

Using a Guideline-Centered Approach for the Design of a Clinical Decision Support System to Promote Smoking Cessation

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Knowledge Acquisition from Guidelines:

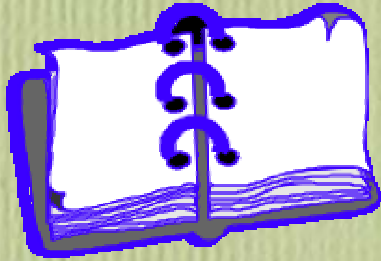
What's the Problem?

- Ambiguity; guideline terms often lack explicit definitions
- Incomplete specification
- Additional knowledge is always necessary to create a decision support tool
- Creation of DSS KB risks error
- Local adaptation (necessary) risks preservation of habit, self interest
- Knowledge maintenance is a largely unaddressed but critical issue

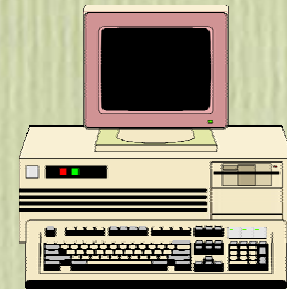
Representation of Guideline Knowledge for Decision Support

- Members of the InterMed Collaboratory encoded representations of guidelines for vaccination and workup of breast masses
- Tested with patient scenarios
- **Different recommendations** were given **for the same patient**

Guideline Implementation Gap



Published Guideline



Computer-Based
Guideline Implementation

Goal (Intention) of This Work

Overview of Presentation

- Articulate a systematic, explicit, and transparent process for translating GL knowledge into DS tools
- GEM Overview
- Handheld, wireless DSS (under construction) for smoking cessation

Advantages of Document-Centered DSS Design

- Preservation of authenticity of knowledge
- Audit of local adaptation (knowledge modifications)
- Diminished variability of DSS designs

GEM



- XML
- Hierarchy of > 100 elements
- Models heterogeneous information
- Has been used successfully for:
 - Guideline quality appraisal (GEM-Q)
 - Feedback to developers (Extractor)
 - Partial generation of MLMs (GEM-Arden)
 - Creating database of NGC guidelines
- DTD adopted as standard by ASTM (E2210-02)

Element Sources

Identity

Developer

Purpose

Audience

Method

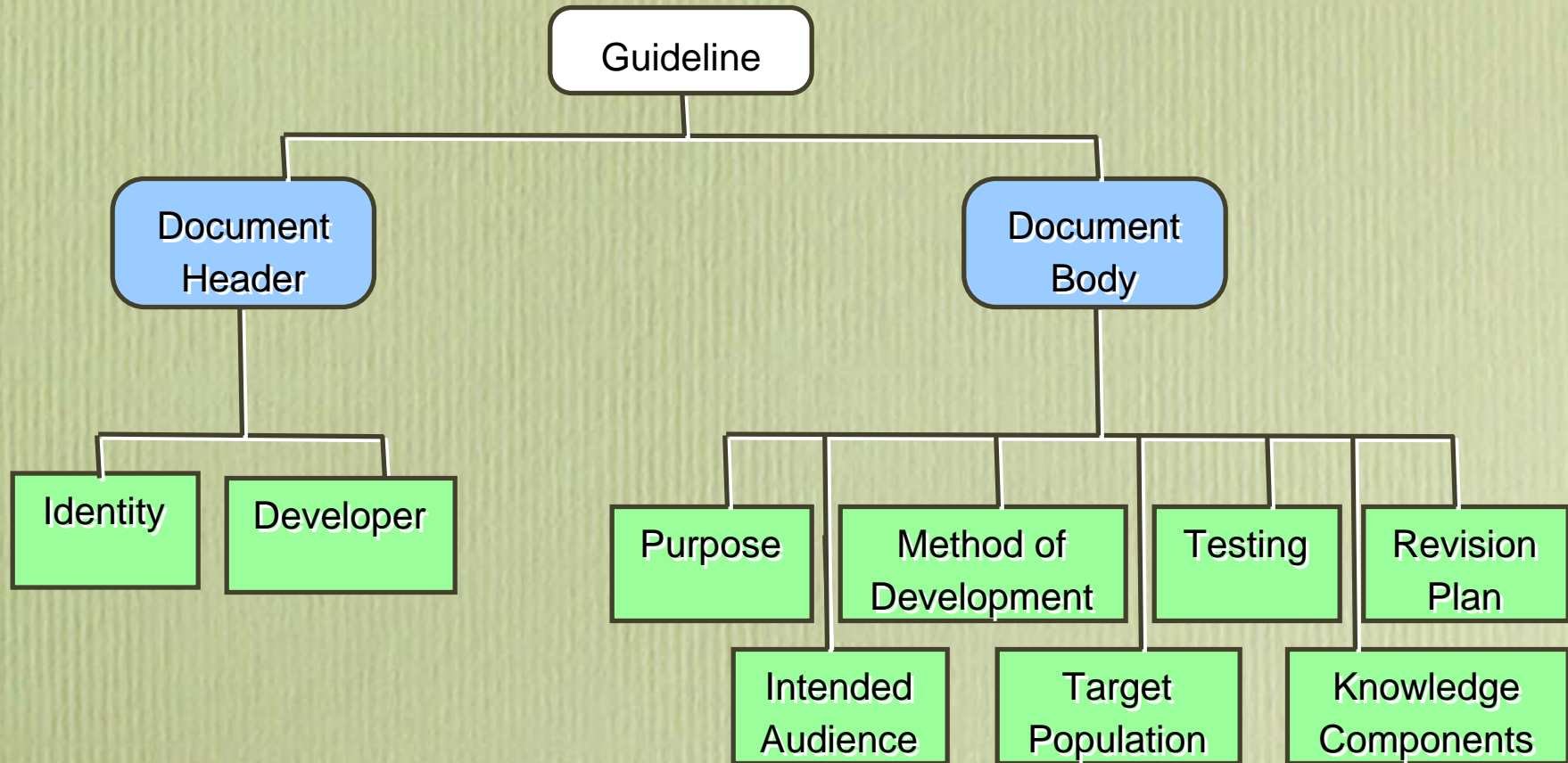
Knowledge

Testing

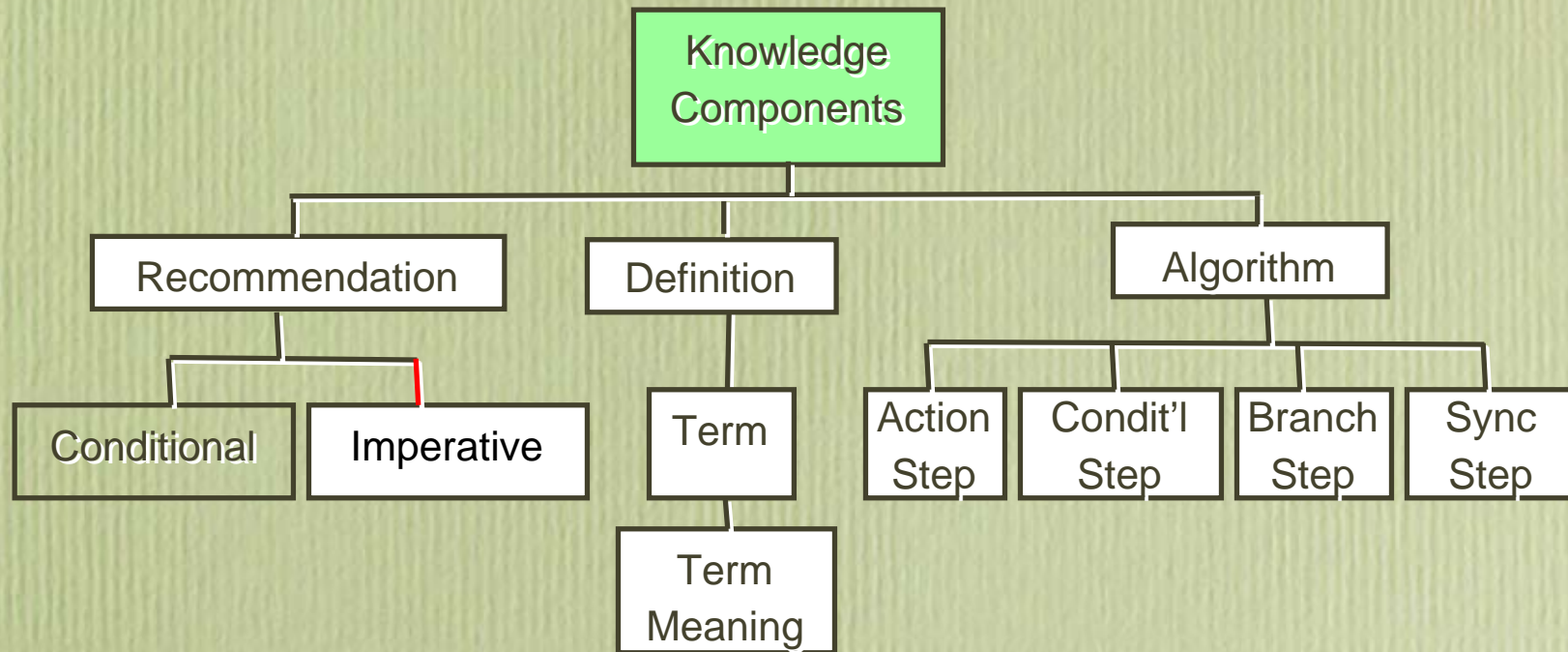
Revision

		Health Informatics Svcs	GEM	
Identity	Title	■	■	
	Citation	■	■	
	Release Date	■	■	
	Availability	■	■	
	Contact Status	■	■	
	Companion Document	■	■	
Developer	Adaptation	■	■	
	Developer Name	■	■	
	Committee Name	■	■	
	Funding	■	■	
Purpose	Endorser	■	■	
	Comparable Guideline	■	■	
	Health Practices	■	■	
	Category	■	■	
	Target Population	■	■	
	Rationale	■	■	
	Objective	■	■	
Audience	Available Options	■	■	
	Implementation Strategy	■	■	
	Health Outcomes	■	■	
	Exceptions	■	■	
	Care Setting	■	■	
	Clinician Users	■	■	
	Method	Evidence Collection	■	■
		Evidence Time Period	■	■
		Evidence Grading	■	■
		Combining Evidence	■	■
Specification of Harm/Benefit		■	■	
Quantification of Harm/Benefit		■	■	
Value Judgment		■	■	
Patient Preference		■	■	
Qualifying Statement		■	■	
Cost Analysis		■	■	
Knowledge		Recommendation	■	■
	Conditional (decision variable)	■	■	
	Action	■	■	
	Logic	■	■	
	Reason	■	■	
	Strength of Recommendation	■	■	
	Evidence Quality	■	■	
	Cost	■	■	
	Certainty	■	■	
	Algorithm	■	■	
Testing	Eligibility	■	■	
	Definition	■	■	
	External Review	■	■	
	Pilot Testing	■	■	
Revision	Expiration Date	■	■	
	Scheduled Review	■	■	

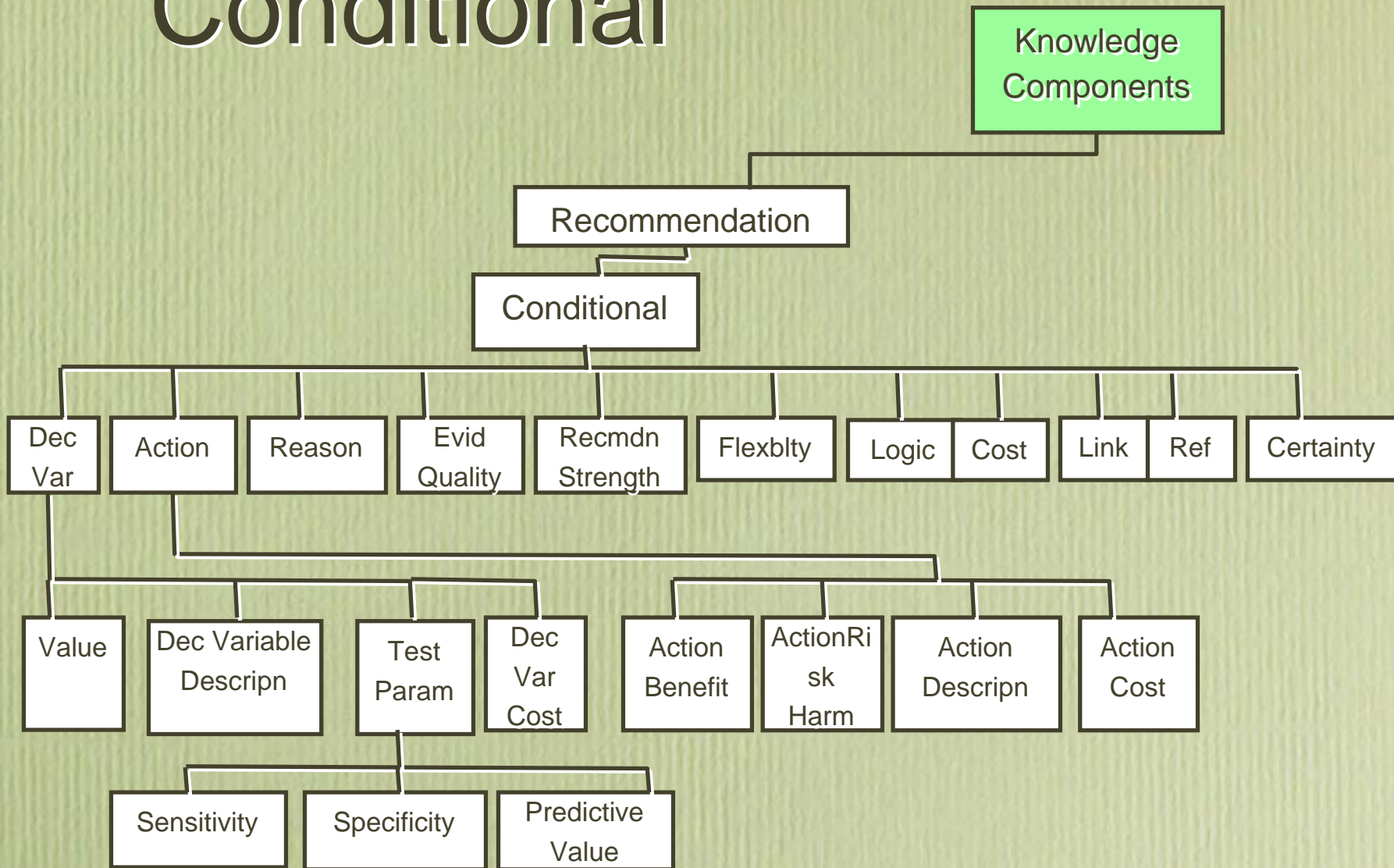
GEM: Top Levels



Knowledge Components



Conditional



GEM Cutter

The screenshot displays the GEM Cutter interface with three main panels:

- Left Panel:** Shows the text of a practice parameter document titled "Practice Parameter: The Neurodiagnostic Evaluation of the Child With a First Simple Febrile Seizure". It includes sections for "DEFINITION OF THE PROBLEM", "TARGET AUDIENCE AND PRACTICE SETTING", and "INTERVENTIONS OF DIRECT INTEREST".
- Middle Panel:** Displays the metadata for the document, including fields for Title, Citation, Release Date, Availability, Status, Companion Document, Adaptation, Developer, Purpose, Category, Rationale, Objective, Available Option, Implem Strategy, Health Outcome, and Exception.
- Right Panel:** Contains the "Main Focus" section, which includes a "Source" dropdown (set to "Explicit") and a text area describing the practice parameter's recommendations.

Below the main panels is a "GEM Structure" window showing a hierarchical tree diagram of the document's components:

- Title
- Citation
- Release Date
- Availability
 - Length
 - Electronic
 - Print
 - Contact
- Status
- Companion Document
 - Patient Resources
- Adaptation

Maintaining Links to Guideline Text

- Each GEM element has
 - a unique *identifier* attribute
 - a *source* attribute:
 - default value is “explicit”
 - changes to “inferred” if content is modified

GEM Polishing

- Select (GL & Rec)
- **Semantic Refinement**
 - (Markup)
 - Atomize
 - De-abstract
 - Disambiguate
 - Verify completeness
 - Build executables

Workflow Integration

- Origins and insertions
- Define action types
- Assoc'd beneficial services
- Develop requirement spec

Encode, design interface

Test

Smoking Cessation



- Cigarette smoking is most common cause of preventable death in the US
- Cessation can dramatically reduce risk of cancer and other diseases
- Smokers are more likely to quit if physicians counsel them
- Physicians infrequently counsel
- -->USPHS Guideline

Markup

- Bupropion SR should be used during pregnancy only if the increased likelihood of smoking abstinence, with its potential benefits, outweighs the risk of bupropion SR treatment and potential concomitant smoking.

Semantic Refinement

- **Atomize:** “Bupoprion should be used”
-> Prescribe bupoprion
- **Deabstract:** “potential benefits outweigh the risks”
 - Benefits: avoid smoking-induced stillbirths, spontaneous abortions, decreased fetal growth, premature births, low birth weight, placental abruption, sudden infant death syndrome (SIDS), cleft palates and cleft lips, and childhood cancers. and infant respiratory disease
 - Risks: unknown + seizures in 1:1000; may be ineffective

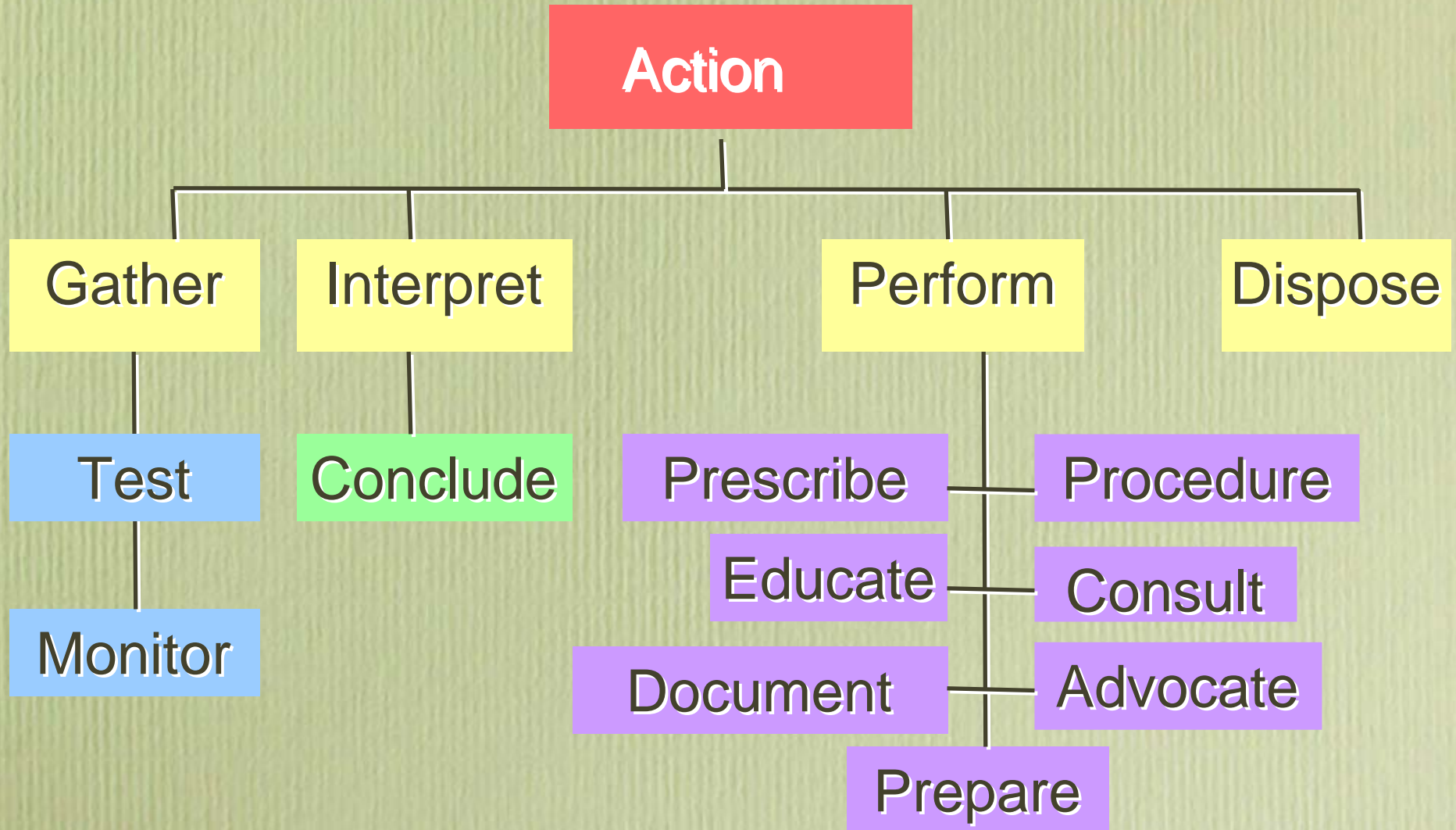
Extractor -> Decision Variables,

Tobacco use	Current, quit recently, abstinent for an extended period, never used
Age	Adolescent, adult
Pregnant	Y/N/0
Breastfeeding	Y/N/0
Hx of depression	Y/N/0
Cardiovascular disease	Y/N/0
Concern about weight gain	Y/N/0
Hx of seizures	Y/N/0

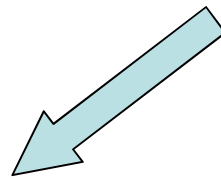
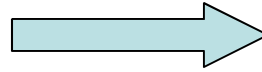
Workflow Integration

- Identify **origins** of DVs, **insertions** of actions
- Define **action type**
- Describe **associated beneficial services**

Guideline Action Classifier (N=405)



System for Delivering Advice



TUNGSTEN | C



Conclusion

- Bridging the gap between guideline text and valid, useful decision support tools is complex
- Extraction of DVs and actions from contextual narrative facilitates clarification
- Document-centered approach helps maintain authenticity of knowledge

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<http://ycmi.med.yale.edu/GEM>