SAGE Guideline Modeling: Motivations and Methodology

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Outline

- SAGE: Standards-Based Active Guideline Environment
- Deployment-Driven Guideline Modeling
- Compliance with Standards
- SAGE Decision-Support System Architecture
- Results and Conclusions
SAGE: Standards-Based Active Guideline Environment

- 3-year US NIST Advanced Technology Program grant
- IDX leads R&D consortium that includes as partners:
  - Apelon, Inc.
  - Stanford Medical Informatics (SMI)
  - Intermountain Healthcare (IHC)
  - University of Nebraska Medical Center (UNMC)
  - Mayo Clinic
- Ultimate goal: An infrastructure that will allow execution of standards-based clinical practice guidelines across heterogeneous clinical information systems (CIS)
- Focus is on the goal of deployment of guideline knowledge within the workflow of clinical information systems
Deployment-Driven Guideline Modeling

• Assumption: Guideline DSS is reactive
  • Not in control of clinical workflow
  • Respond to external events (including passage of time)
• Methodology
  • Empirically define points in care processes where guideline DSS may provide services
  • Discover characteristics of human-computer interactions that enhances prospect of acceptance
• Method
  • Create scenarios that walk-through care process
  • Create prototype GUI to validate in usability lab
Clinical scenario: Patient arrives for visit with primary physician. At check-in, SAGE checks for immunizations that are due and prints consents and information sheets. Nurse then reviews any other shots received, updates the record, and SAGE pre-order immunizations to be given that day.
Mayo Usability Lab

- Prototypes tested by clinicians in Mayo usability lab
Results of Scenario Development

- Scenario development defines events and actions that SAGE must respond to and generate. Scenarios help to define what guideline knowledge must be encoded and what data must be queried.

**Diagram:**
- CIS
- Order/Order Set
- In-Box Message
- Inquiry
- Events
- Queries
- Guideline Actions
- SAGE
- Guidelines
- SAGE Guideline Knowledge Base
Top-Level Workflow-Aware Process

- Top-level process description in encoded guideline reflect expected reactions to events in clinical workflow
Context nodes organize and specify the relationship to workflow. They record:

- Who is involved
- Where the session occurs
- What resources are required
- Clinical Information processing
- What triggers or begins session
Sub-guidelines

Can be thought of as reusable subsets of guideline logic (much like subroutines) for repeated use within a recommendation set.
Compliance with Standard....

• Take existing components whenever possible
  • Data types: HL7 version 3 data types
  • Reference terminology: SNOMED CT, LOINC, NDF-RT
  • Patient data model: “virtual medical record” being defined by HL7 Clinical Decision Work TC
  • Expression language: GELLO

• Difficulties
  • Moving targets: e.g. GELLO not well specified until 2004/03
  • Mismatches
    e.g. between guideline concepts and terminology concepts
Specifying a Decision Criterion: Presence of Chronic Pulmonary Disease (excl asthma)

- GELLO
  - Collection->exists(attribute.equals(value))
- Virtual Medical Record
  - Problem-> exists(code.equals(Factory.CodedValue(...)))
- Terminology
  - CodedValue
    - display_name: Chronic pulmonary disease (excl asthma)
    - terminology SAGE
    - code 434343
  - Concept expression
    - (SNOMED 128272009) AND (SNOMED 128272009) AND (NOT (SNOMED 195967001))
    - Chronic respiratory disease AND Disease of lower respiratory system AND (NOT Asthma)
Integration of SAGE Decision-Support System with Clinical Information System

CIS (CareCast) → Event Notification → Event Listener → VMR Service Calls → Terminology Server → Action Service Calls → Action Services

SAGE Execution Engine and Guideline Knowledge Bases
Results and Conclusions

• Prototype specification and implementation
• Working cycles of scenario development, guideline encoding, and simulation in CIS environment for exemplar guidelines:
  • Immunization, Diabetes
  • Community-acquired pneumonia, Hip replacements
• Good understanding of components of infrastructure required to integrate standard-based guideline DSS with CIS
• Involvement with standard organization (Health Level 7) to reconcile SAGE project results with emerging version 3 standards