

Medinfo 2004 S059 Theater-style Demonstration

Kwiz, a Knowledge- acquisition Framework to Encode Guidelines



R. D. Shankar, S. W. Tu, and Mark A. Musen
Stanford University, Stanford, CA, USA

N. K. Jones



University of Newcastle
Newcastle upon Tyne, United Kingdom



Agenda

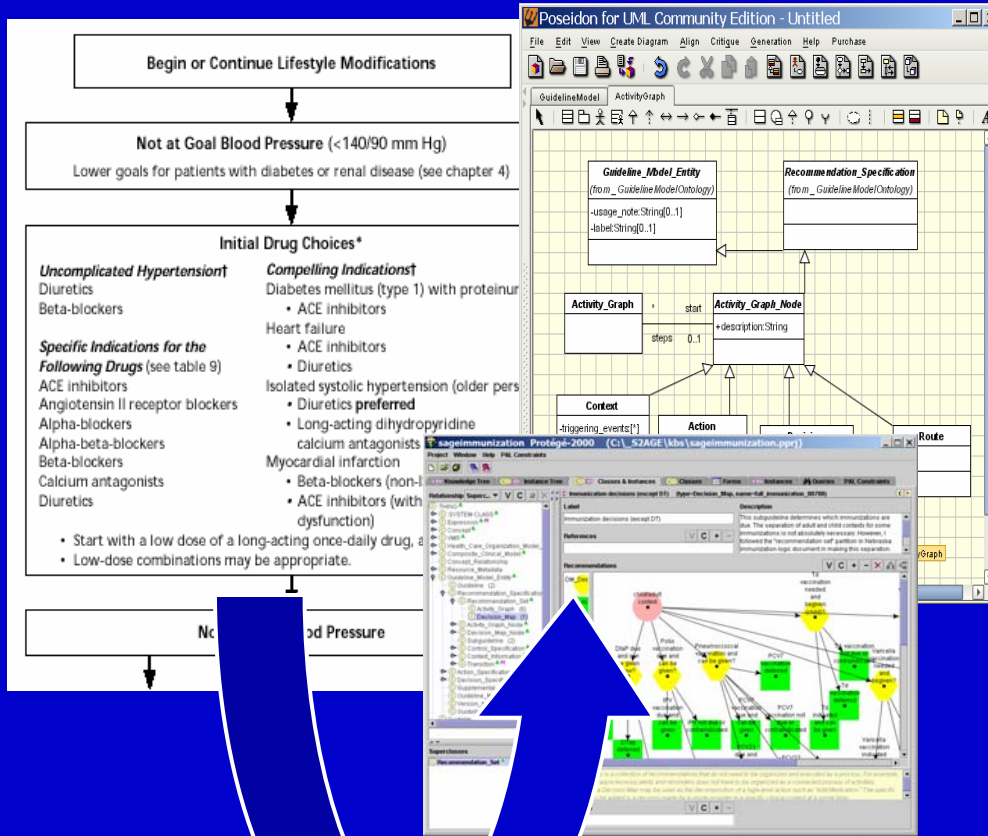
- Introduction: Guideline modeling and guideline workbench
- Kwiz overview
- Demonstration of Kwiz in SAGE
- Demonstration of Kwiz in PRODIGY
- Questions and answers



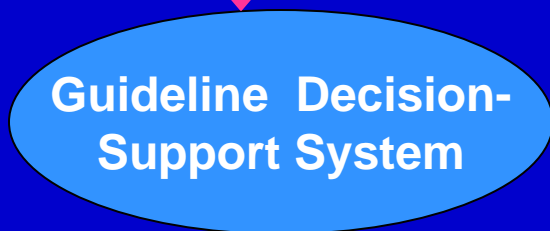
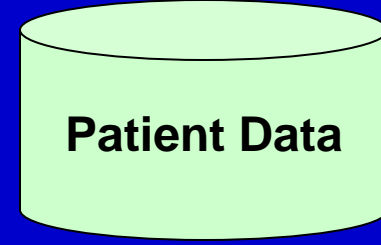
Use of Clinical Practice Guidelines to Improve Healthcare

- Expected benefits of clinical practice guidelines
 - improve clinical practice
 - recommend evidence-based best practice
 - reduce small area variation that is due to custom rather than to differences due to patient characteristics
 - Reduce cost of clinical care
- Thousands of guidelines have been created by professional organizations, HMOs, government agencies
- Traditional dissemination model ineffective

Decision Support For Guideline Based Care



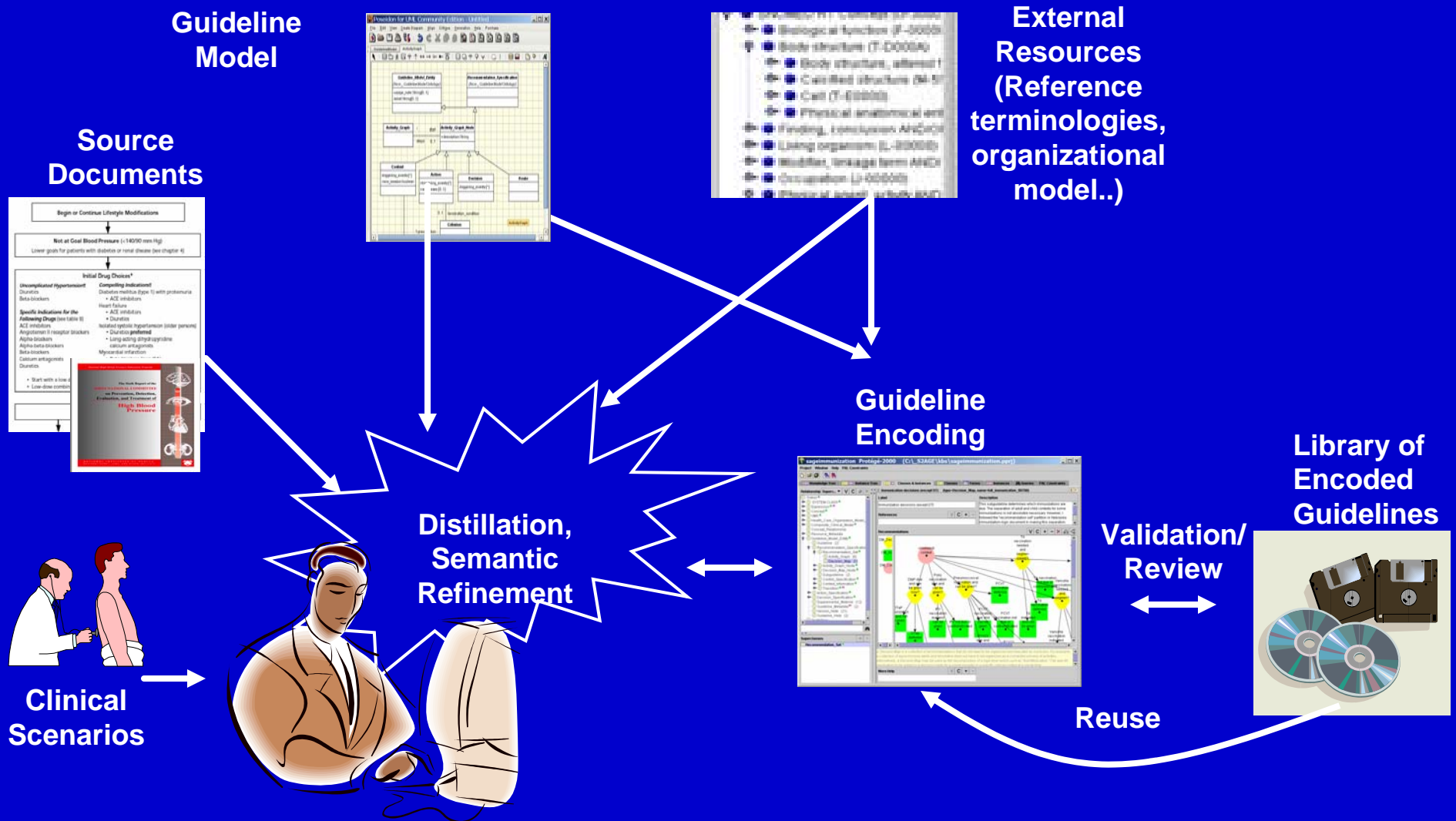
Guideline Knowledge Acquisition Process



Consider adding an ACE Inhibitor because of a compelling indication (heart failure)



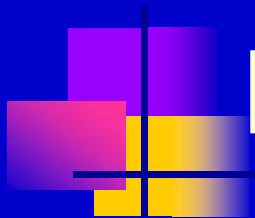
Guideline Knowledge-Acquisition Process





Tool Support for Guideline Knowledge-Acquisition Process: SAGE Project

- Standards-based **S**harable **A**ctive **G**uideline **E**nvironment
- An R&D consortium to develop the technology infrastructure to enable computable clinical guidelines, that will be shareable and interoperable across multiple clinical information system platforms
- Partners in the project are:
 - IDX Systems Inc.
 - Apelon, Inc.
 - Intermountain Healthcare (IHC)
 - Mayo Clinic
 - Stanford Medical Informatics (SMI)
 - University of Nebraska Medical Center (UNMC)
- Funded by: NIST Advanced Technology Program
- Selected Protégé as the guideline knowledge-acquisition environment



Protégé

- Originated as Mark Musen's 1987 PhD dissertation
- A **tool** which allows you to create and maintain a *knowledge base* by:
 1. constructing a domain model using classes and slots
 2. customizing forms for acquiring instances of classes
 3. entering knowledge as instances
 4. customizing user-interface widgets for your domain
- An **platform** on which you can add functionalities through several extension mechanisms
- An NLM funded open source **national resource** with several thousand active users around the world

Guideline Knowledge-Acquisition in Protégé

- Guideline model and external resources (e.g. terminologies) as Protégé classes

The screenshot displays the Protégé interface with a class hierarchy on the left and a template slot configuration on the right.

Class Hierarchy:

- :THING ^A
- :SYSTEM-CLASS ^A
- VersionNote
- Expression ^A
- Concept ^A
- DataModel ^A
- Deprecated DTS CodedValue
- Health_Care_Organization_Model_Entity ^A
- Resource_Metadata
- Guideline_Model_Entity ^A
- Guideline
- Recommendation_Specification ^A
- Recommendation_Set ^A
- Activity_Graph_Node ^A
- Decision_Map_Node ^A
- Subguideline
- Control_Specification ^A
- Context_Information ^A
- Transition ^{A M}
- Action_Specification ^A
- Decision_Specification ^A
- Supplemental_Material
- Guideline_Metadata ^M
- Recommendation_Backing ^M
- Deprecated_Concept ^A
- Order_Set_Entity ^A
- Apelon DTS CodedValue

Template Slots:

Name
<input type="checkbox"/> description
<input type="checkbox"/> metadata
<input type="checkbox"/> de-enrollment_criteria
<input type="checkbox"/> evidence_statements
<input type="checkbox"/> enrollment_criteria
<input type="checkbox"/> configurable_parameters
<input type="checkbox"/> recommendation_set
<input type="checkbox"/> label

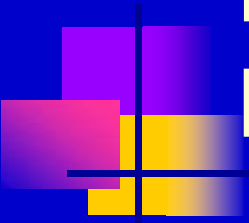
Superclasses:

- Guideline_Model_Entity ^A

Guideline Knowledge-Acquisition in Protégé

- Guideline model and external resources (e.g. terminologies) as Protégé classes
- Specific guidelines (e.g. diabetes guideline) as Protégé instances

The screenshot displays the Protégé 2.1.2 interface with a project named 'SAGEDiabetes'. The main window shows a class hierarchy on the left, including 'THING', 'SYSTEM-CLASS', 'VersionNote', 'Expression', 'Concept', 'DataModel', 'Deprecated DTS CodedVal', 'Health_Care_Organization', 'Resource_Metadata', 'Guideline_Model_Entity', 'Recommendation_Spe', and 'Action_Specification'. The central pane shows a class 'Guideline' with slots for 'label' and 'Example guideline'. The right pane shows the 'SAGE Diabetes Guideline' instance with a label 'SAGE Diabetes Guideline' and a description 'This guideline encodes the ADA Diabetes management guideline'. Below this, there are sections for 'Enrollment/Applicability' (Diabetes Mellitus on Problem List) and 'De-enrollment Criteria'. A separate window titled 'ARB evaluation AG' shows a flowchart with nodes like 'Start node for ARB evaluation', 'Is ARB therapy contraindicated?', 'ARB contraindications present?', 'Relative ARB contraindications', and 'Does provider wish to give ARBs despite rel contraind?'. The flowchart uses colored nodes (red for context, yellow for decision, green for action) and arrows to represent the logic of the activity graph.



Kwiz: a Knowledge-Acquisition Framework to Encode Guidelines

- A model-based approach to formalize narrative guidelines for clinical decision support
- A life-cycle view of guideline encoding and usage
- Tool support built on top of robust and extensible Protégé knowledge-engineering environment
- Kwiz creates additional capabilities that facilitate guideline encoding process

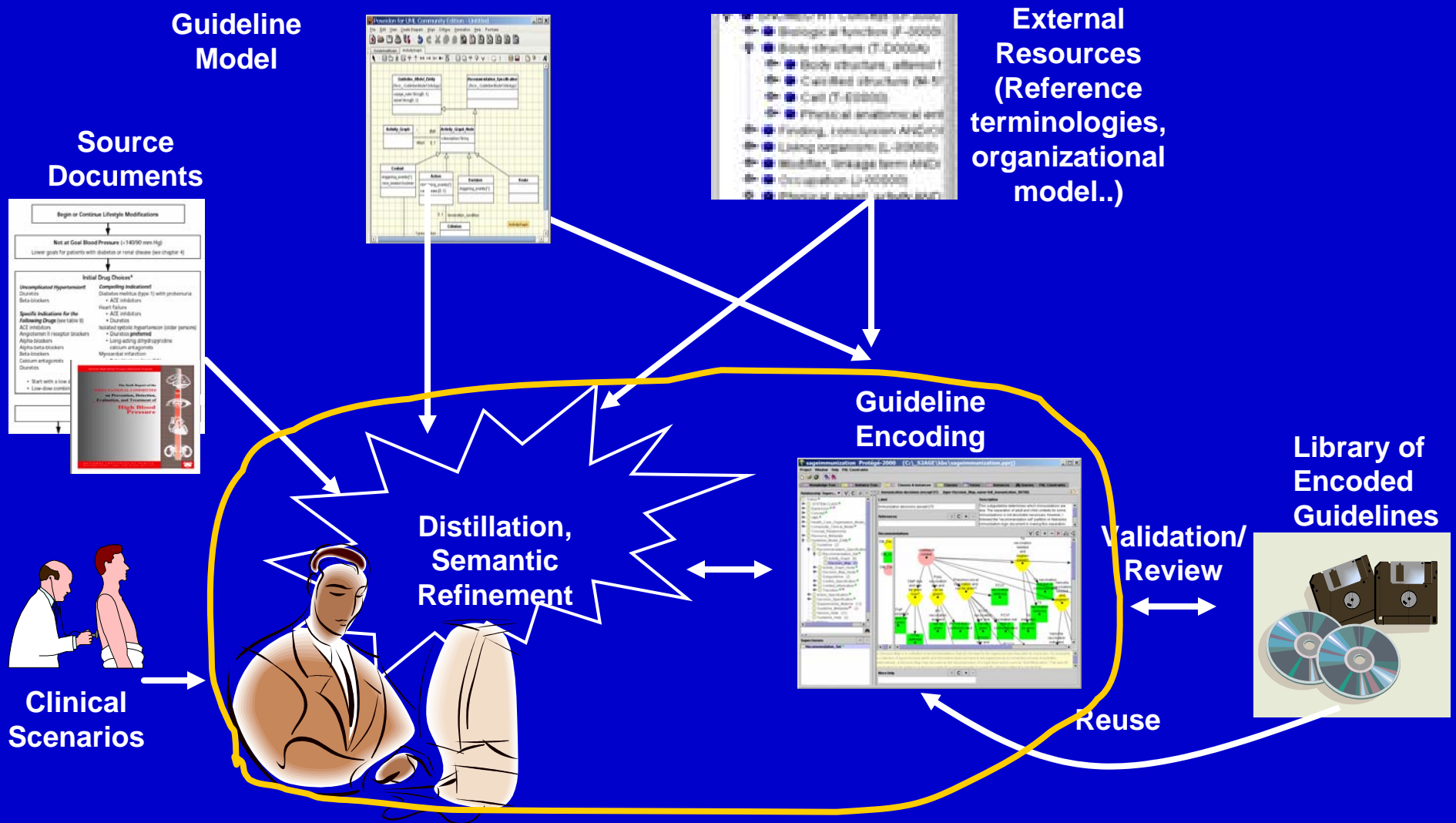


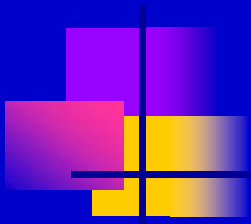
KWIZ – A Knowledge-Acquisition Framework to Encode Guidelines

The Goal: To improve the knowledge acquisition environment especially for novice users.

- Customizable high-level views of the knowledge base
- Constrained navigation
- Reuse of already encoded guidelines
- Context-sensitive search and help

Guideline Knowledge-Acquisition Process





KWIZ

**Document
Generator**

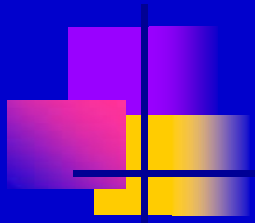
**Apelon
DTS**

Protégé

**Guideline
Simulation**

**Facet
Constraints
Checker**

**PAL
Constraints
Checker**



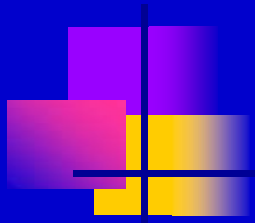
Guideline Concepts

Physical quantity
Nary Criterion
Recommendation Sets
Guideline Instance
Health Care Organization Model
PAL Constraints
Coded Concepts

HL7 Data Types
Variables
Order Sets
Guideline Resources
Presence Criterion
Decision Model

Guideline Logic
Decision Maps
Functions
VMR Queries
SNOMED CT Concepts
Activity Graph
Concept Express

Metadata
Supplemental Material
Data Values
Action Specific
Gello Criterion



Guideline Concepts

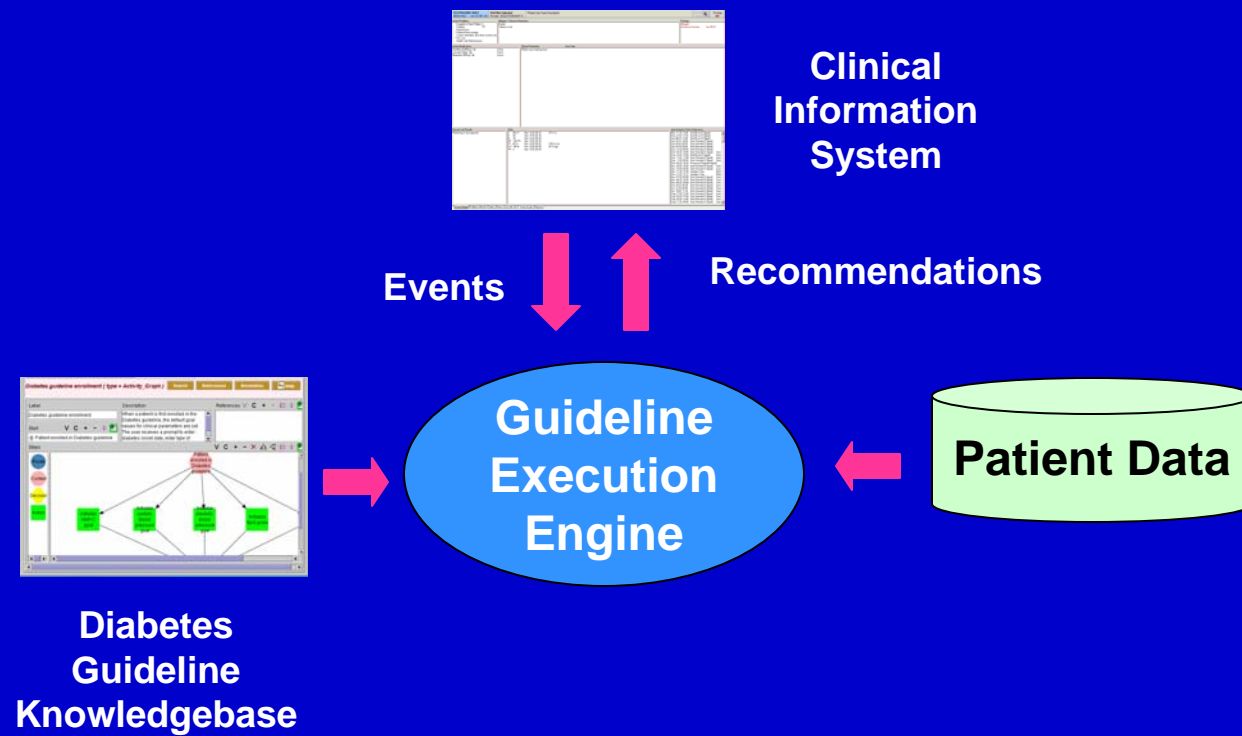
Physical quantity
Criterion
Recommendation Sets
Guideline
Health Care Organization Model
PAL Constraints
Coded Concepts

HL7 Data Types
Variables
Order Sets
Guideline Resources
Presence Criterion
Decision Model

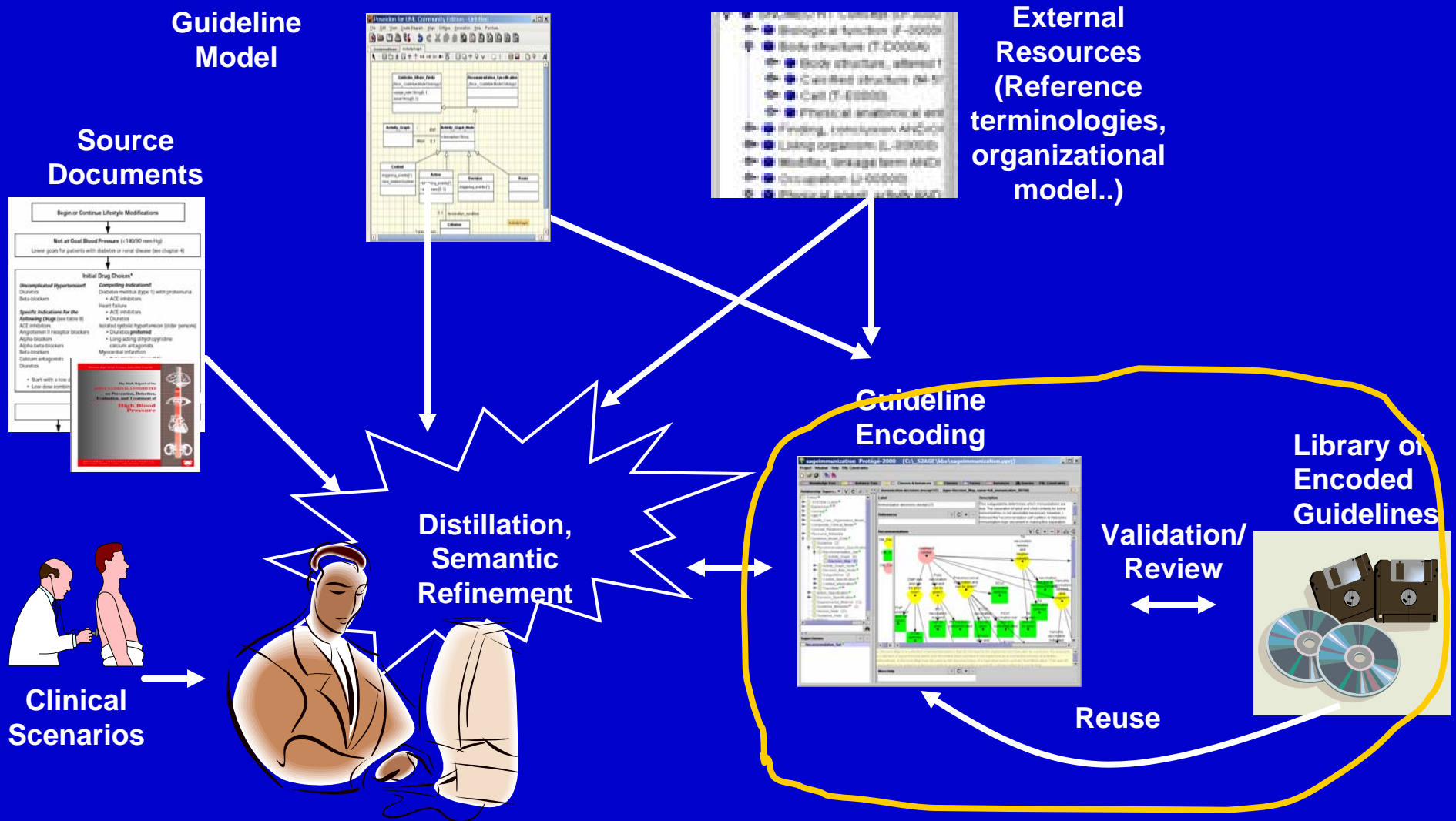
Guideline Logic
Decision Maps
Functions
VMR Queries
SNOMED CT Concepts
Activity Graph
Concept Express

Metadata
Supplemental Material
Data Values
Action Specific
Gello Criterion

Guideline Execution



Guideline Knowledge-Acquisition Process

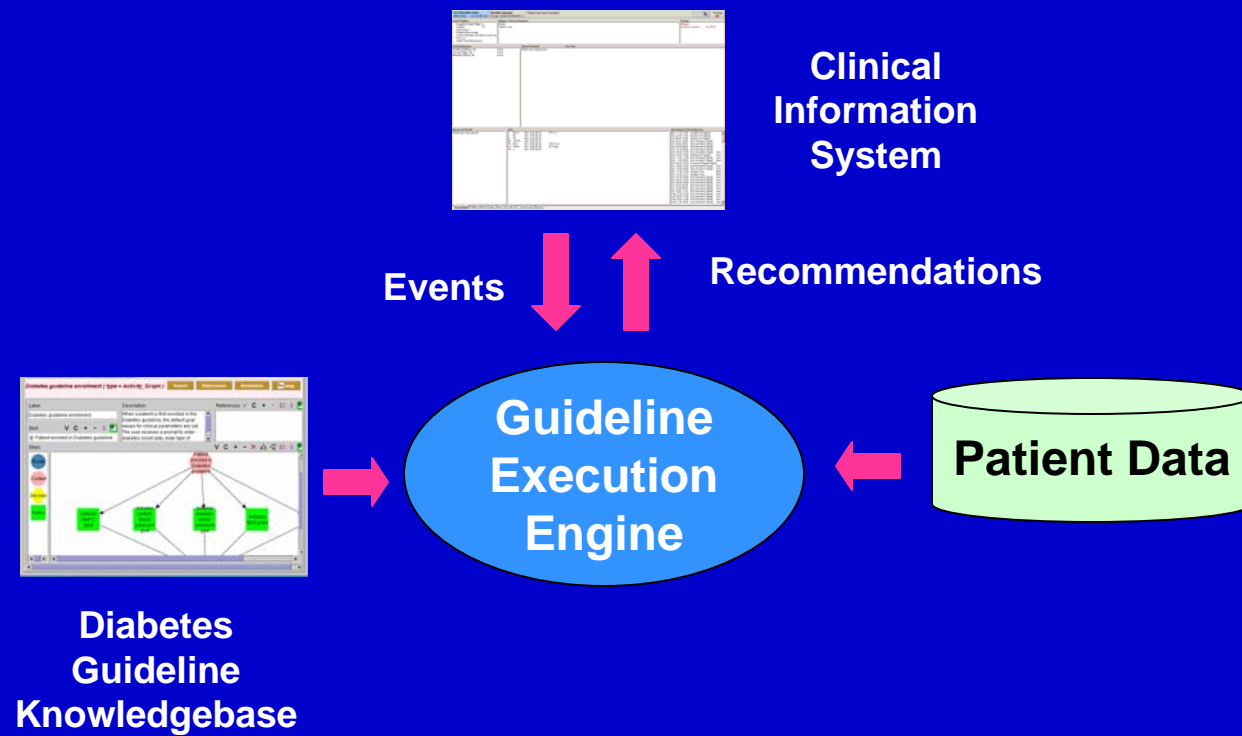




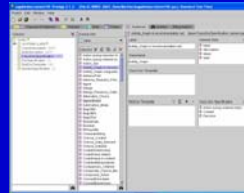
Guideline Knowledge base Validation & Testing

- Facet Constraints Checking
- PAL Constraints Checking
- Guideline Execution Constraints Checking
- Guideline Simulation

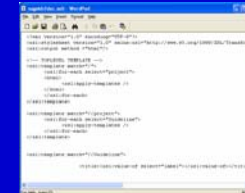
Guideline Execution



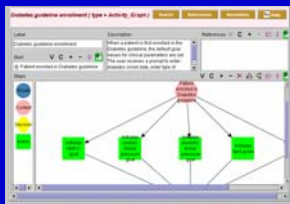
Document Generation



KB-to-Doc
Description

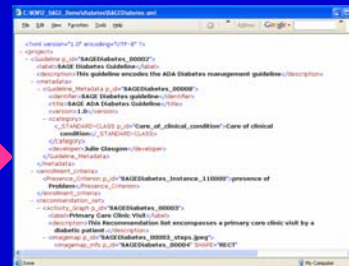


XML-to-HTML
Style Sheet



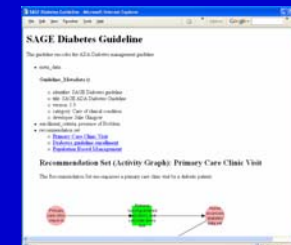
Diabetes
Guideline
Knowledgebase

XML Document
Generator



Diabetes.xml

HTML Document
Generator

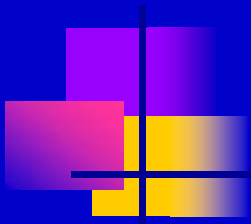


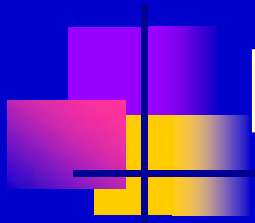
Diabetes.html



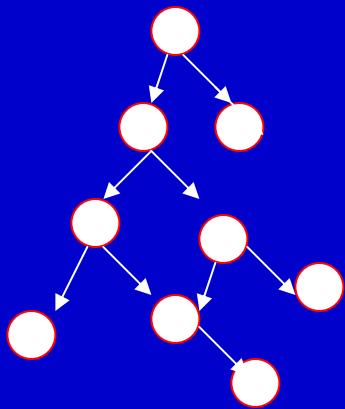
Conclusion

- KWIZ provides a controlled knowledge acquisition environment especially for novice users.
- Protégé, KWIZ and other applications provide an integrated environment for guideline encoding.



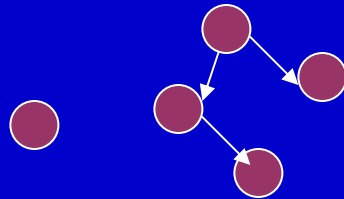


Efficient Copy



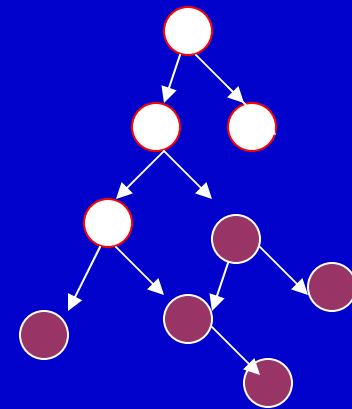
To be copied
Instance Tree
in the Library

+



Already existing
Instances
in the Working
Knowledge Base

=



Copied Instance
Tree in the Working
Knowledge Base