terminology references + a data model
 - Support for quality measure implementation
 - Support for data interface (e.g., expansion of the READ statement; ask now vs later directed at synchronous users)



GELLO = Common Expression Language

- **Executable language for expressing logical rules and queries in clinical decision support applications**
- **Provides a standard interface to medical record systems and other data/knowledge sources**
 - **Based on OMG OCL**
- **GELLO expressions:**
 - **Extract and manipulate data**
 - **Construct decision criteria, abstractions, formulae**



GELLO = Common Expression Language

- **Purpose**: Share queries and logical expressions
 - Query data (READ)
 - Logically manipulate data (IF-THEN, etc)
- **Initial rationale**: Stepping stone to a RIM-compliant guideline formalism
- **Initial version**: ANSI standard release 1 = May, 2005

Ogunyemi O, Zeng Q, Boxwala A. Object-oriented guideline expression language (GELLO) specification: Brigham and Women's Hospital, Harvard Medical School, 2002. Decision Systems Group Technical Report DSG-TR-2002-001.



GELLO: Examples

□ Queries

`Observation.select(coded_concept='03245')`

`Observation.selectSorted(coded_concept="C0428279")`

□ Expressions

- **The variables calcium and phosphate are not null**

`calcium.notEmpty()` and `phosphate.notEmpty()`

- **The patient has renal failure and the product of calcium and phosphate exceeds a threshold signifying osteodystrophy**

`renal_failure and calcium_phosphate_product > threshold_for_osteodystrophy`



GELLO: Status

- 2006
 - Tool release by Medical Objects (Australia)
 - Demonstration project: e-Prescribing prior authorization rules



GELLO: Status

- **2007**
 - **Authoring tool release by InferMed (UK).**
 - **Demonstration projects**
 - **Possible: Clinical trial**
 - **Australia (Medical Objects + Haematology Society + Leukaemia Society of Australia):
Guideline representation in a GLIF context**
 - **Result of demonstration projects**
 - **BNF revision**
 - **Work on vMR as a RIM-derived data model for
decision support**



GELLO: Status

- **2008: Two work products**
 - v 1.0: Revision of BNF to fix errors
 - v 2.0: Expand in light of prior testbed projects
- **2009: Further refinement**
 - v 2.0: Passed initial normative ballot 9/2009



Moving right along...

- Arden Syntax
- GELLO
- Infobutton
- DSS



Discussion Questions

- **Overall**
 - How do I get involved?
 - Need for shared knowledge repository?
- **Infobutton**
 - Where can I get them?
 - How should the standard be improved?
- **DSS**
 - What types of knowledge modules are useful?
 - Would you use a DSS provider?
 - Do we need a guideline representation formalism?



Discussion Questions

- Arden
 - Where can I get a rules engine?
 - Where can I get “rules”?
- HQMF
 - How will organizations use this?
- Order Set
 - Will an HL7 standard matter in the setting of a de facto standard?



The End

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Thanks!

