

Component 9 - Networking and Health Information Exchange

Unit 7-2 - Supporting Standards for EHR Application

Slide 2

Unit 7-2 Objectives

- Understand
 - Standards for clinical guidelines
 - Object-oriented expression language for clinical decision support
 - GELLO

Health IT Workforce Curriculum Version 2.0/Spring 2011

Slide 3

Guidelines

- Computer-interpretable guidelines
- Sharing computer-interpretable guidelines
- Guidelines
 - Deliver patient-specific recommendations
 Integrated with EHRs

 - Automated reminders and alerts
 Decision support and task management
 - Order entry appropriateness, referral criteria
- Background monitoring, care plans, quality review

| - | | | | |
|---|------|------|------|--|
| - | | | | |
| - | | | | |
| - | | | | |
| - | | | | |
| _ | | | | |
| _ | | | | |
| | | | | |
| - | | | | |
| - | | | | |
| - | | | | |
| - | | | | |
| - | | | | |
| - | | | | |
| _ | | | | |
| | | | | |
| | | | | |
| - | | | | |
| - | | | | |
| - | | | | |
| - | | | | |
| - | | | | |
| _ | | | | |
| | | | | |

| и | n | |
|---|---|--|
| | | |

Benefits of Guidelines

- Provide automatic decision support
 - Applied to individual patients
 - Perform retrospective analysis to test if patients were treated appropriately
- Simulations
- · Aid human visualization
 - Interactive, dynamic display of guideline pathways
 - Allows one to focus on relevant sections of flowchart

Component 9/Unit 7-

Health IT Worldorce Curriculu Version 2 0/Spring 2011

Slide 5

Challenges in Sharing Guidelines

- · Local adaptation of guidelines
 - Availability of resources and expertise
 - Local workflow issues
 - Practice preferences
- · Integration with local information systems
 - Match patient data from EHR to GL
 - Match recommendations in guideline to actions in order entry systems
- · Dissemination formats

Component 9/Unit 7-

Health IT Worldforce Curriculum Version 2.0/Spring 2011

Slide 6

Common Shared Model

- · Ability to share guideline across
 - Different platforms and systems
 - Different guideline models
- · Joint development of:
 - Shared model that incorporates features of different models
 - Tools to support entire guideline life cycle
 - Authoring, validation, local adaptation & mappings, execution, revision and update

Component 9/Unit 7-2

| | | | |
|------|------|------|--|
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |

| S | | |
|---|--|--|
| | | |
| | | |

Expressiveness

- · Ability to express knowledge content of different types of guidelines

 - Structured parts

 • Definitions, recommendations, algorithms
- Decision-support guideline tasks
 - Expressive decision model
- Specifying work to be performed
- Data interpretation
- Generating alerts and reminders

Slide 8

Comprehensibility

- · Guideline visualization and readability
- Complexity management
- · Coherence facilitation
 - e.g., Support material

Slide 9

Implementation Requirements

- · Ease of
 - Guideline integration into clinical environments
 - Sharing actual specifications

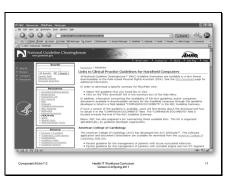
| | | |
|------|------|--|
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |

Integration into Clinical Environment

- · Local adaptation of guideline content
- · Integration with EHR
 - Mapping references to patient data to entries in EHR
 - Mapping recommendations to implementable actions
 - e.g. Linking to order entry system
 - Printing a prescription
- · Workflow integration

Health IT Workforce Curriculum Version 2.0/Spring 2011

Slide 11



Slide 12

Guideline Representation Models

- Arden SyntaxGLIF

- GEM DILEMMA
- EON
- PROforma
- Asbru
- GUIDE
- PRODIGY

| |
|------|
| |
| |
| |
| |
| |
| |
| |
| |
| |
| |
| |
| |
| |
| |
| |
| |
| |
| |
| |
| |
| |
| |
| |
| |
| |
| |
| |
| |
| |
| |
| |
| |
| |
| |
| |
| |
| |
| |
| |
| |
| |
| |

| Slide 13 | | | |
|----------|---|---|------|
| | GuideLine Interchange Format (GLIF) | | |
| | A format for sharing clinical guidelines | | |
| | independent of platforms and systems | | |
| | Based on a object-oriented logical model | | |
| | of concepts | | |
| | Has an XML-based syntax Is an executable model | | |
| | io an oxecutable measi | | |
| | | | |
| | Component 9/Unit 7-2 Health IT Workforce Curriculum Version 2.0/Spring 2011 13 | | |
| | | - | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| Slide 14 | | 1 | |
| Silue 14 | GLIF Model | | |
| | Flowchart representation of a temporal | | |
| | sequence of clinical steps | | |
| | Guideline has title and author Guideline Step | | |
| | - Decision step | | |
| | – Action step | | |
| | Branch step Synchronization step | | |
| | - Patient sleep step | | |
| | Component 9/Libit 7-2 Health 1T Worlforce Curriculum 14 Veninos 2.09 gring 2011 | | |
| | version 2.20 opening 2011 | J | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | 7 | |
| Slide 15 | GLIF Classes | | |
| | GLIF Classes | | |
| | Action steps: Passampadations for clinical actions to be parformed. | | |
| | Recommendations for clinical actions to be performed Prescribe aspirin | | |
| | Decision steps: Criteria for conditional flowchart traversal | | |
| | If patient has pain, then (x) Branch and synchronization steps | | |
| | - Allow concurrency | | |
| | Patient-state sleep Characterizes patient's clinical state | | |
| | | | |
| | Component Bithin 7-2 Health IT Workforcs Corriculum 15 Version 2-05gring 2011 | J | |
| | | | |

| SI | ide | 16 |
|----|-----|----|
|----|-----|----|

Three Representation Levels

- · Author/viewer level
 - Conceptual flowchart of clinical actions and decisions
 - Aids in human understanding
- · Abstract machine representation
 - Can be executed by an interpreter
 - Correctness can be analyzed
- Integration into application environments

Slide 17

Abstract Machine Representation

- Unambiguous syntax for logical expressions based on Arden Syntax
- All logical expressions & actions refer to defined concepts
 Medical ontology
- · Allowed values, ranges, and time constraints
- Can be interpreted and analyzed for correctness
 - Syntax, type, and range checking

Health IT Workforce Curriculum Version 2.0/Spring 2011

Slide 18

Guideline Elements Model (GEM)

- Developed at Yale Center for Medical Informatics
- Hierarchical data structure to organize the heterogeneous information contained in practice guidelines
- · Includes a XML editor specifically for guideline markup called GEM Cutter

| | | |
|--|------|------|
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |

Structure of GEM

knowledge.componentsvecommendation-<Conditionalselection variables decision variables designes des designes designes designes designes designe

.

Slide 20

GELLO

- Object-oriented expression language for clinical decision support
- Based on Object Constraint Language
- Used to
 - Build up queries to extract and manipulate data from EHRs
 - Construct decision criteria by building up expressions to reason about particular data features/values such as guidelines
 - Create expressions, formulae, and queries for applications within other HL7 standards

mponent 9/Unit 7-2

Health IT Worldorce Curriculum

Slide 21

Expression Language

- Used for specifying decision criteria and deriving summary values
- Provides basic built-in data types, assuming an underlying data model virtual medical record (vMR) that is a refinement of the HL7 RIM
- Major problem to sharing clinical knowledge is lack of common format for data encoding and manipulation

Component 9/Unit 7-2

| | | |
|--|------|--|
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |

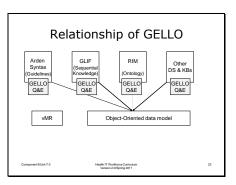
Requirements

- Targeted to clinicians who need to use expression language for sharing and manipulating knowledge in medical context Declarative language Extensible

- Extensione
 Vendor independent
 Platform independent
 Object-oriented and compatible with vMR
 Easy to read/write
 Side-effect free (leaves system unchanged) Side-effeFlexible

Health IT Worldorce Curriculum Version 2.0/Spring 2011

Slide 23



Slide 24

GELLO Expressions

- Any text string conforming to the definition of an expression in GELLO language specification
 Build decision criteria
 Abstract or derive summary values
 The result of the evaluation of an expression is a value with a specified data type

- Examples of expressions
 calcium.nolEmpty() and phosphate.notEmpty()
 Renal. failure and calcium_phosphate_product > threshold_for_osteodystrophy
- · Includes temporal operators

| | | |
|------|------|--|
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |

Example in GELLO

Let month : CodedValue = Factory.CodedValue("SNOMED-CT", "258706009")

Let finding : CodedValue = Factory.CodedValue("SNOMED-CT", "246188002")

Let azotemia : CodedValue = Factory.CodedValue ("SNOMED-CT", "371019009")

Diservation ? exists(code.equal(finding) and value.implies(azotemia) and effective_time.intersect(ThreeMonthsAgo, PointInTime.NOW()))

Health IT Workforce Curriculum Version 2.0/Spring 2011

Slide 26

Summary

This subunit has discussed guideline representation models. The future of such work is likely to be based on GELLO. Guidelines themselves are very important. Use of guidelines should increase significantly with pressure from Meaningful Use.

| | | |
|------|------|--|
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |