

COLORADO

AHIMA  
*denver 06*

Annual Convention and Exhibit  
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# Making Standard Terminology Work In Clinical Guidelines

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## Introductions

- Who are we?
- Who we think you are...
  - Training and experience:
    - Clinical understanding
    - Management of electronic information
  - Interest
    - Prepare to implement clinical guidelines
    - Understand how terminology standards are used in guidelines

## Objectives

- Gain general understanding of CDSS and standard terminologies
- Understand use of standard terminologies in CDSS
- Learn to manage challenges that arise in mapping local concepts to a CDSS

# Agenda

- Session Overview (McClure)
  - Intro
  - Guidelines overview
  - SAGE overview
  - Standard Terminologies
    - What and why important
- Guideline Abstraction (Glasgow)
  - SAGE process
  - Identifying concepts in the guideline
- Making terminology work locally (Nyman)
  - Mapping
  - Issues to grapple with
- Wrap-up – Questions (McClure)

## What are Guidelines?

- Guideline(n): a cord or rope to aid passage over a difficult point (Merriam-Webster)
- Systematic statements of evidence-based policy rules or principles to assist clinicians and patients make decisions on healthcare alternatives
- Characteristics
  - May be developed by government agencies at any level, institutions, professional societies, governing boards, or by convening expert panels.
  - May be in narrative, outline, flowchart or tabular forms
  - Need to be formalized to provide computerized clinical decision support at point of care

## Why Study Guidelines?

President's Information Technology Advisory Committee (2001)  
“Transforming Health Care through Information Technology”

Findings...:

- The U.S. lacks a broadly disseminated and accepted national vision for information technology in health care
- The introduction of integrated decision-support systems that can proactively foster best practices and reduce errors requires enhanced information-technology methods and tools

Recommendations...:

- Expand the range and granularity of routinely captured data
- Standardize terminology
- Develop **guidelines** based on evidences and best practices
- Implement guidelines so that they are usable effectively at the point of care, including **embedded decision support** that is continually updated as new evidence accumulates

## SAGE Project Overview

- Collaborative research and development project to develop a **standards-based** technology to enable encoding and dissemination of guidelines in executable format.
- Infrastructure will employ informatics standards including Protégé open source workbench, HL7 RIM, SNOMED CT and LOINC, and deployment technology to **support encoding and dissemination of guidelines across vendor platforms** and throughout the spectrum of care
- Guideline deployment technology will present guideline content to clinicians through **active, patient-specific recommendations** surfaced through functions of the local clinical information system, and **integrated into the care workflow**

SAGE is partially supported under a grant from the U.S. Department of Commerce, National Institute of Standards and Technology, Advanced Technology Program, Cooperative Agreement Number 70NANB1H3049.

# Why Terminology Standards

- Interoperability
  - Common representation of meaning
    - Robust terminology model
  - Common coding
  - Interlingua
    - Translate once
  - Shared framework for collaborative improvement of the terminology
- Decision support needs all of this

## Selected NCVHS Terminology Standards

- SNOMED CT
  - CAP, soon International SDO
- LOINC
  - Regenstrief Institute
- ICD-9-CM
  - WHO/NCHS
- CPT
  - AMA
- NDC, RxNorm, NDF-RT, ...

## SNOMED CT<sup>®</sup>

- Under development by the College of American Pathologists since the 1960's
- Provides a disambiguated, polyhierarchical representation of over 450,000 medical concepts, with approximately 1 million descriptions
- Under licensing agreement with the NLM
- Crossmaps to other commonly-used terminologies are built in
- Presently the most complete formal medical ontology in existence

## Why do we need SNOMED CT?

- Synonyms & homonyms
  - By assigning a unique numeric code to each medical concept, SNOMED CT formalizes clinical terminology.
- Subsumption
  - By representing the complete set of relationships among medical concepts, SNOMED CT automates classification logic.
- Expressiveness
  - By defining rules for combining concepts into “expressions”, many clinical ideas can be encoded

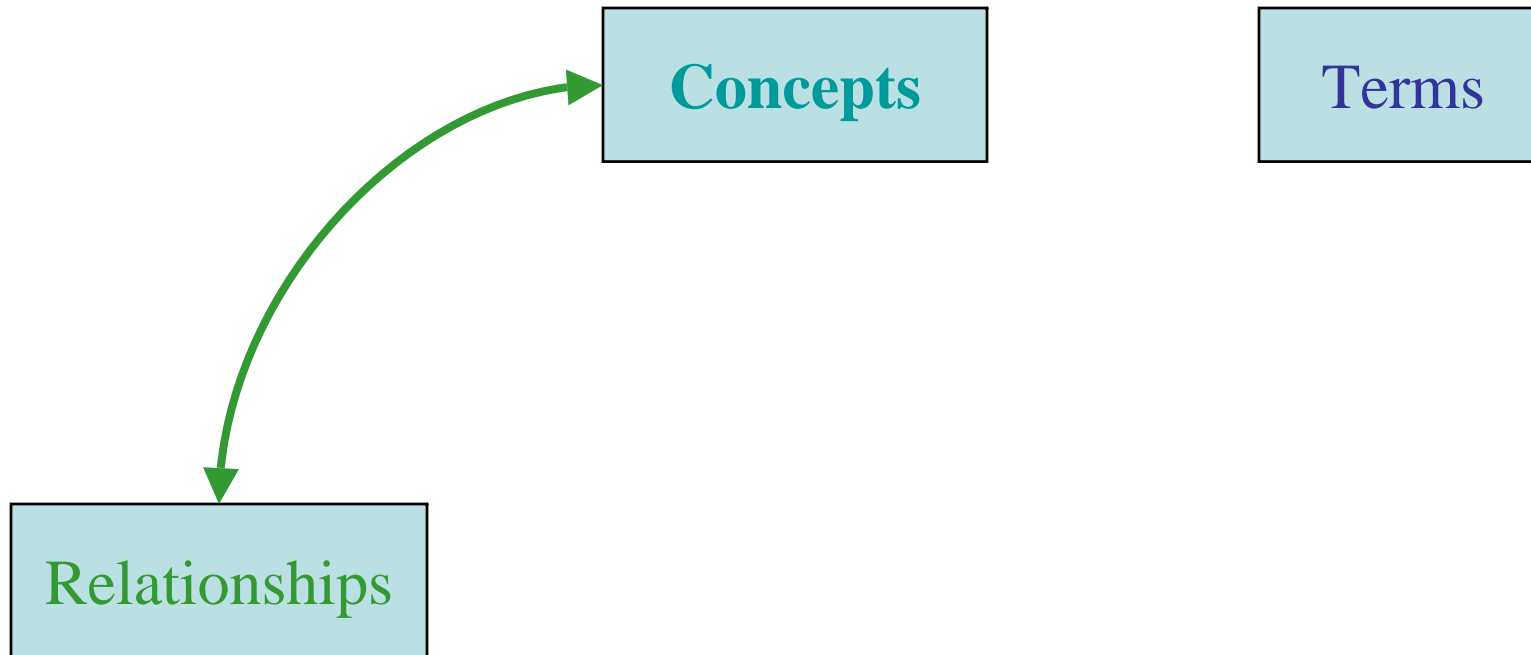
# SNOMED CT Structure

Concepts

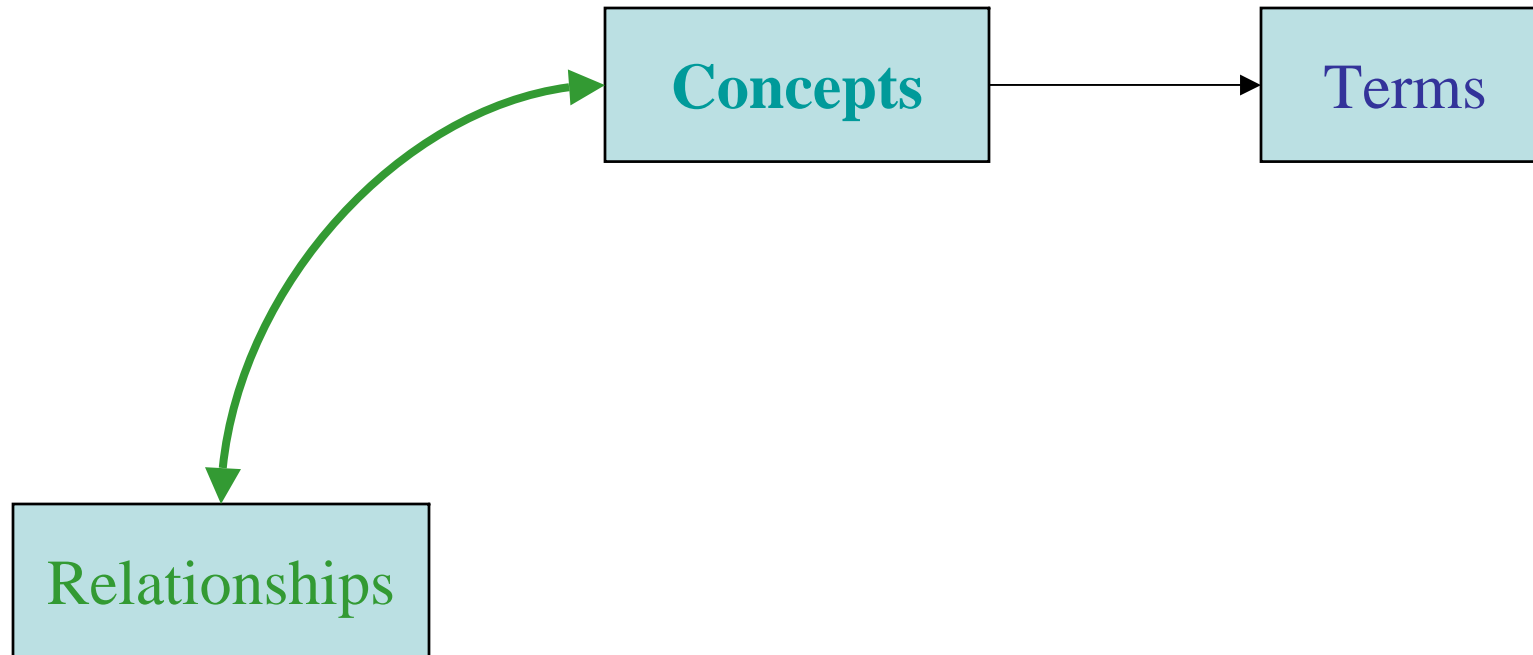
Terms

Relationships

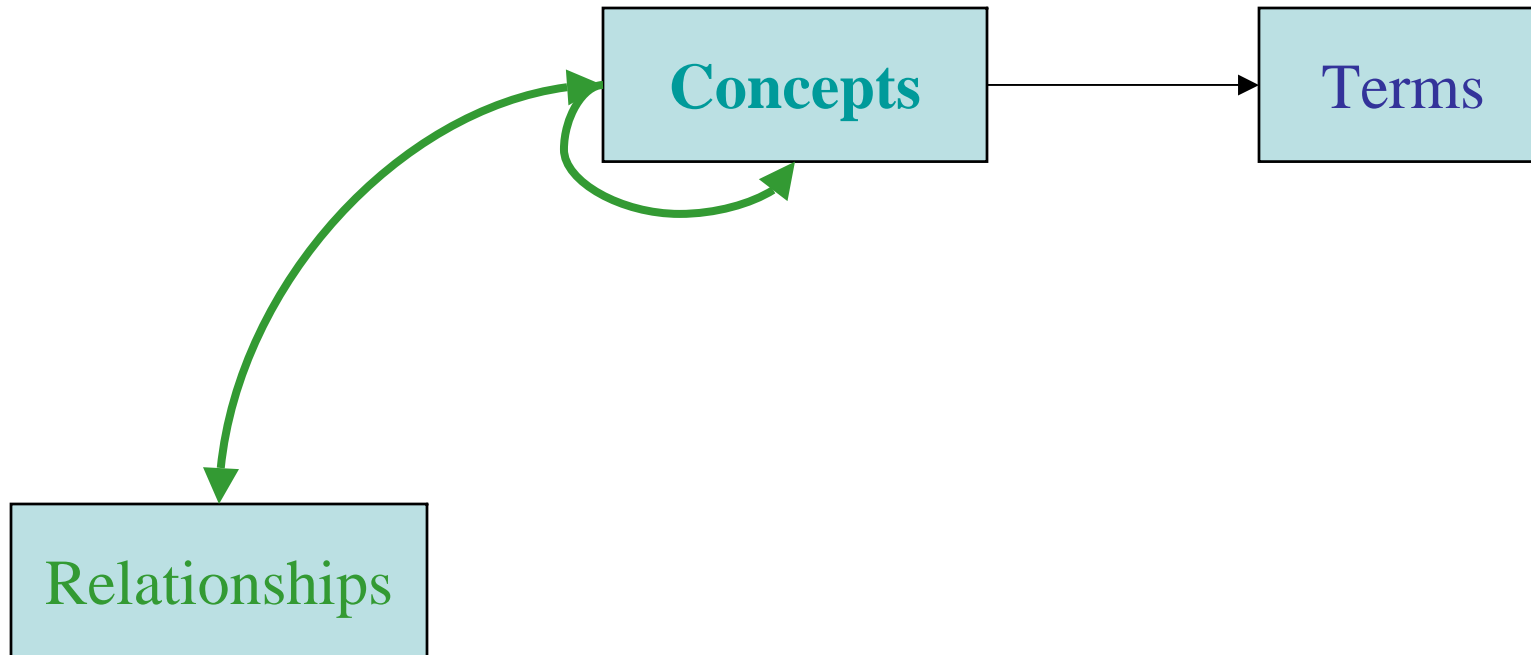
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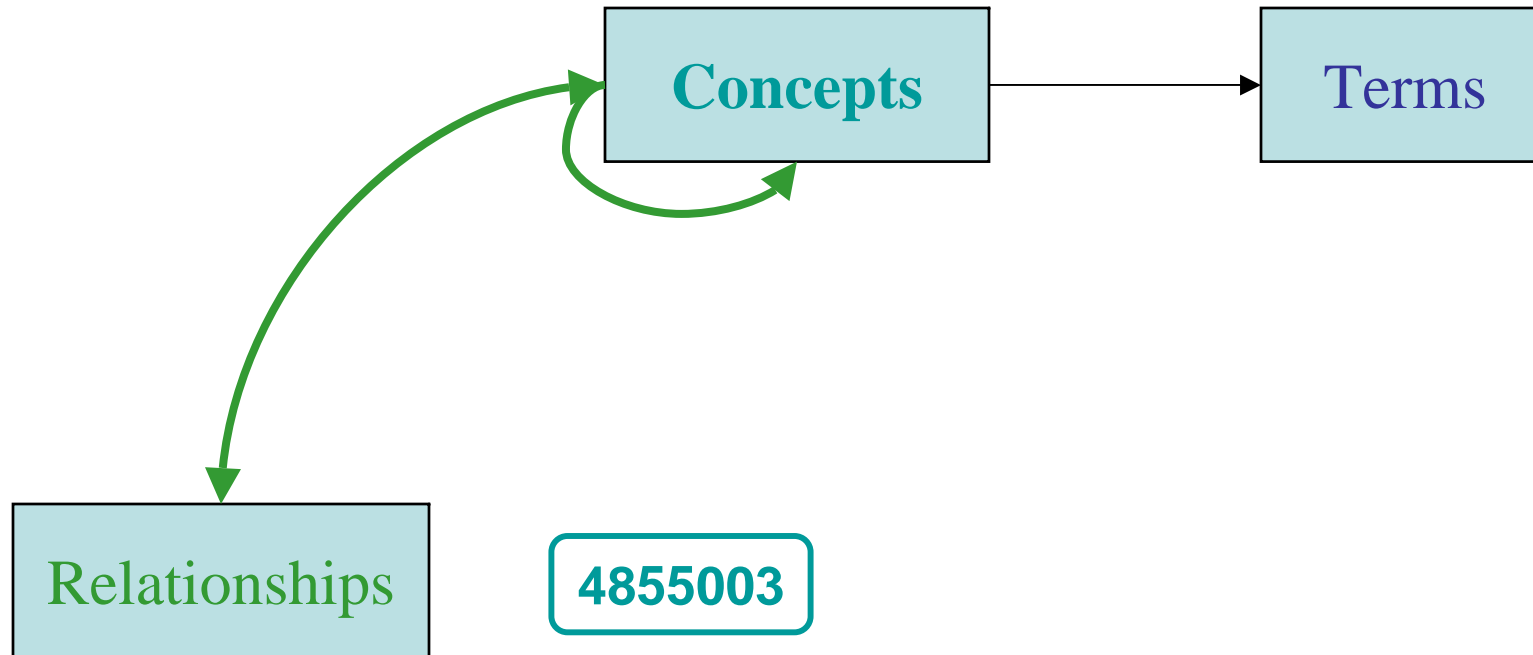
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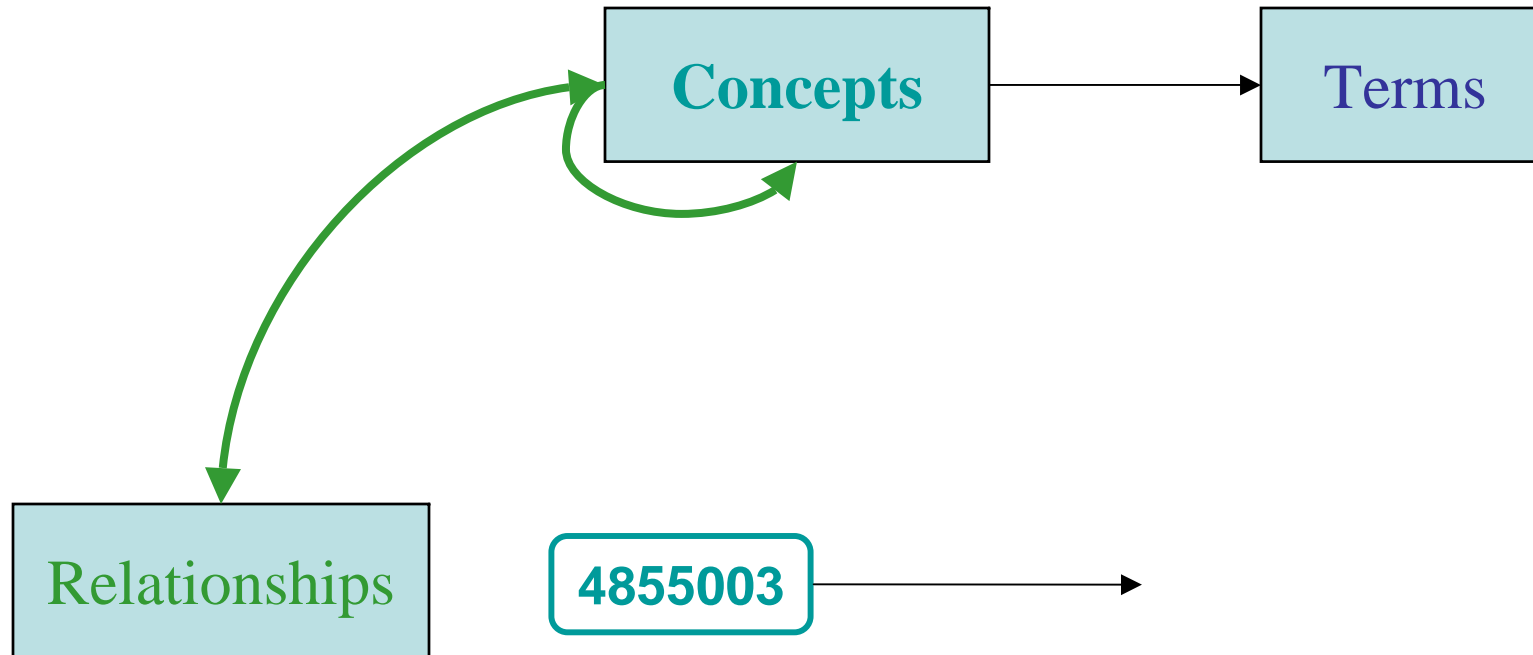
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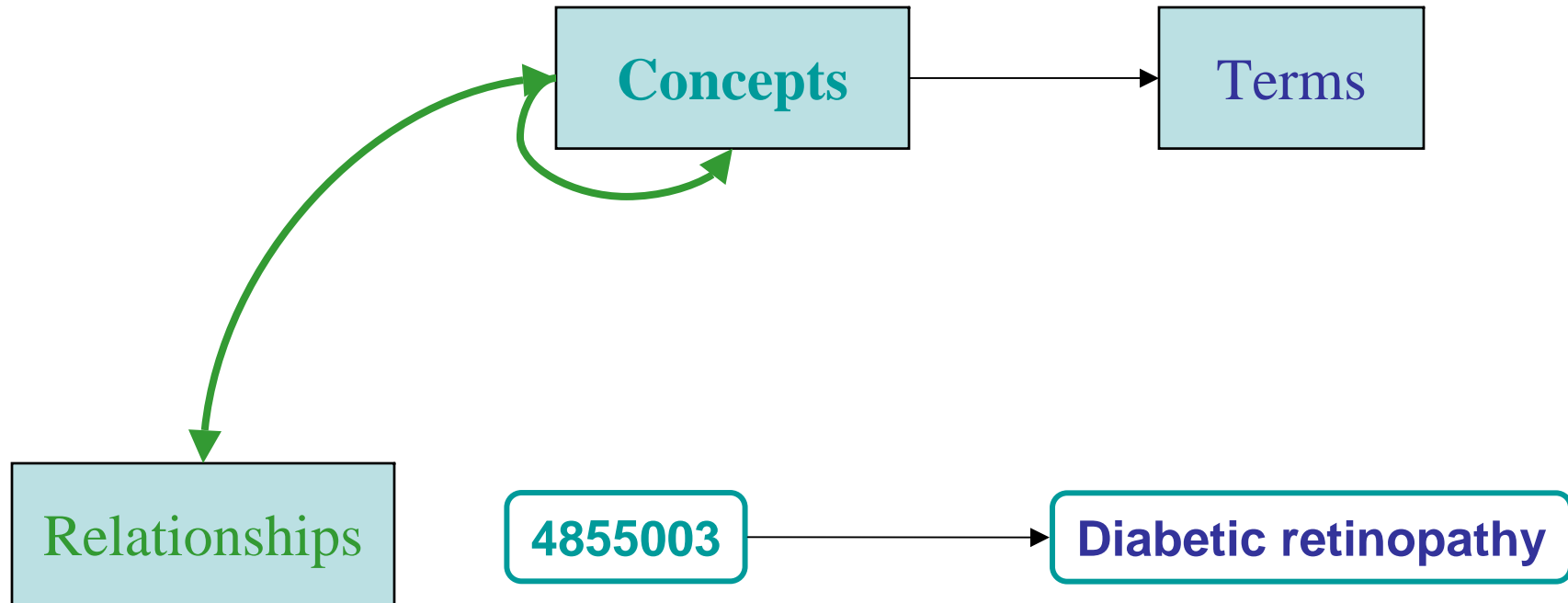
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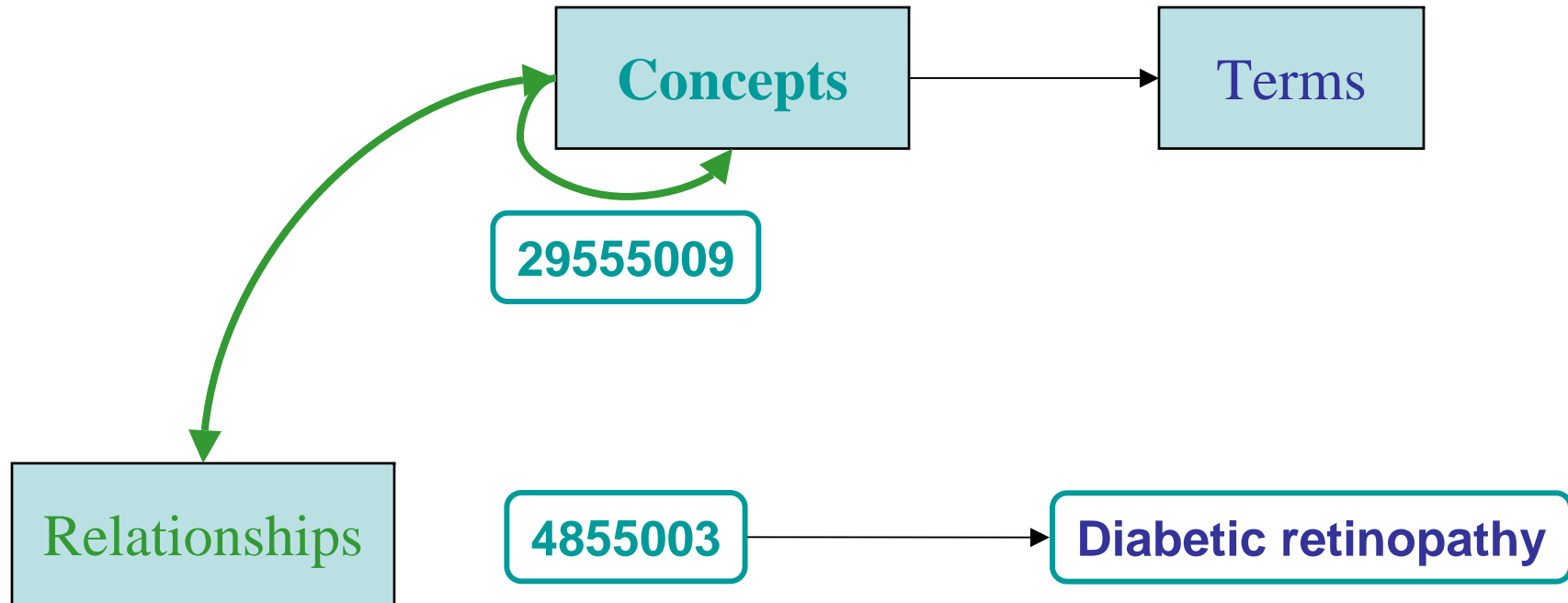
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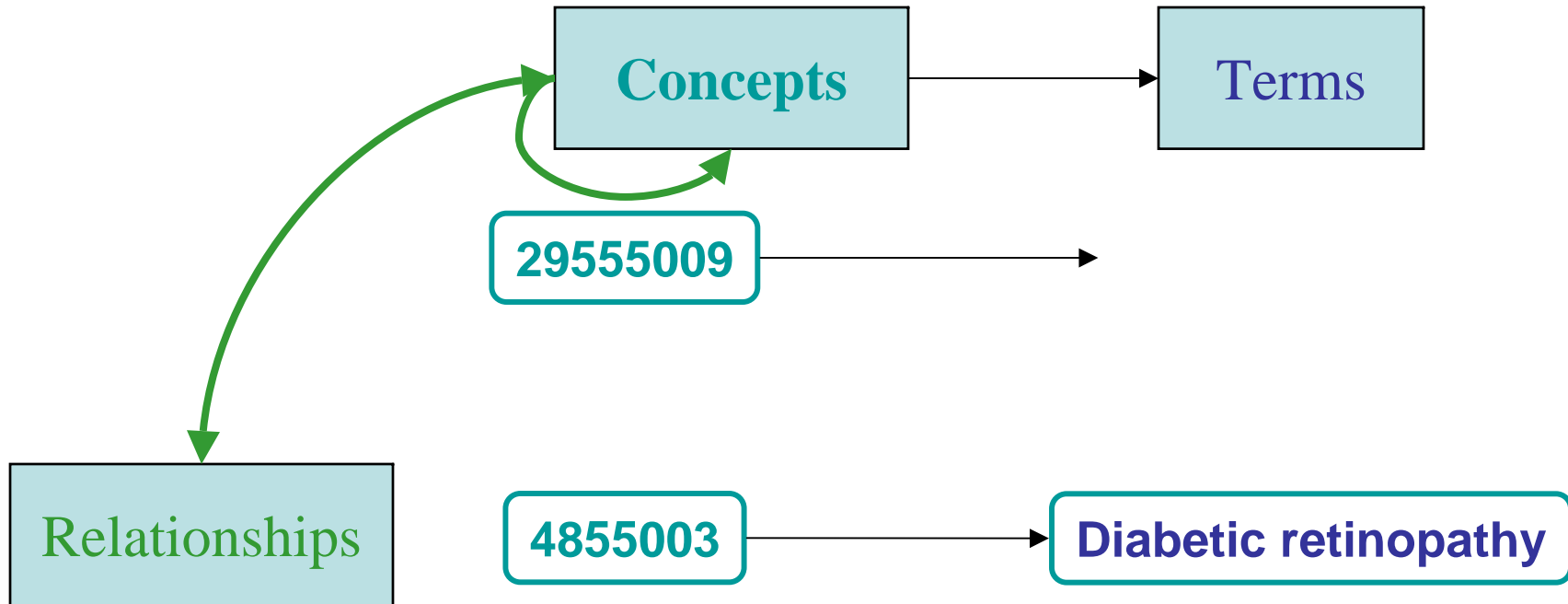
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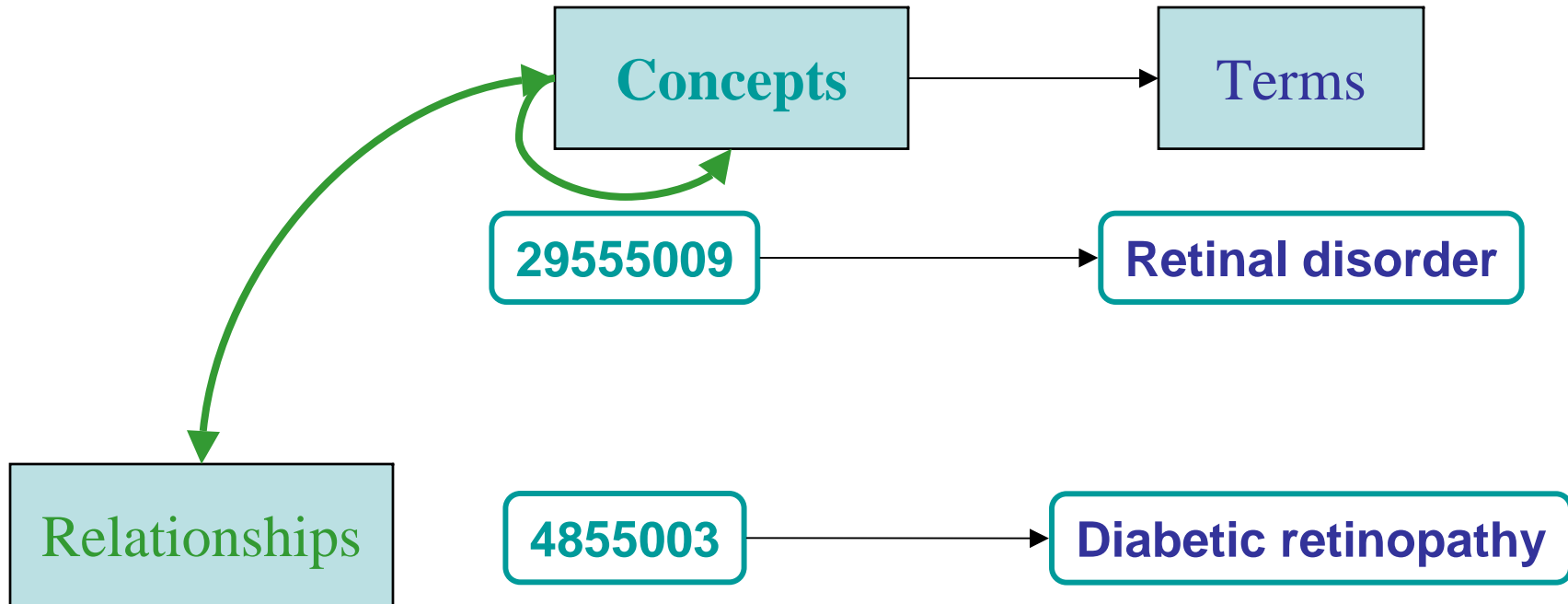
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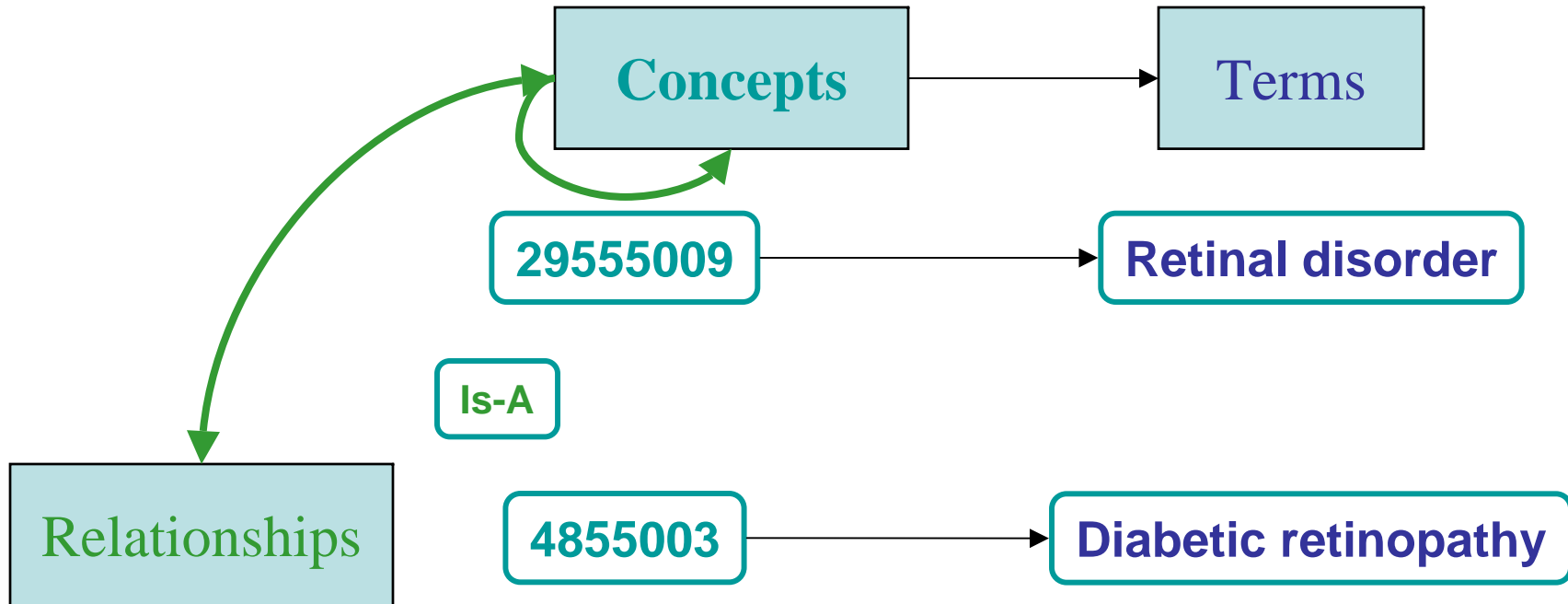
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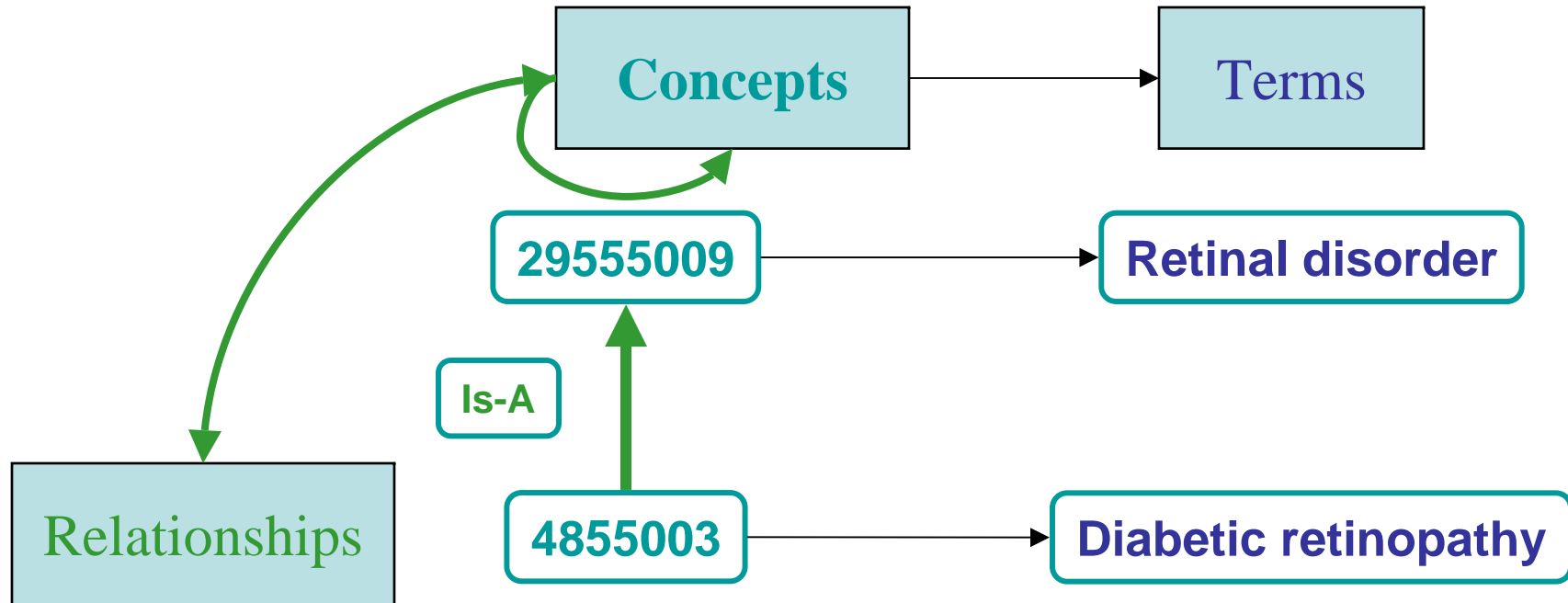
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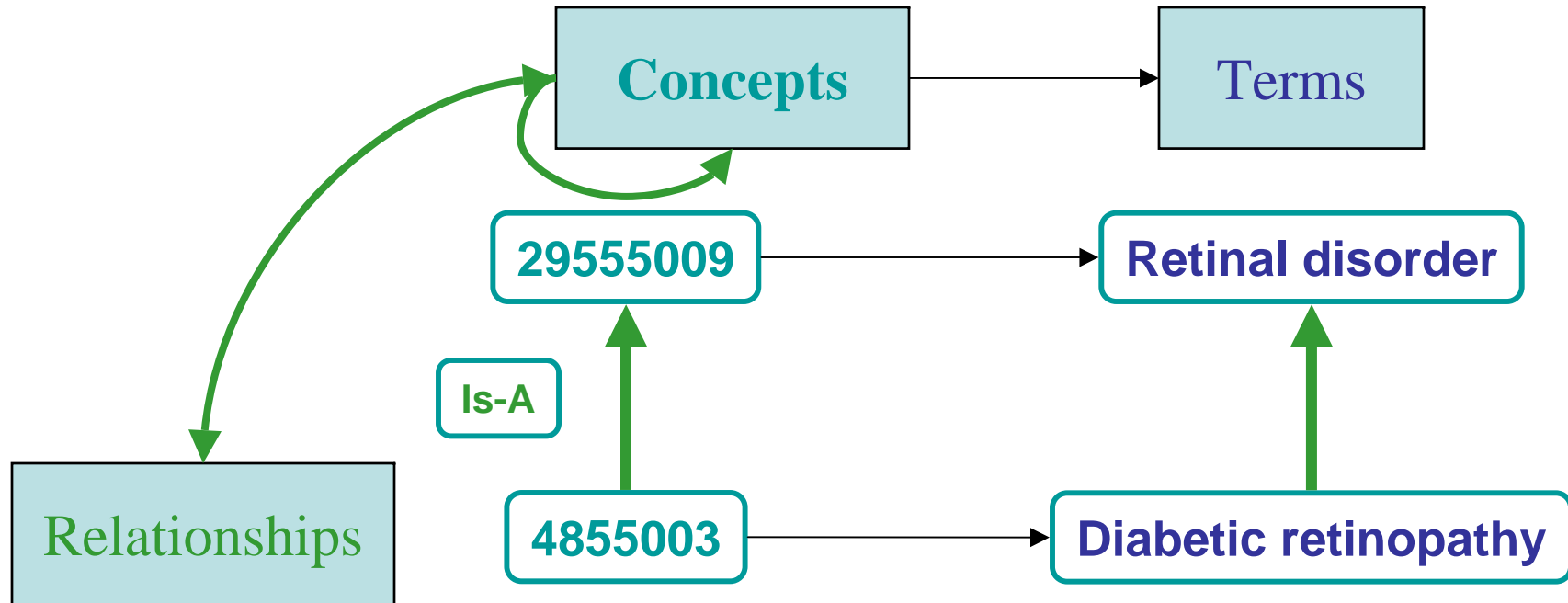
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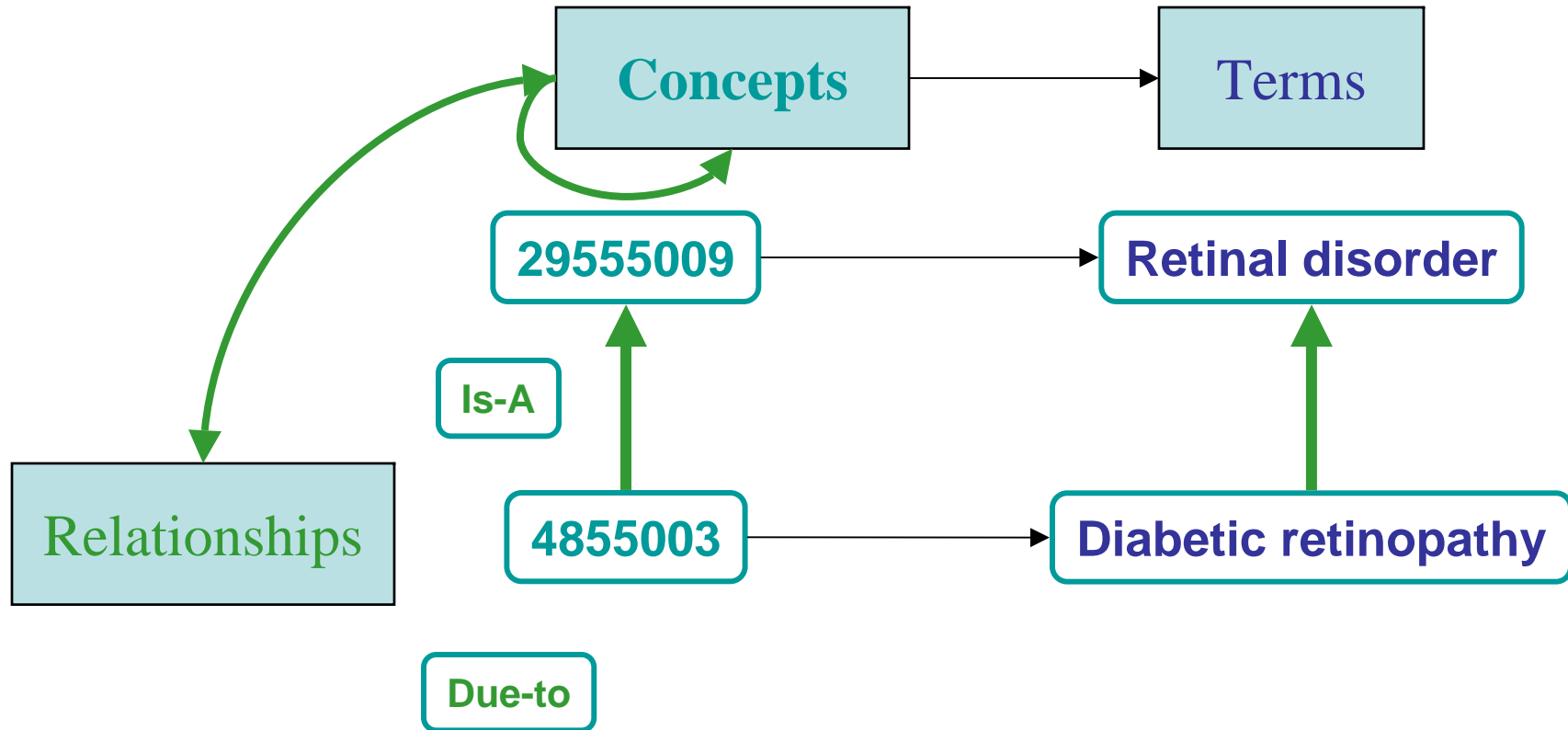
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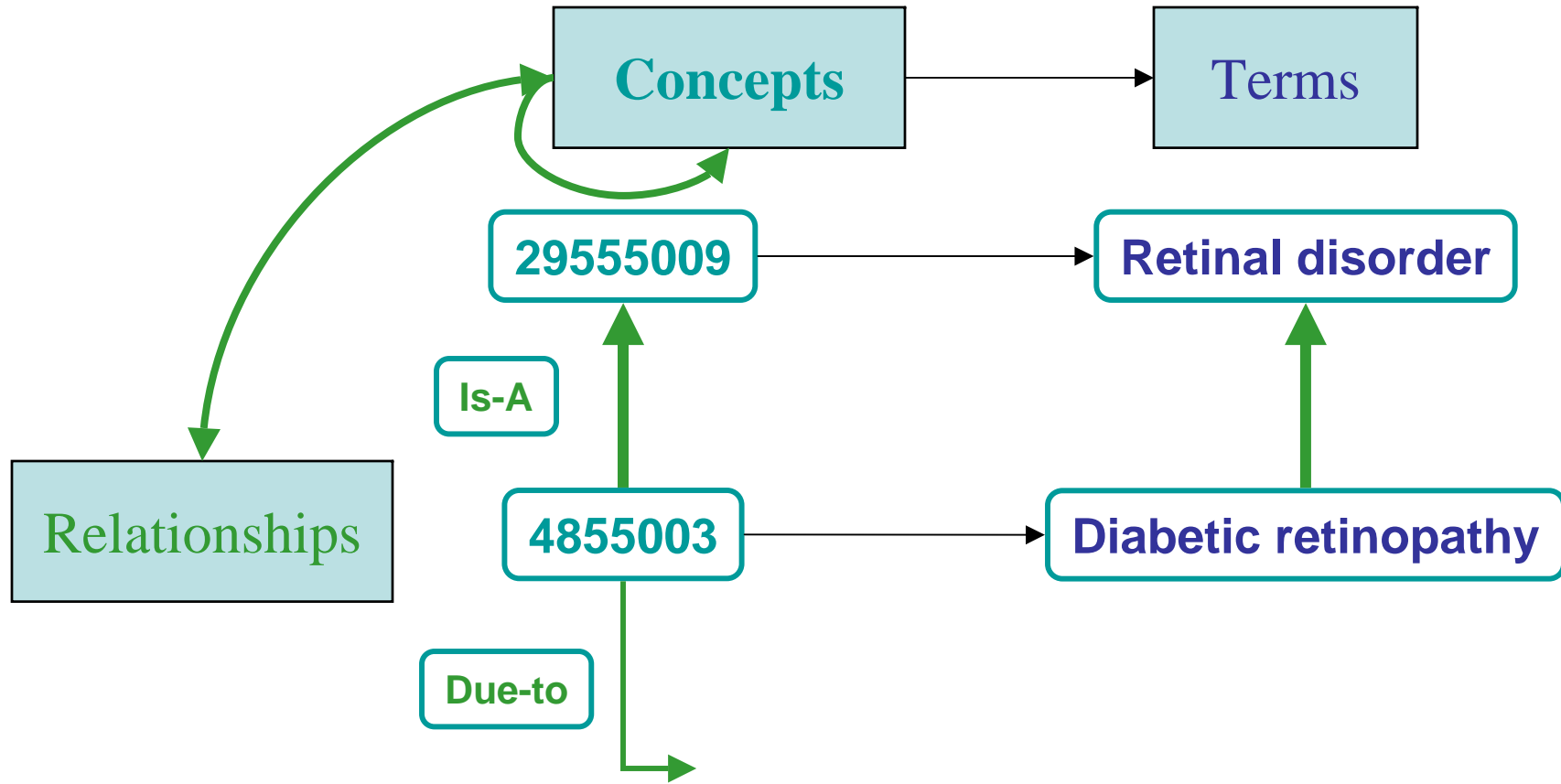
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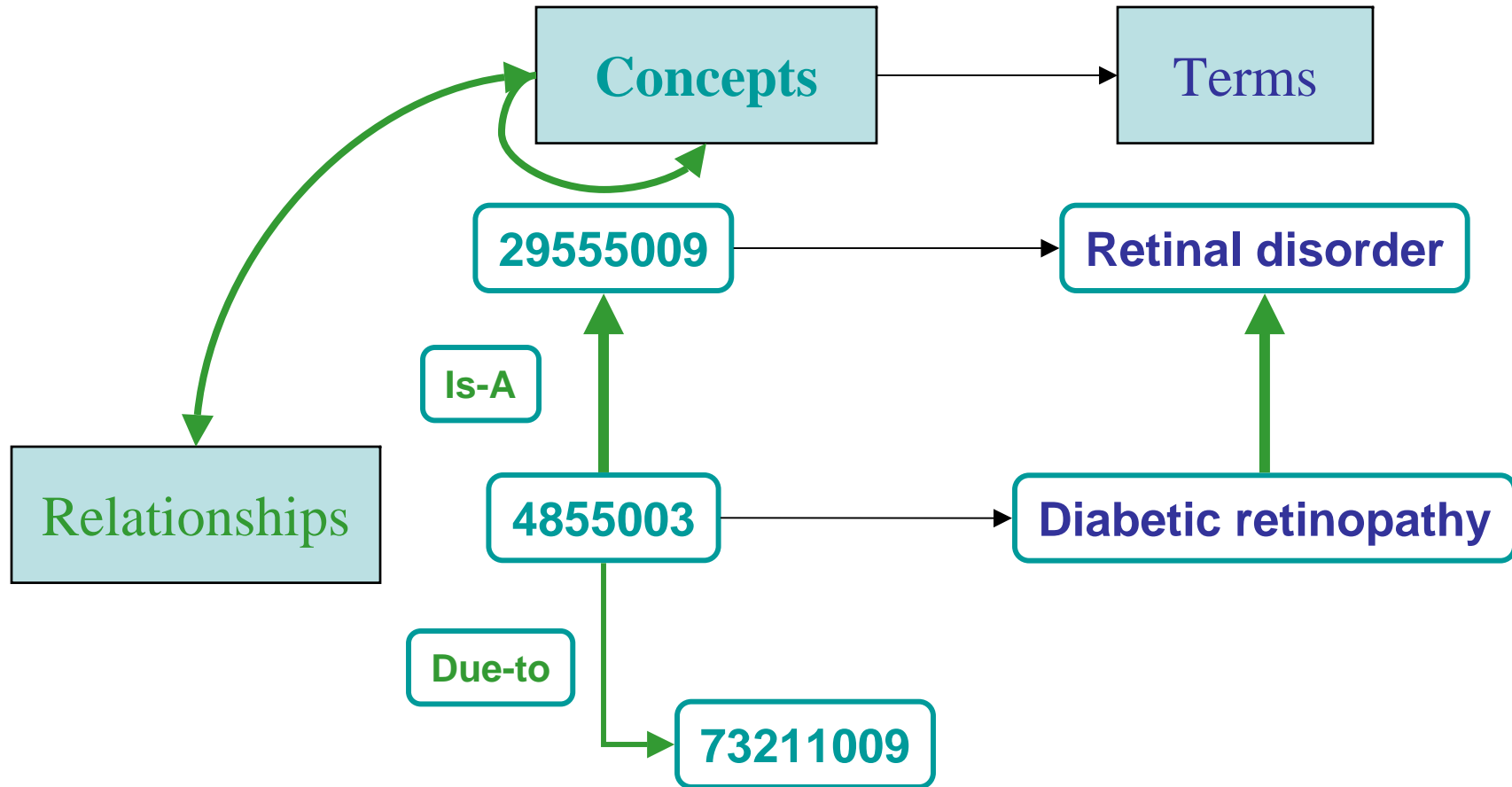
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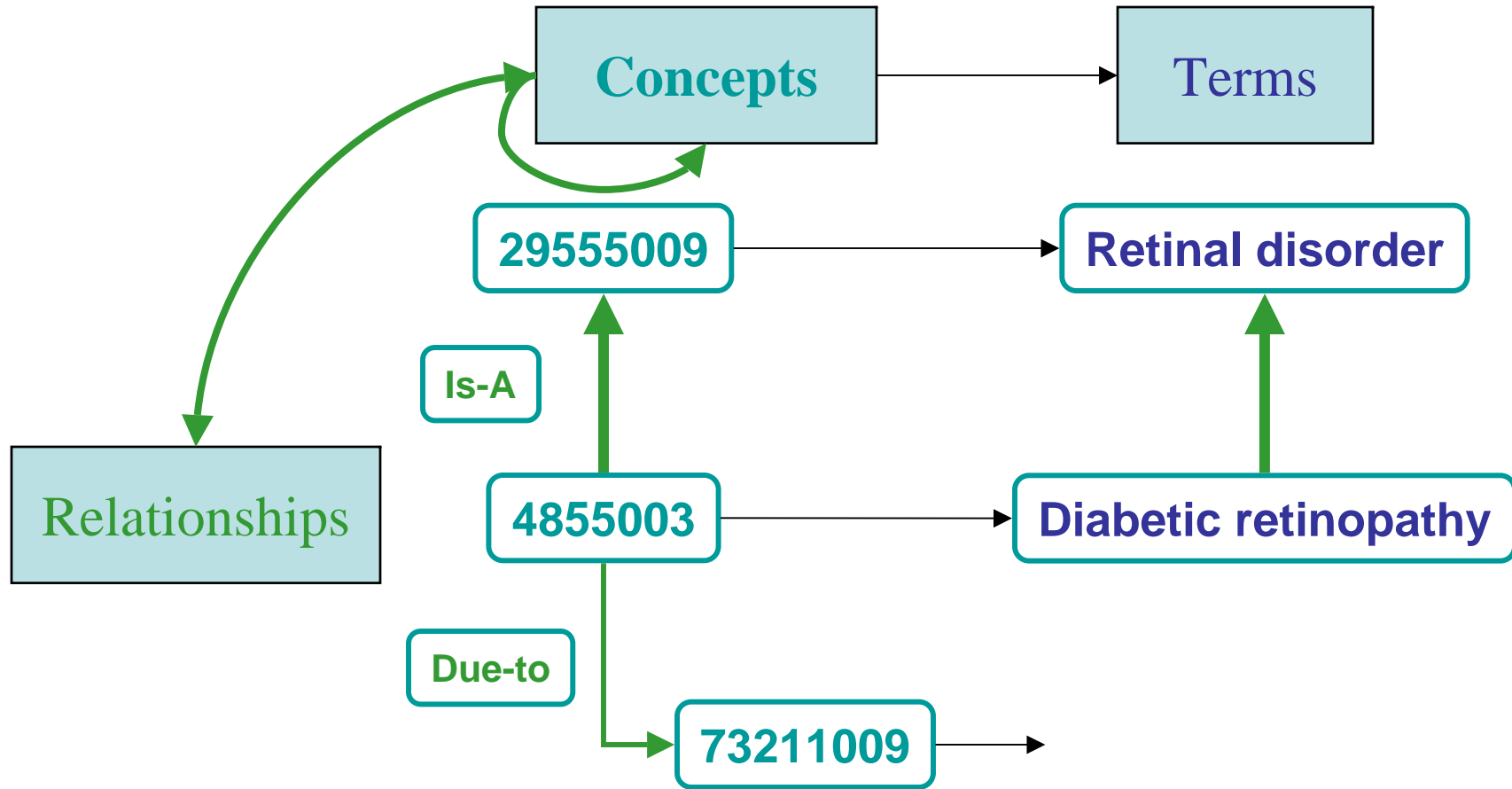
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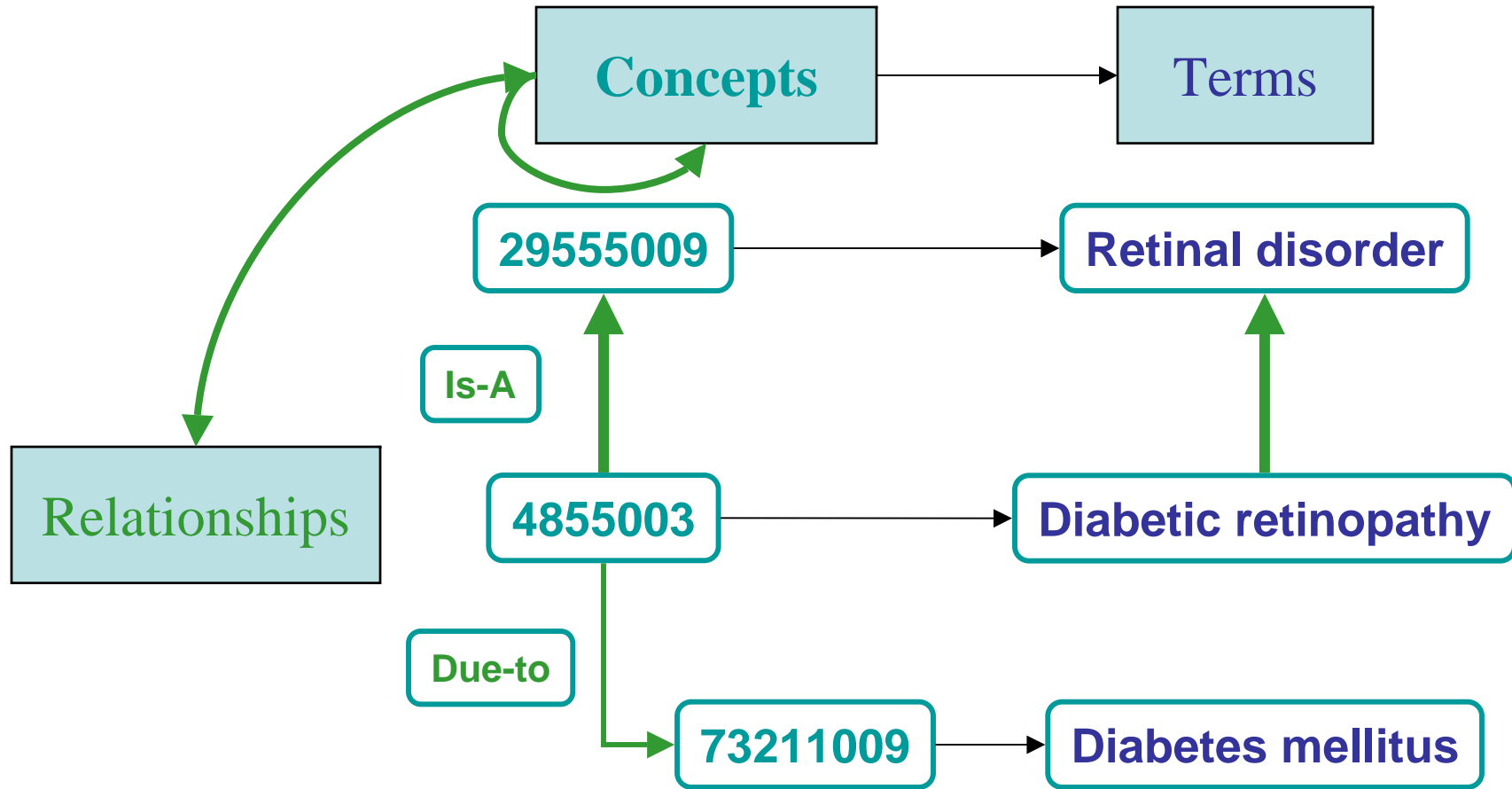
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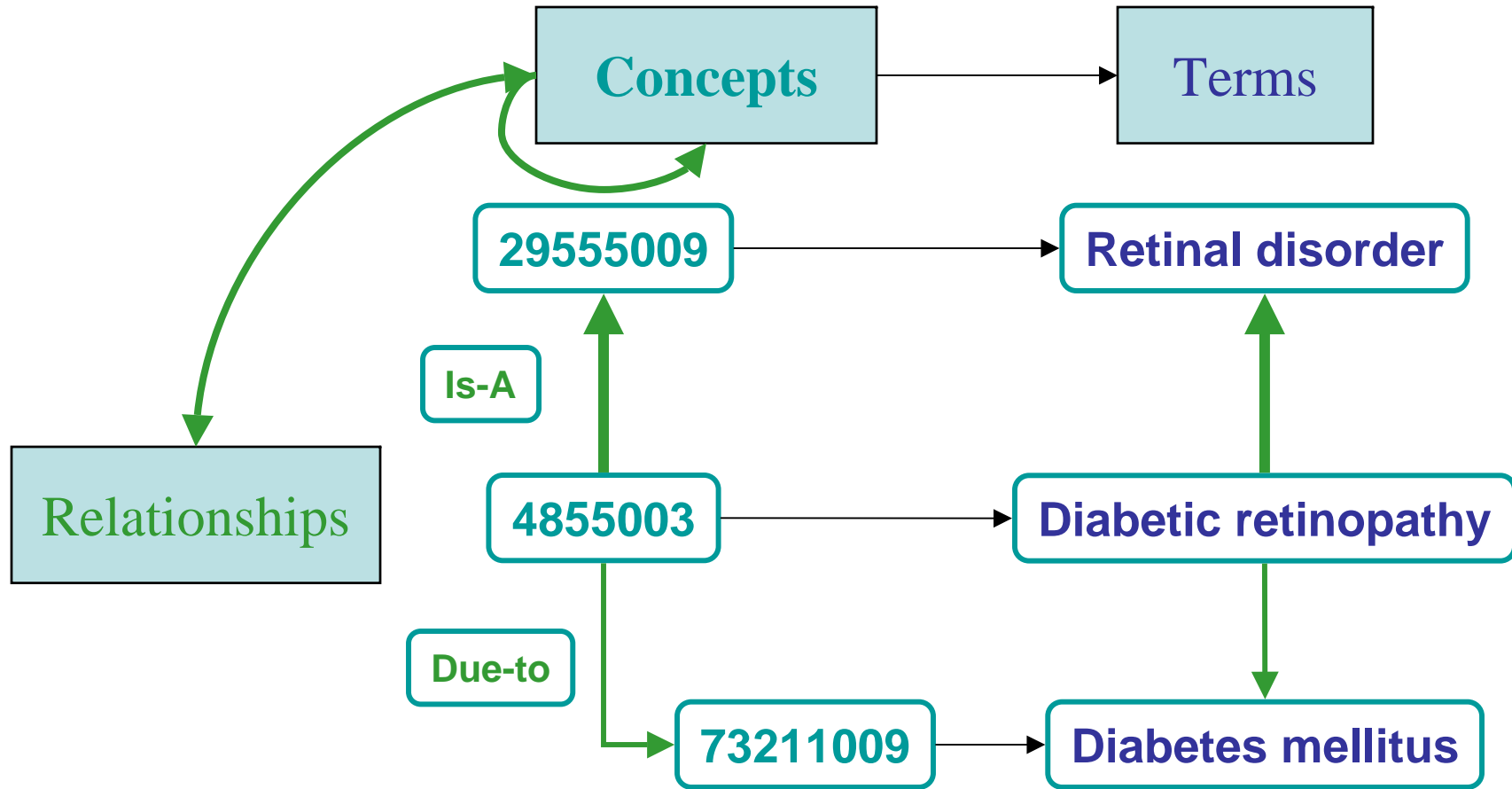
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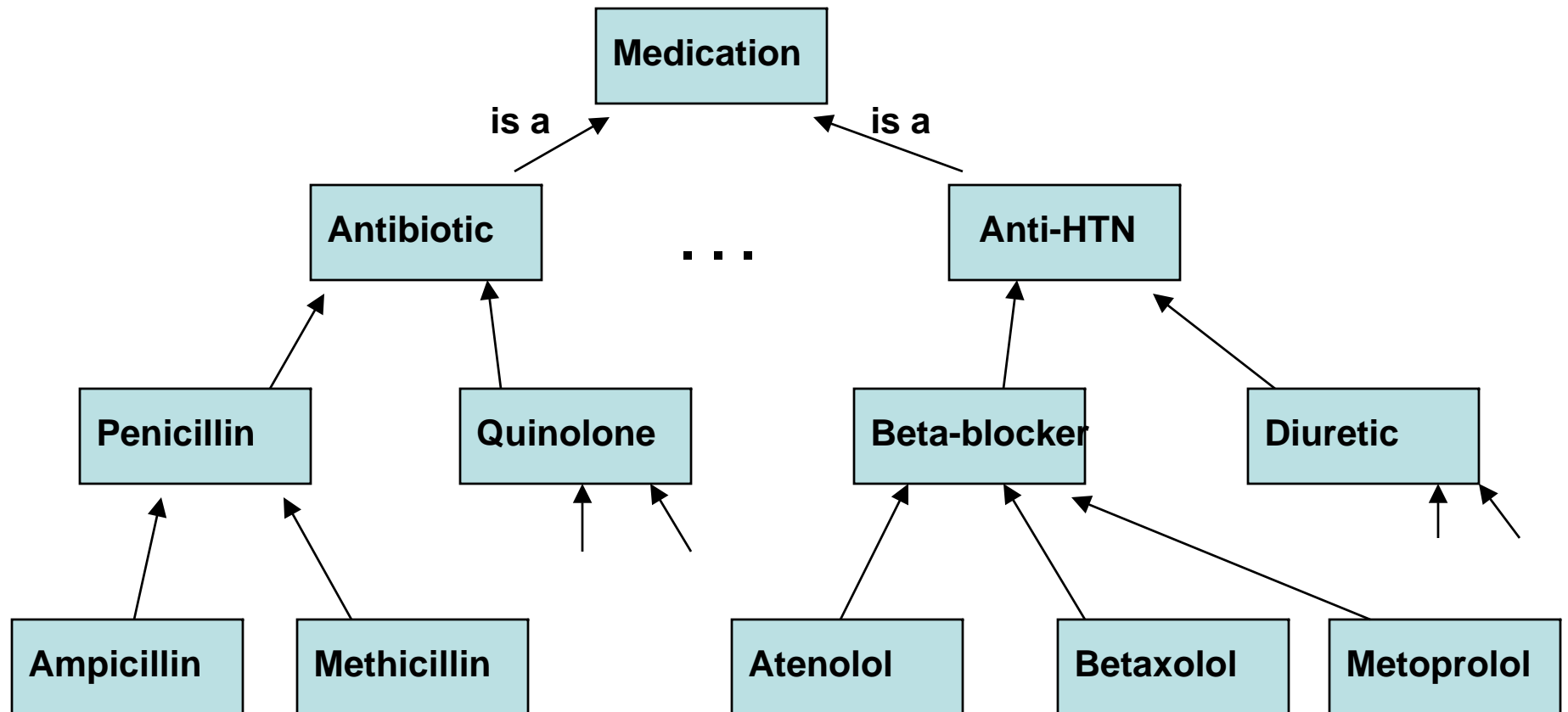


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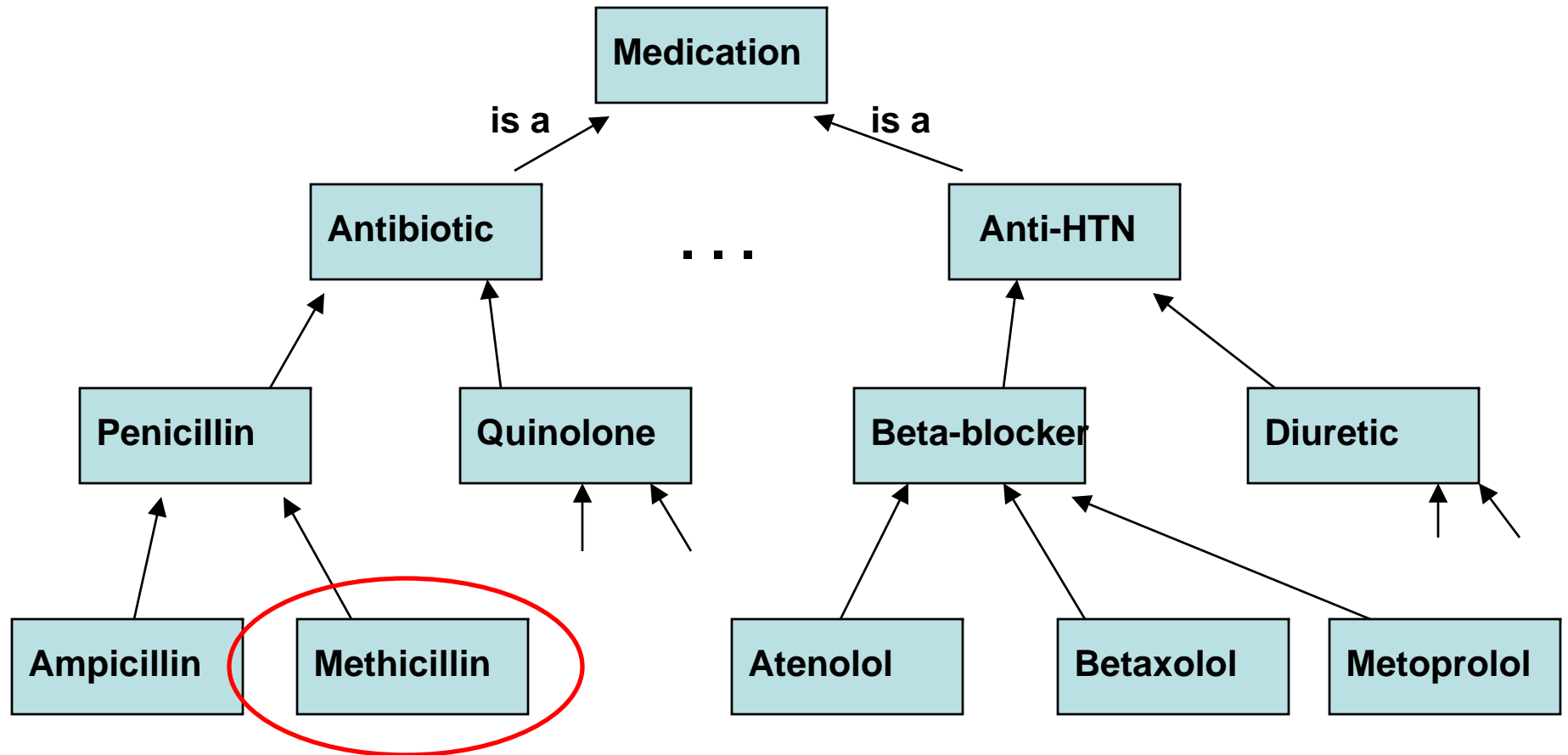
# The Inheritance Hierarchy

Concepts are arranged in a tree hierarchy



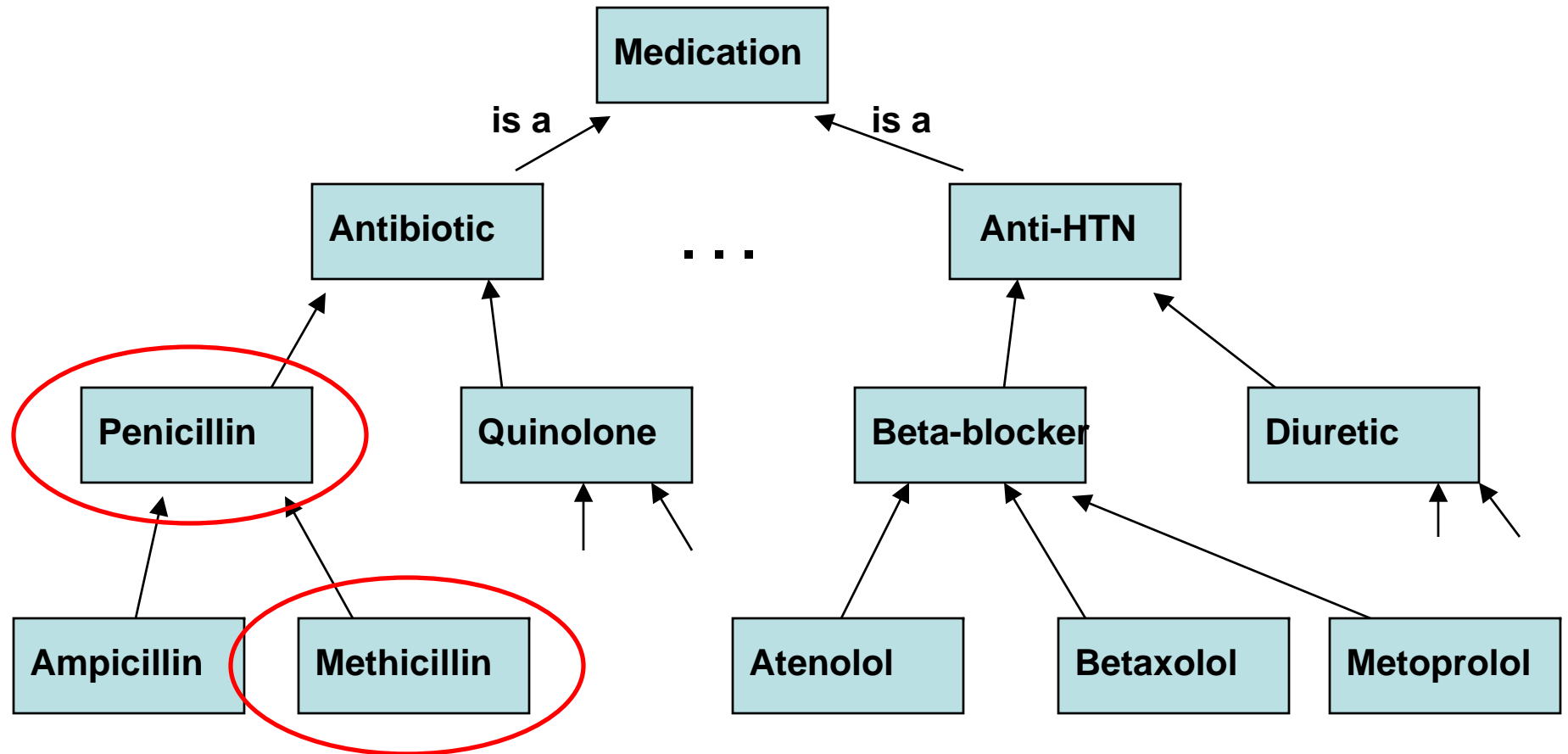
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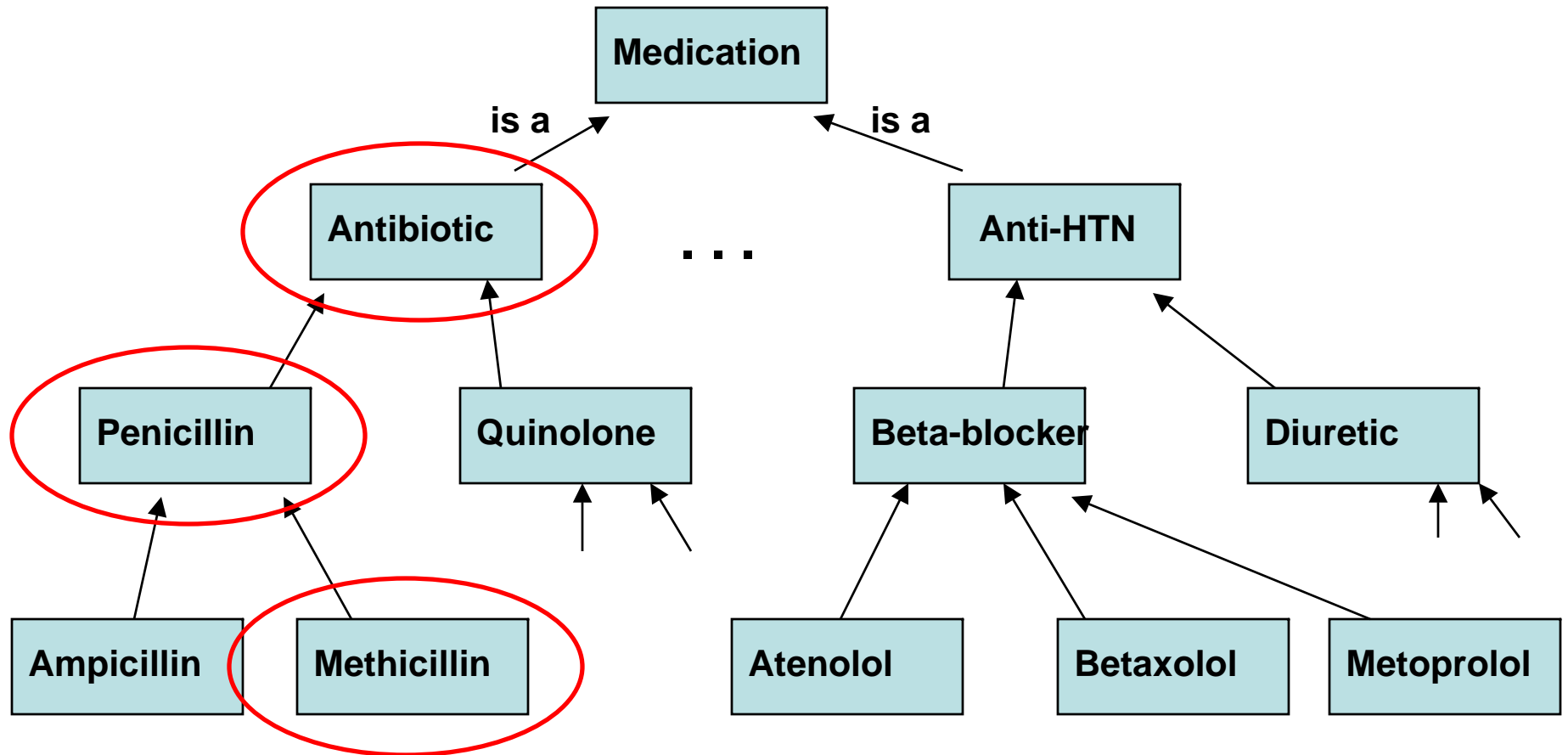
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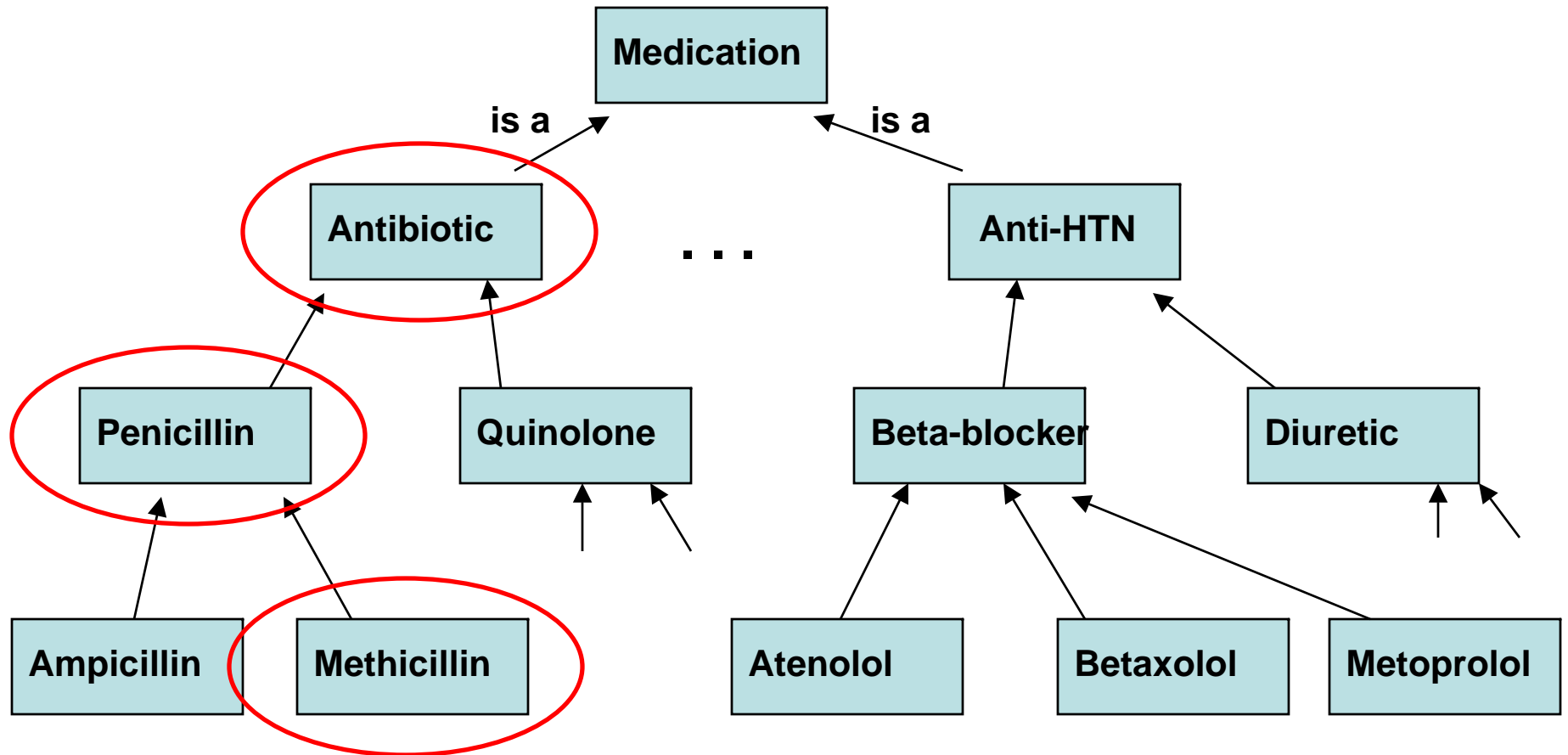
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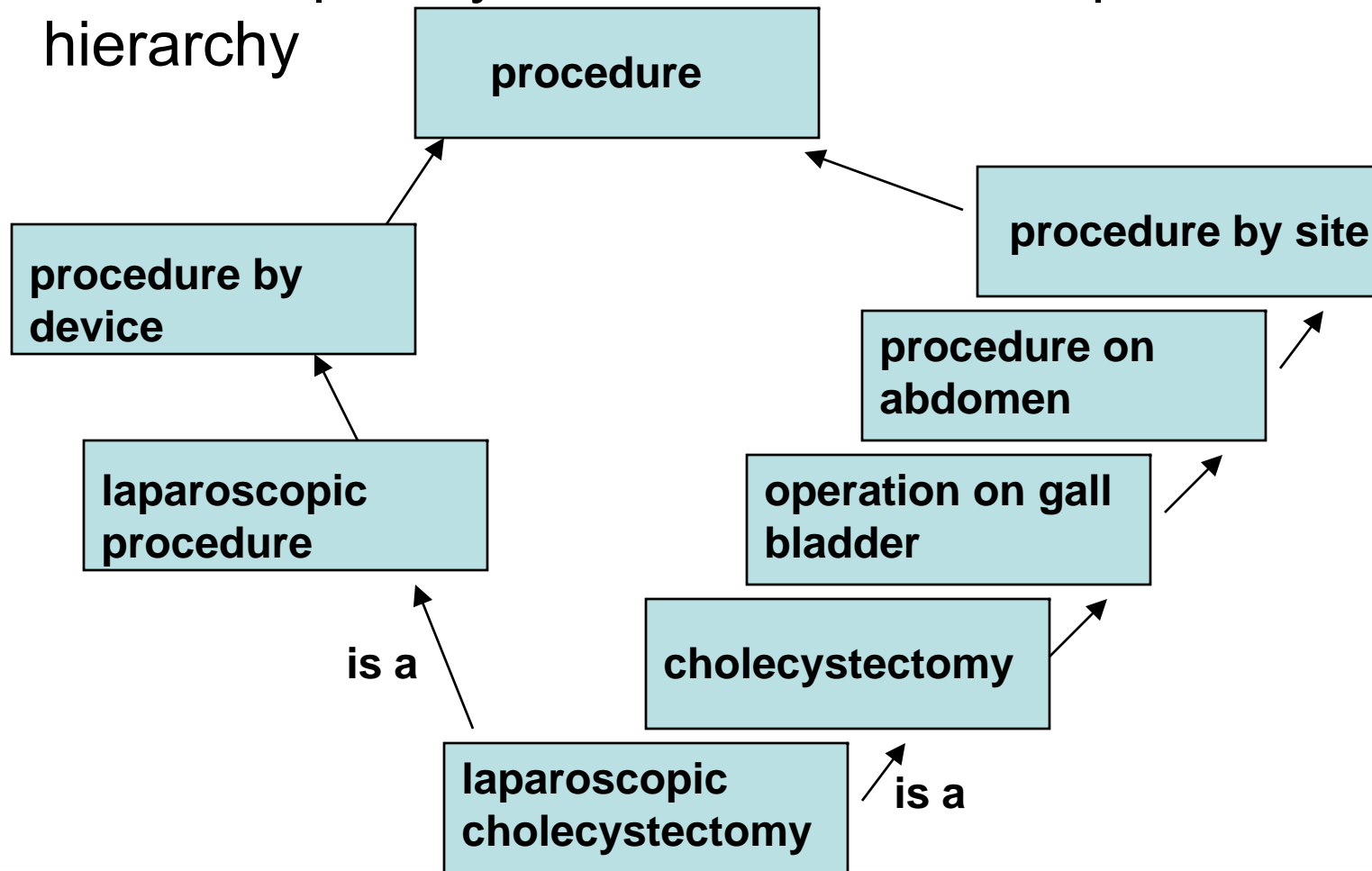
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Antibiotic subsumes Penicillin and Methicillin

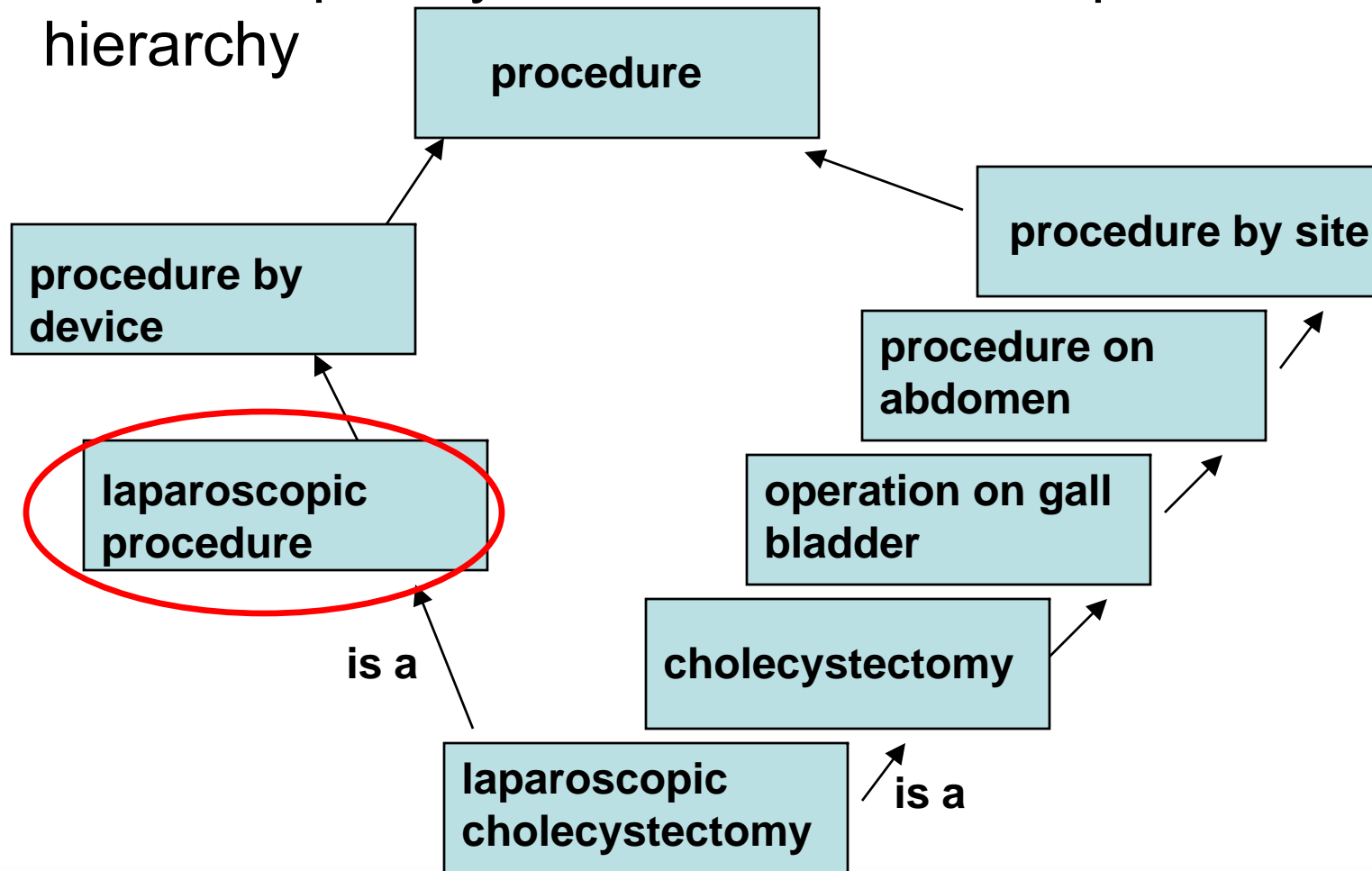
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A concept may have more than one parent in the hierarchy



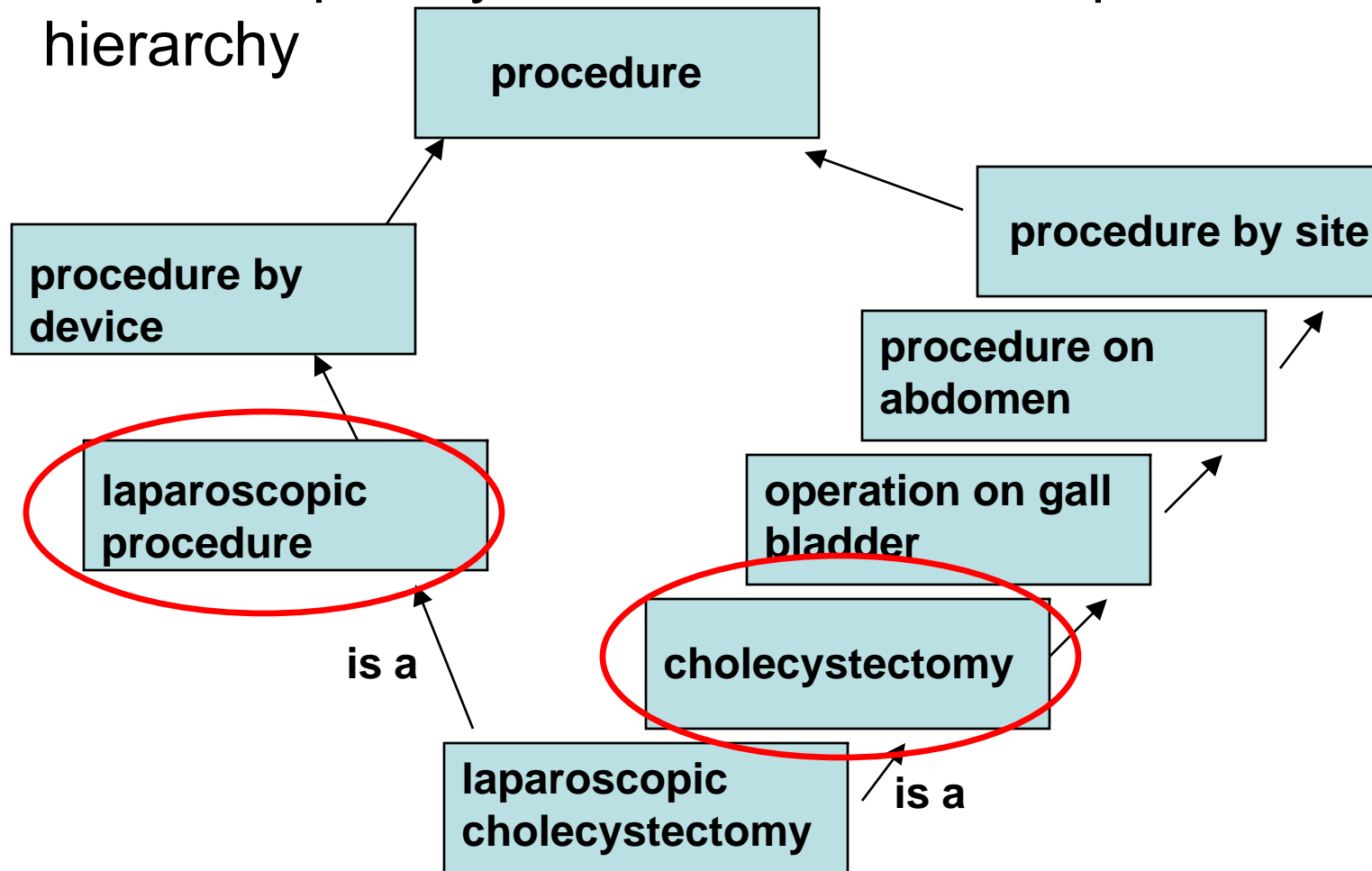
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297143008

or

Occlusion of Artery	2929001
Associated Morphology	116676008
Embolus	55584005
Finding Site	363698007
Suprarenal Artery	89500000

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## CDSS Vocabulary Services

Effective use of SNOMED vocabulary by the CDSS requires that these functions (at a minimum) be supported by the query/vocabulary management software:

- 1) Retrieve information about a single concept
- 2) Determine if *concept A* is a “child” of *concept B*
- 3) Query for a set of concepts, such as those defined for use in clinical systems
  - a) “All the concepts that represent an immunocompromised host””

A composite image featuring a scenic view of a Colorado river valley on the left and a city skyline at sunset on the right. The word "COLORADO" is overlaid in large, semi-transparent letters across the top.

COLORADO

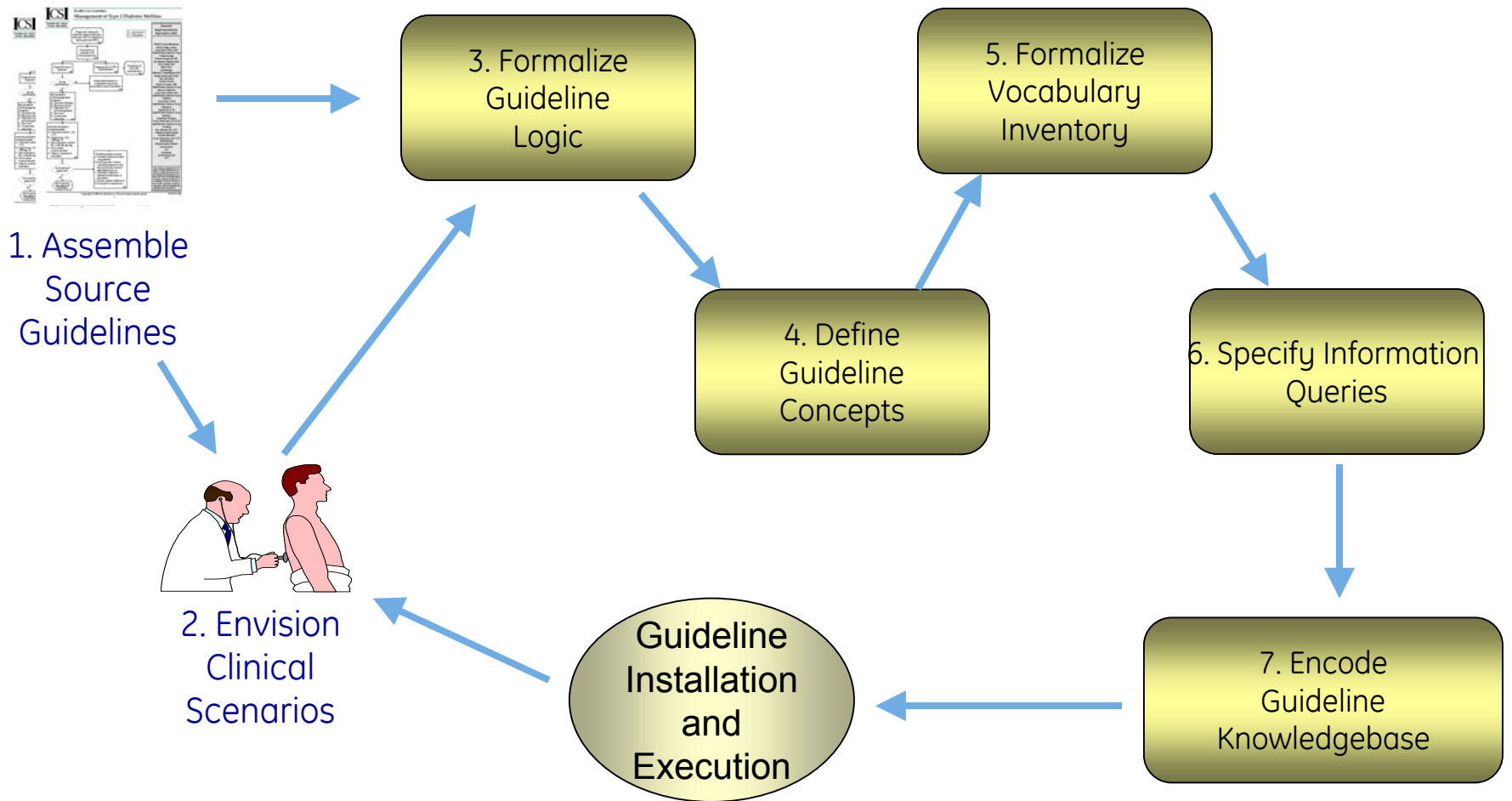
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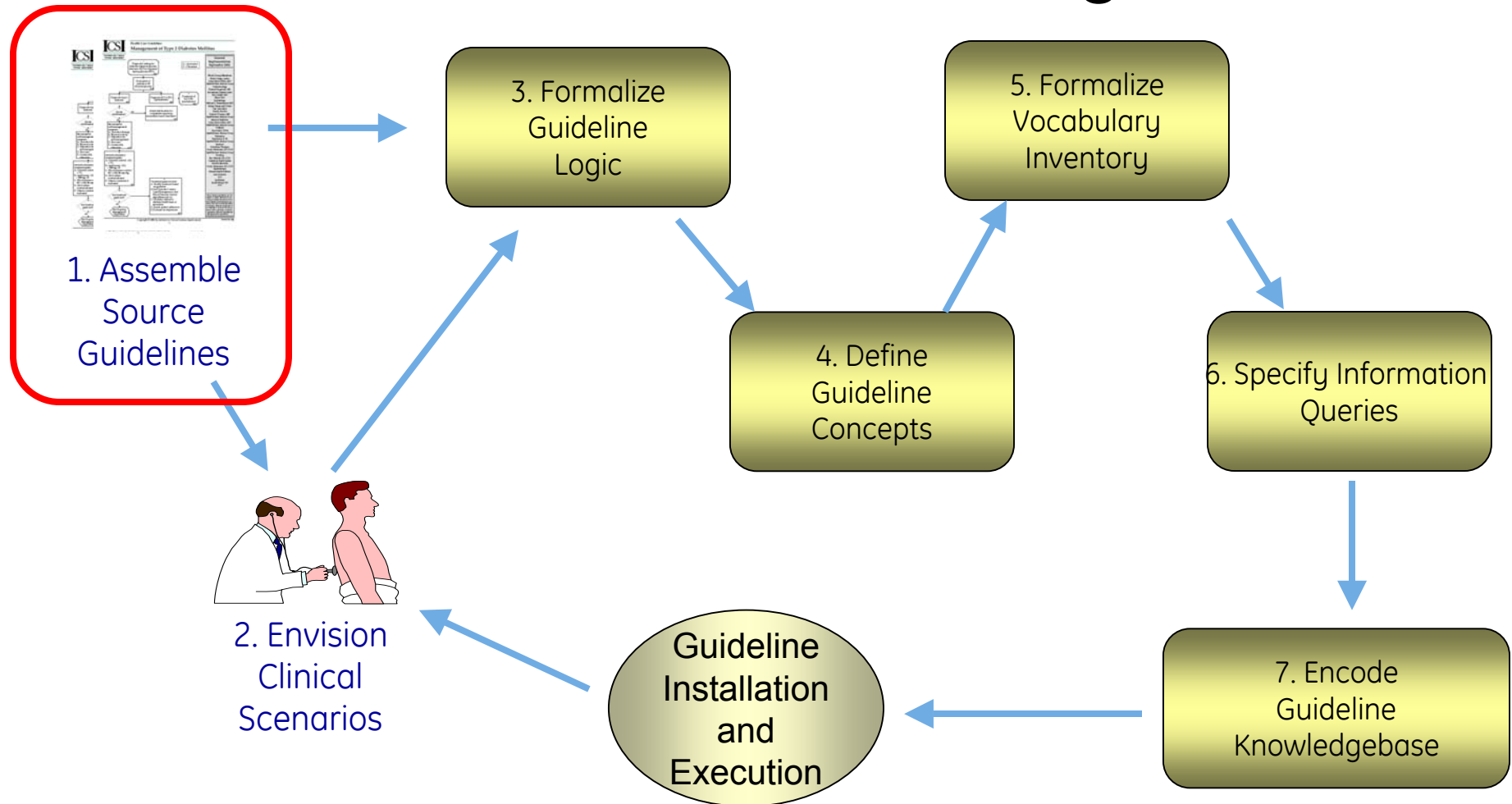
## Guideline Abstraction

Julie Glasgow, MD

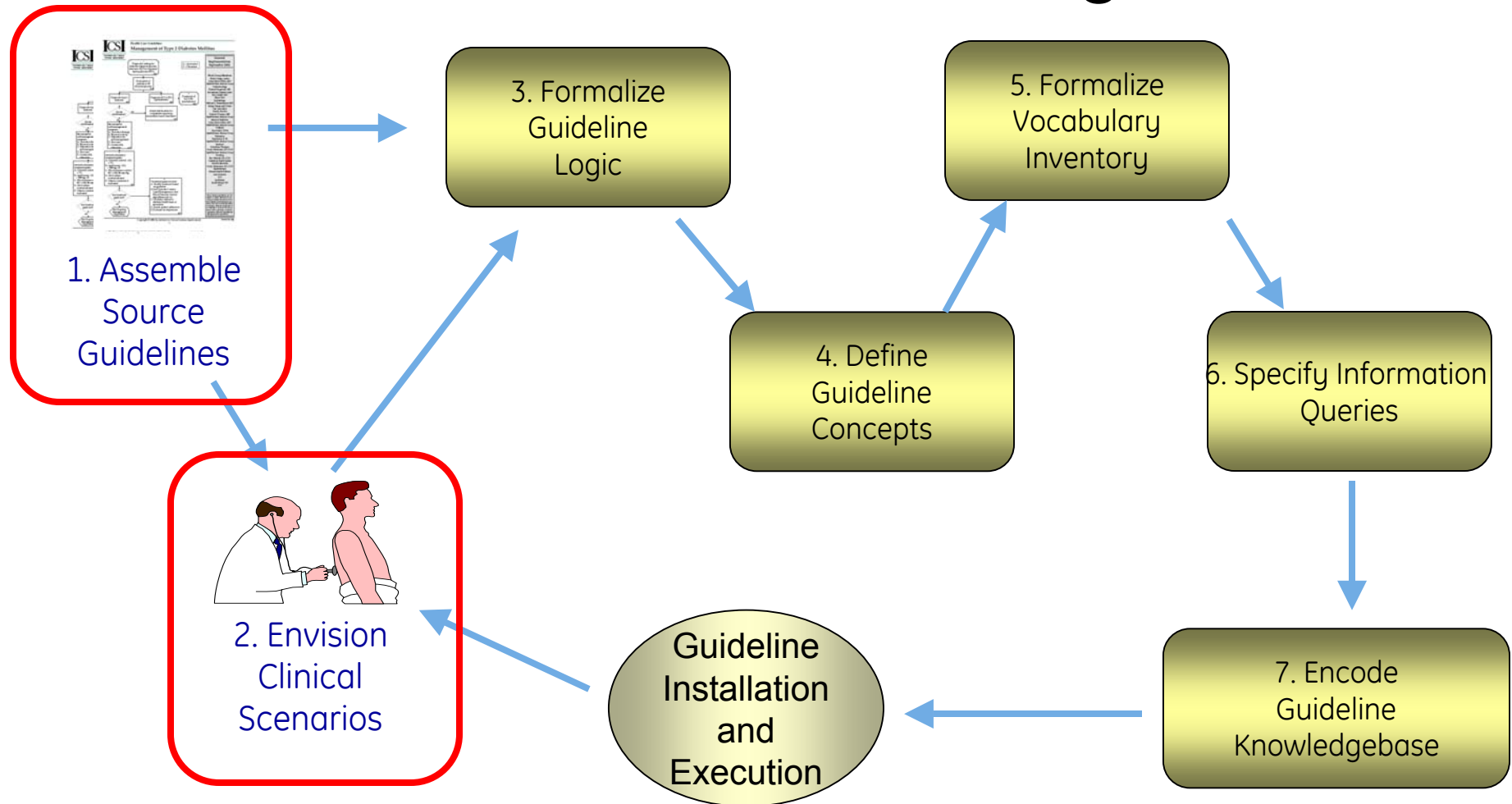
# SAGE Guideline Encoding Process



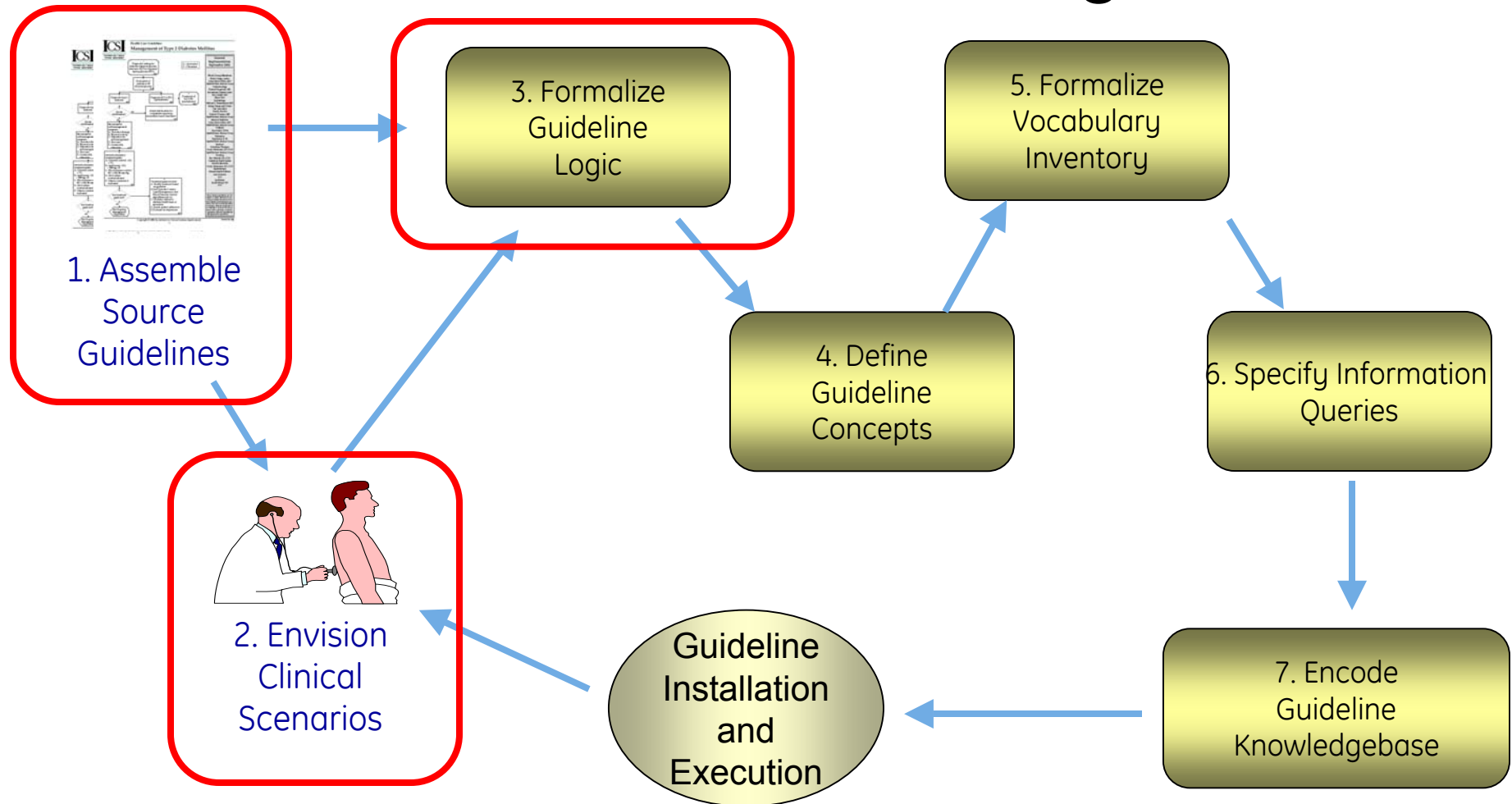
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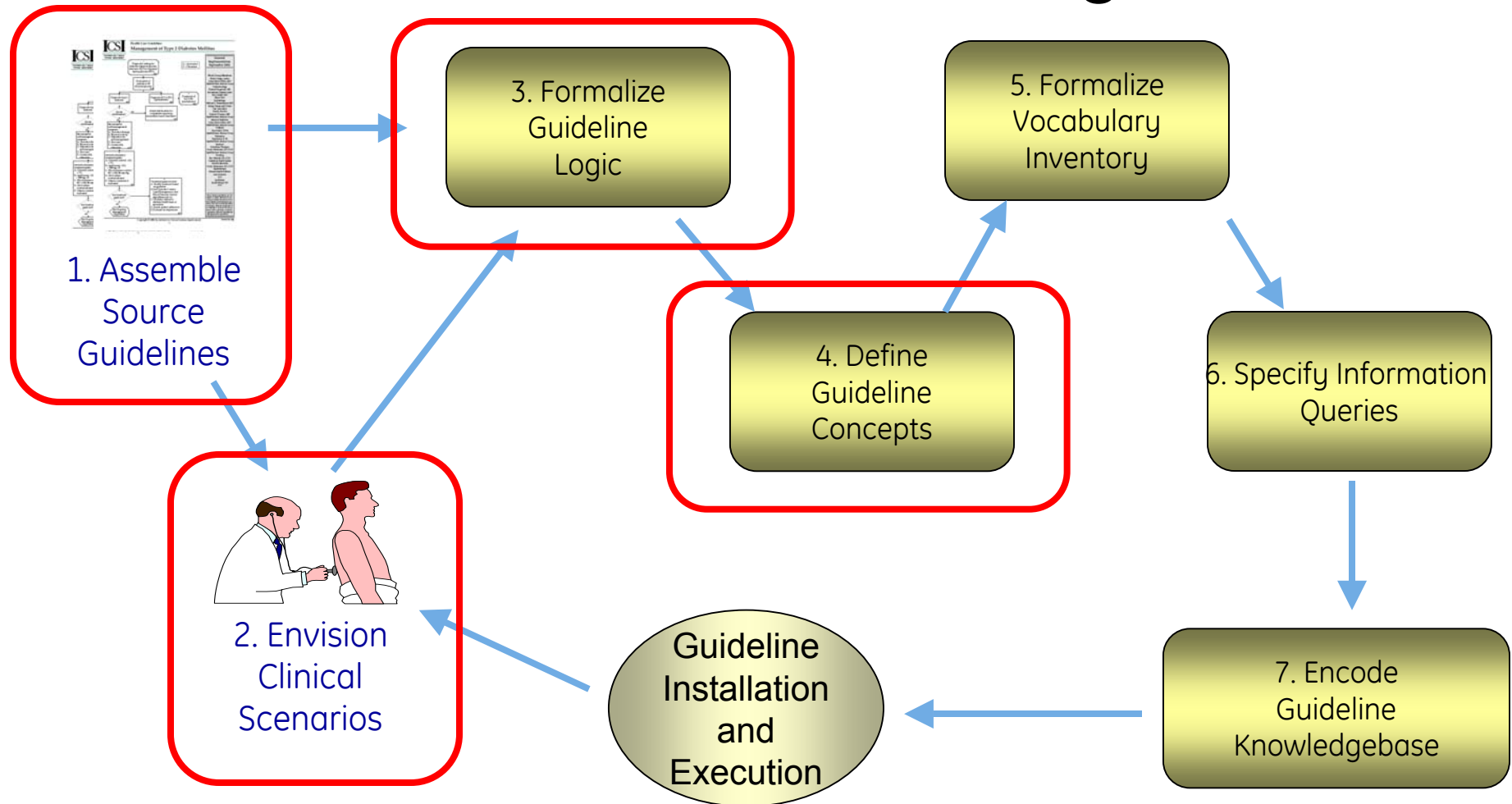
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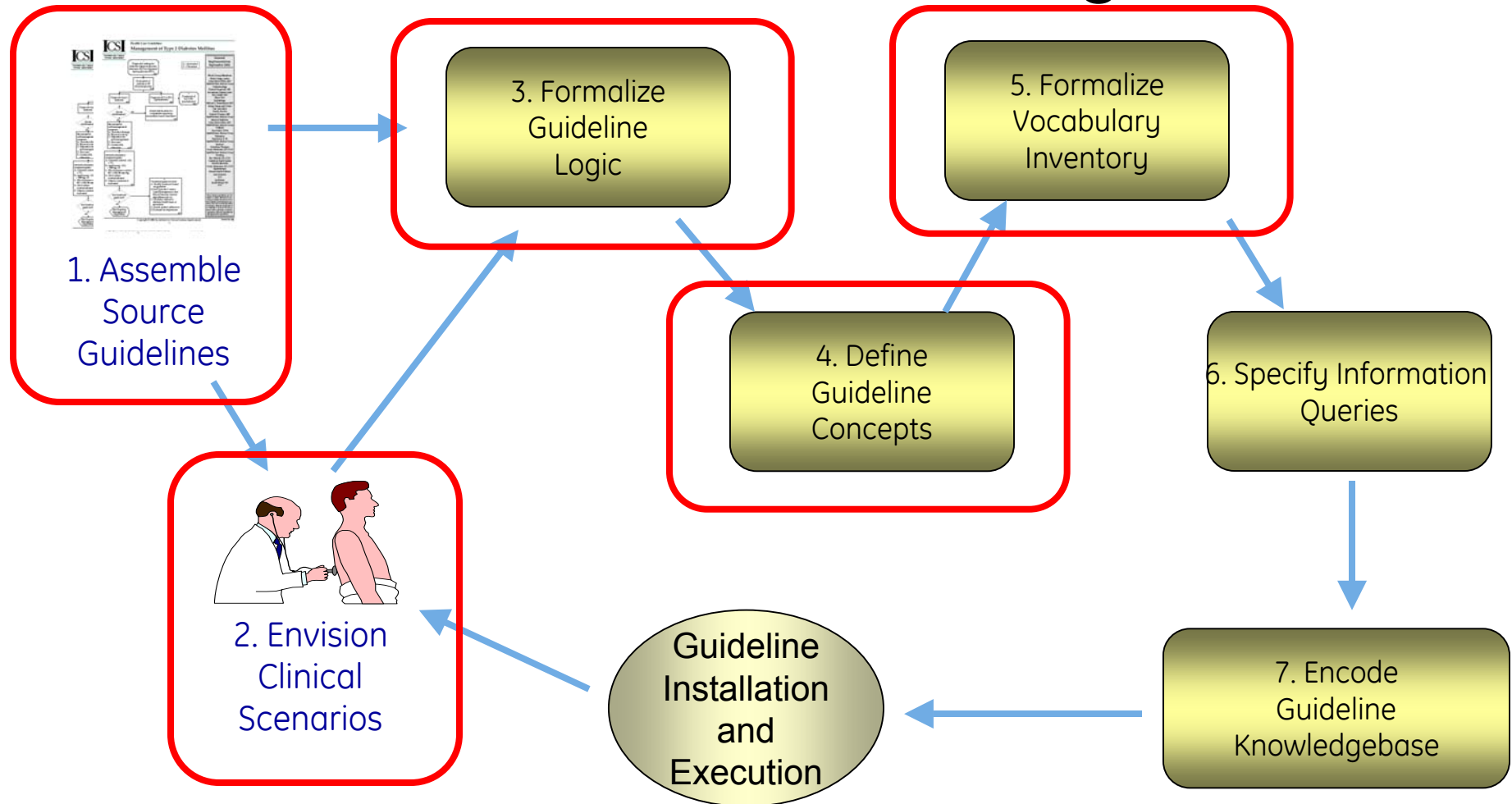
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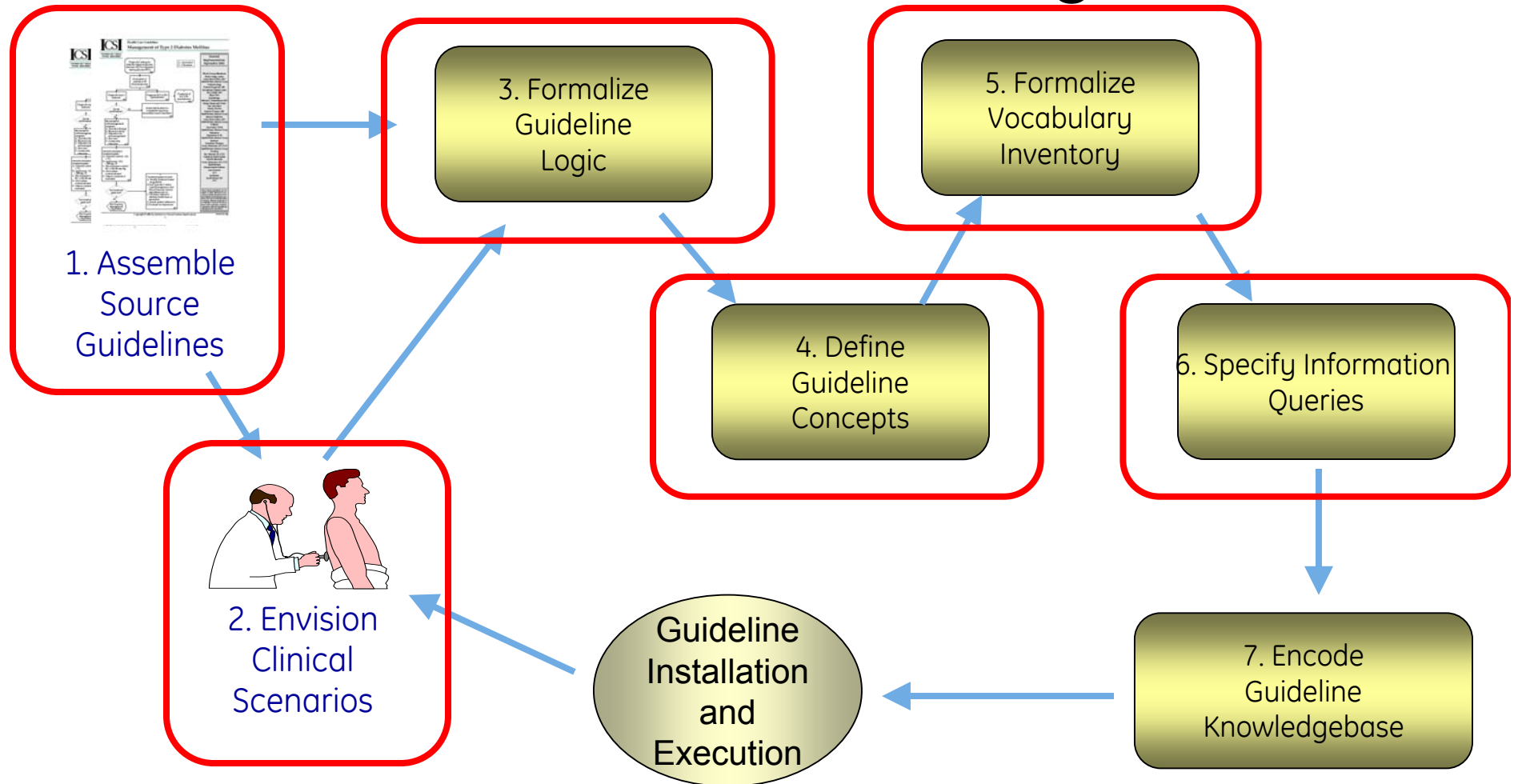
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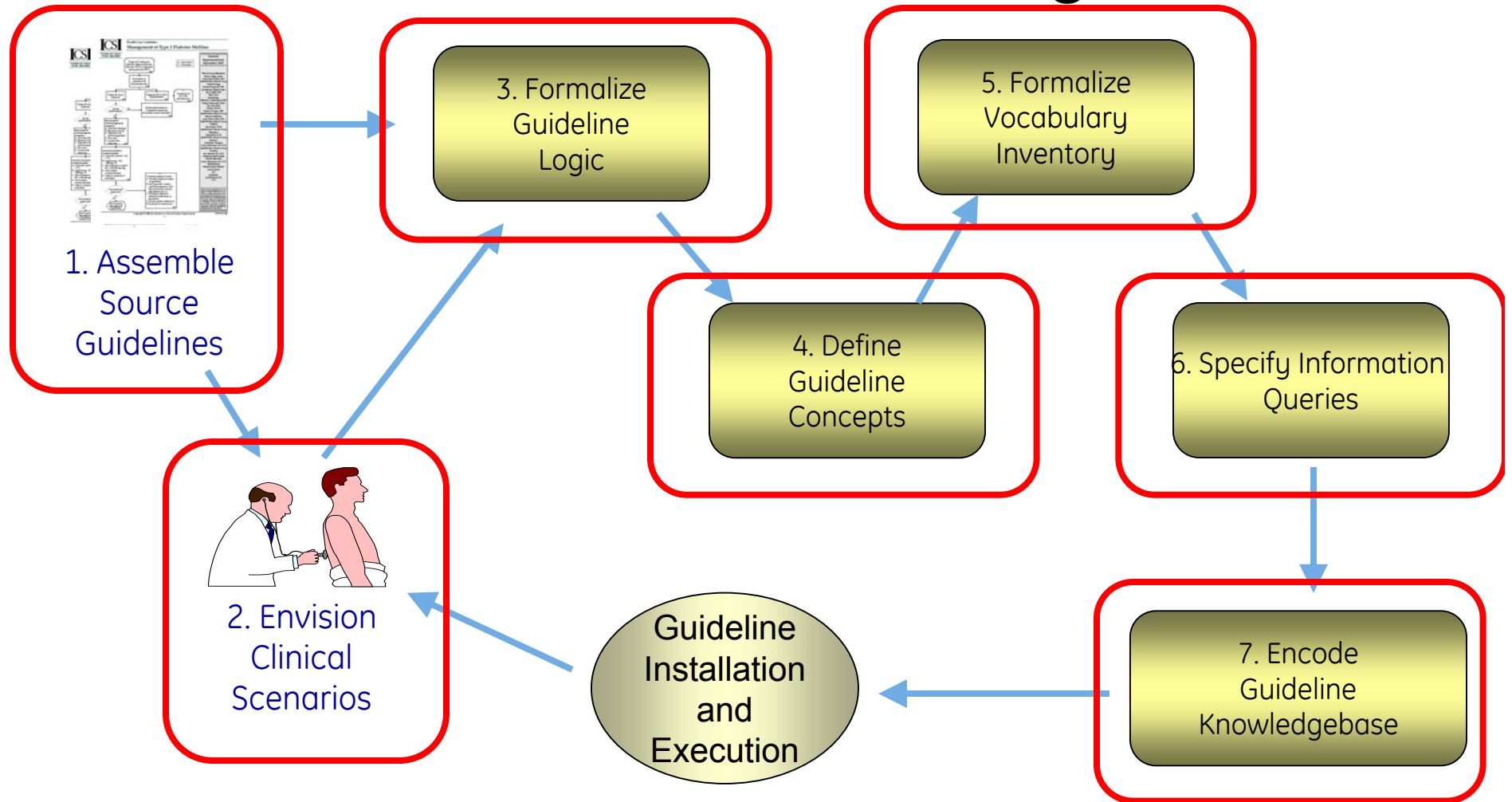
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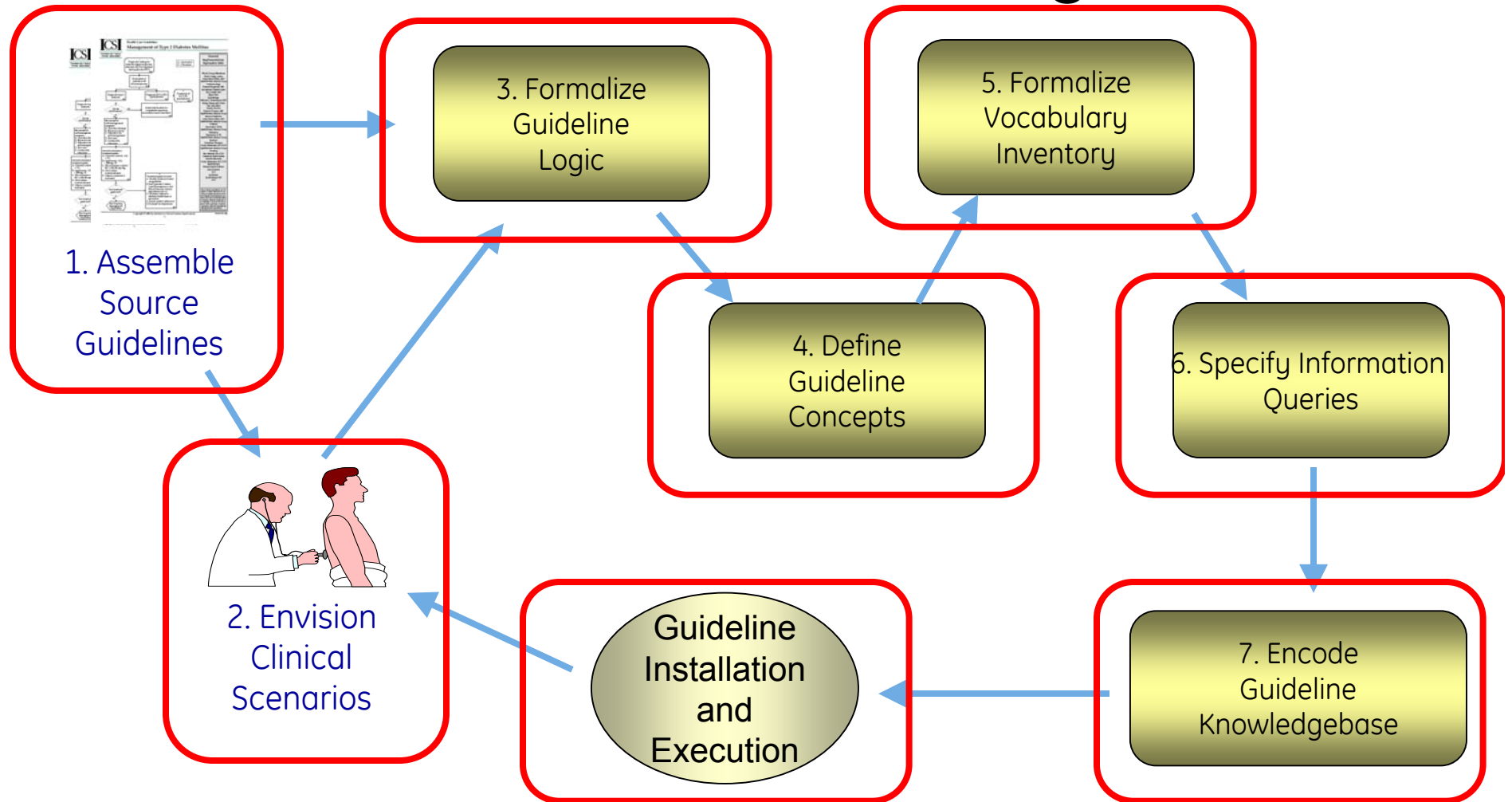
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# CDC Adult Immunization Sub-guideline Schedule

## Recommended Adult Immunization Schedule, by Vaccine and Age Group UNITED STATES, OCTOBER 2005–SEPTEMBER 2006

Vaccine ▼	Age group ►	19–49 years	50–64 years	≥ 65 years
Tetanus, diphtheria (Td) <sup>1*</sup>		1-dose booster every 10 yrs		
Measles, mumps, rubella (MMR) <sup>2*</sup>		1 or 2 doses	1 dose	
Varicella <sup>3*</sup>		2 doses (0, 4–8 wks)	2 doses (0, 4–8 wks)	
<small>--- Vaccines below broken line are for selected populations</small>				
Influenza <sup>4*</sup>		1 dose annually	1 dose annually	
Pneumococcal (polysaccharide) <sup>5,6</sup>		1–2 doses		1 dose
Hepatitis A <sup>7*</sup>		2 doses (0, 6–12 mos, or 0, 6–18 mos)		
Hepatitis B <sup>8*</sup>		3 doses (0, 1–2, 4–6 mos)		
Meningococcal <sup>9</sup>		1 or more doses		

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NOTE: These recommendations must be read along with the footnote.

**TABLE 2. Recommendations for the use of pneumococcal vaccine**

Groups for which vaccination is recommended	Strength of recommendation*	Revaccination†
<b>Immunocompetent persons<sup>§</sup></b>		
Persons aged ≥65 years	A	Second dose of vaccine if patient received vaccine ≥5 years previously and were aged <65 years at the time of vaccination.
Persons aged 2–64 years with chronic cardiovascular disease, <sup>¶</sup> chronic pulmonary disease, <sup>**</sup> or diabetes mellitus	A	Not recommended.
Persons aged 2–64 years with alcoholism, chronic liver disease, <sup>††</sup> or cerebrospinal fluid leaks	B	Not recommended.
Persons aged 2–64 years with functional or anatomic asplenia <sup>§§</sup>	A	If patient is aged >10 years: single revaccination ≥5 years after previous dose. If patient is aged ≤10 years: consider revaccination 3 years after previous dose.
Persons aged 2–64 years living in special environments or social settings <sup>¶¶</sup>	C	Not recommended.
<b>Immunocompromised persons<sup>§</sup></b>		
Immunocompromised persons aged ≥2 years, including those with HIV infection, leukemia, lymphoma, Hodgkins disease, multiple myeloma, generalized malignancy, chronic renal failure, or nephrotic syndrome; those receiving immunosuppressive chemotherapy (including corticosteroids); and those who have received an organ or bone marrow transplant.	C	Single revaccination if ≥5 years have elapsed since receipt of first dose. If patient is aged ≤10 years: consider revaccination 3 years after previous dose.

# Detail: US Adult Pneumococcal Guideline

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## Concepts in the Source Guideline

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- What defines diabetes mellitus?
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Persons aged 2–64 years with functional or anatomic asplenia <sup>‡§</sup>	A	If patient is aged >10 years: single revaccination ≥5 years after previous dose. If patient is aged ≤10 years: consider revaccination 3 years after previous dose.
Persons aged 2–64 years living in special environments or social settings <sup>¶¶</sup>	C	Not recommended.
Immunocompromised persons <sup>§</sup>		
Immunocompromised persons aged ≥2 years, including those with HIV infection, leukemia, lymphoma, Hodgkins disease, multiple myeloma, generalized malignancy, chronic renal failure, or nephrotic	C	Single revaccination if ≥5 years have elapsed since receipt of first dose. If patient is aged ≤10 years: consider revaccination 3 years after previous dose.

## “Functional or anatomic asplenia”

- **Clinical Definition**
  - Congenital asplenia
  - Functional asplenia
  - Splenectomy
  - Asplenia syndrome
  - Hyposplenism
  - Sickle cell disease
- **SNOMED CT Concept**
  - 93030006
  - 38096003
  - 234319005 (Procedure)
  - 17604001
  - 23761004
  - 127040003 (Hemoglobin S disease)

## “Functional or anatomic asplenia”

- **Clinical Definition**  **SNOMED CT Concept**
  - Congenital asplenia
    - 93030006
    - 38096003
  - Functional asplenia
    - 234319005 (Procedure)
  - Splenectomy
    - 17604001
  - Asplenia syndrome
    - 23761004
  - Hyposplenism
    - 127040003 (Hemoglobin S disease)
  - Sickle cell disease

# Concepts in the Encoded Guideline: Protégé

Label	Description
Adult Immunization Subguideline	Adult Immunization Subguideline Computes eligibility and contraindications for all vaccines applicable to patient 19 years older.

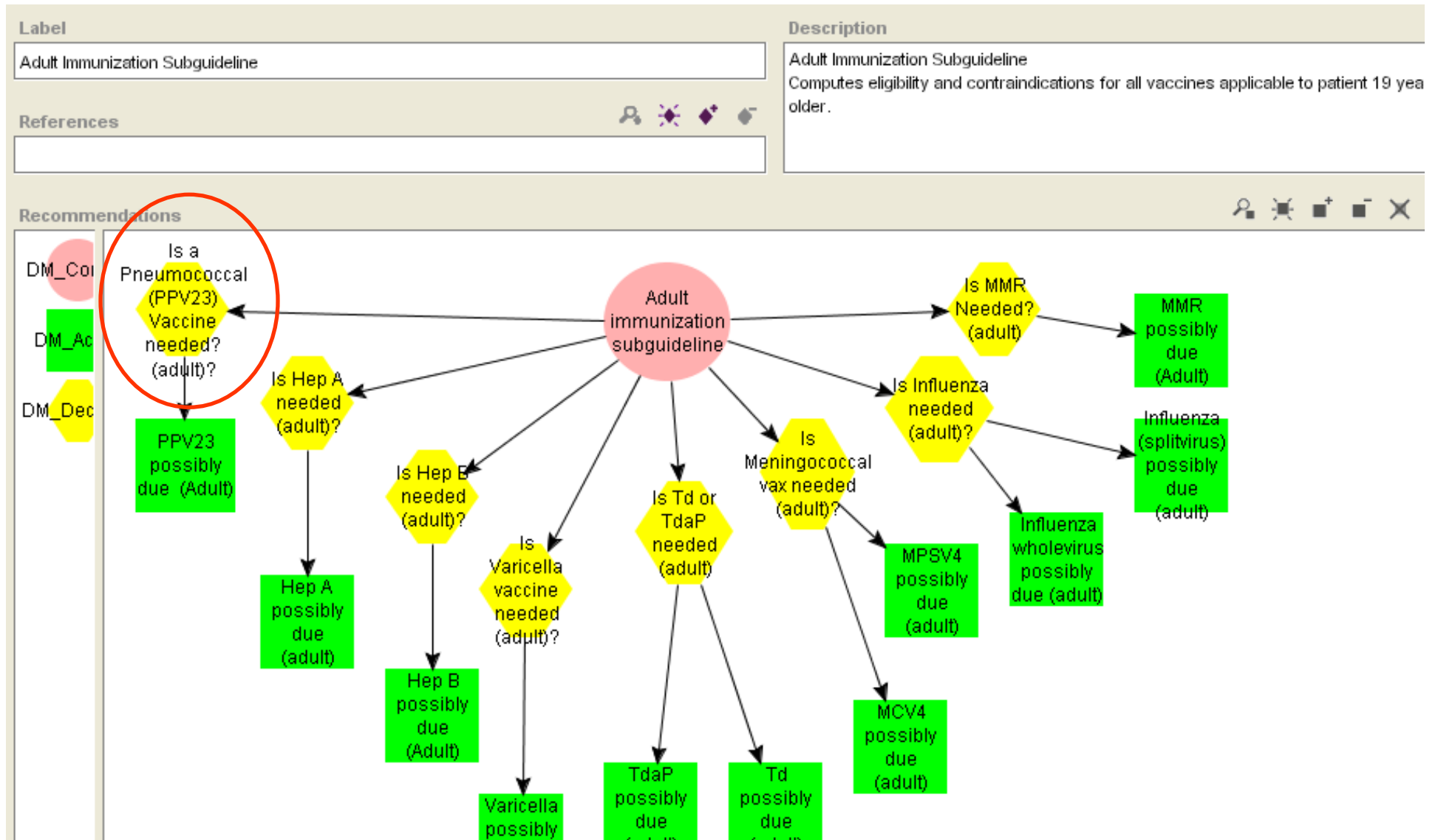
  

References

Recommendations
<pre> graph TD     Root((Adult immunization subguideline))     Root --&gt; Q1{{Is a Pneumococcal (PPV23) Vaccine needed? (adult)?}}     Root --&gt; Q2{{Is Hep A needed (adult)?}}     Root --&gt; Q3{{Is Hep B needed (adult)?}}     Root --&gt; Q4{{Is Td or TdaP needed (adult)?}}     Root --&gt; Q5{{Is Meningococcal vax needed (adult)?}}     Root --&gt; Q6{{Is MMR Needed? (adult)}}     Root --&gt; Q7{{Is Influenza needed (adult)?}}          Q1 --&gt; R1[PPV23 possibly due (Adult)]     Q2 --&gt; R2[Hep A possibly due (adult)]     Q3 --&gt; R3[Hep B possibly due (Adult)]     Q4 --&gt; R4[Varicella possibly]     Q4 --&gt; R5[TdaP possibly due (adult)]     Q4 --&gt; R6[Td possibly due (adult)]     Q5 --&gt; R7[MPSV4 possibly due (adult)]     Q5 --&gt; R8[MCV4 possibly due (adult)]     Q6 --&gt; R9[MMR possibly due (Adult)]     Q7 --&gt; R10[Influenza (splitvirus) possibly due (adult)]     Q7 --&gt; R11[Influenza wholevirus possibly due (adult)]          style Root fill:#f9d5e5     style Q1 fill:#fff2cc     style Q2 fill:#fff2cc     style Q3 fill:#fff2cc     style Q4 fill:#fff2cc     style Q5 fill:#fff2cc     style Q6 fill:#fff2cc     style Q7 fill:#fff2cc     style R1 fill:#d9ead3     style R2 fill:#d9ead3     style R3 fill:#d9ead3     style R4 fill:#d9ead3     style R5 fill:#d9ead3     style R6 fill:#d9ead3     style R7 fill:#d9ead3     style R8 fill:#d9ead3     style R9 fill:#d9ead3     style R10 fill:#d9ead3     style R11 fill:#d9ead3             </pre>

# Concepts in the Encoded Guideline: Protégé

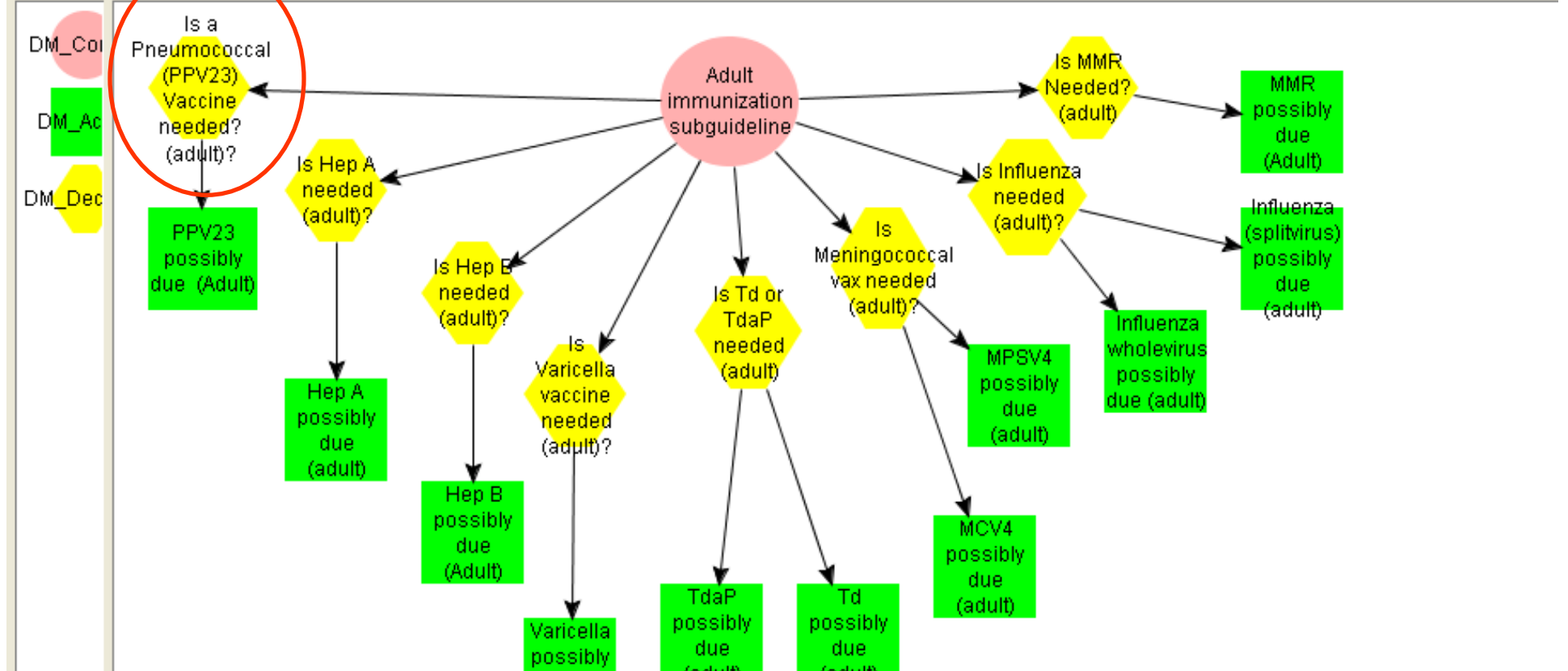


# Concepts in the Encoded Guideline: Protégé

Label	Description
Adult Immunization Subguideline	Adult Immunization Subguideline computes eligibility and contraindications for all vaccines applicable to patient 19 years of age or older.
References	
Recommendations	

**Context Nodes** organize and specify the relationship to workflow.

- What triggers the session
- Who is involved
- Where the session occurs

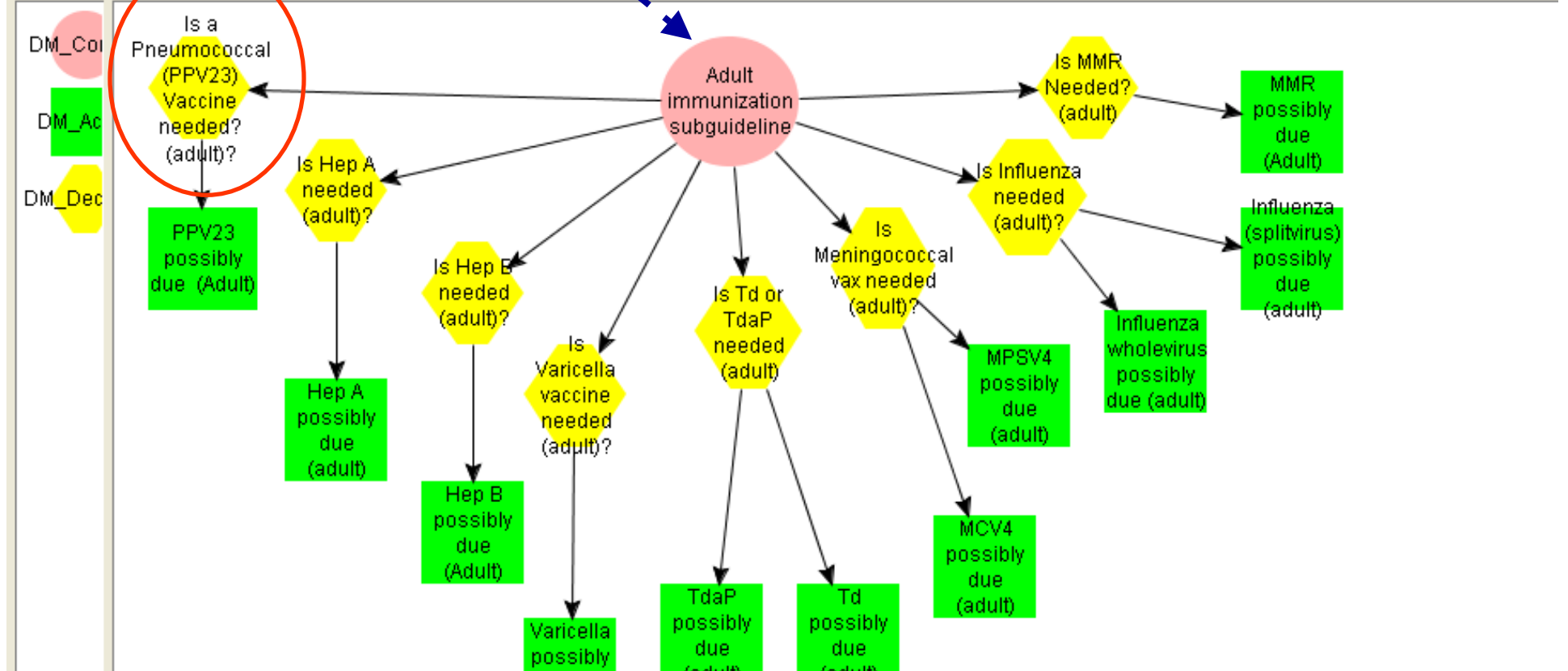


# Concepts in the Encoded Guideline: Protégé

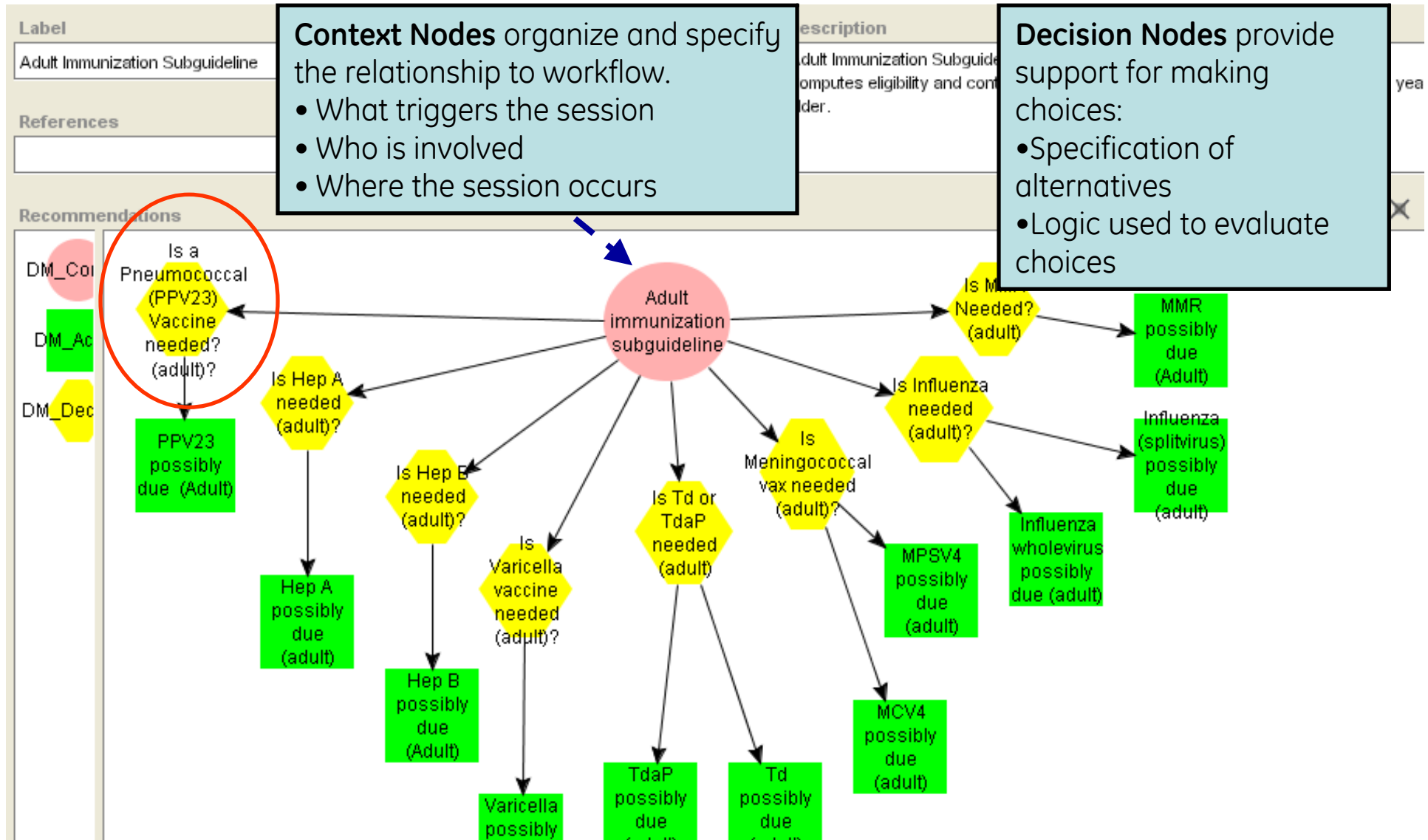
Label	Description
Adult Immunization Subguideline	Adult Immunization Subguideline computes eligibility and contraindications for all vaccines applicable to patient 19 years of age or older.
References	
Recommendations	

**Context Nodes** organize and specify the relationship to workflow.

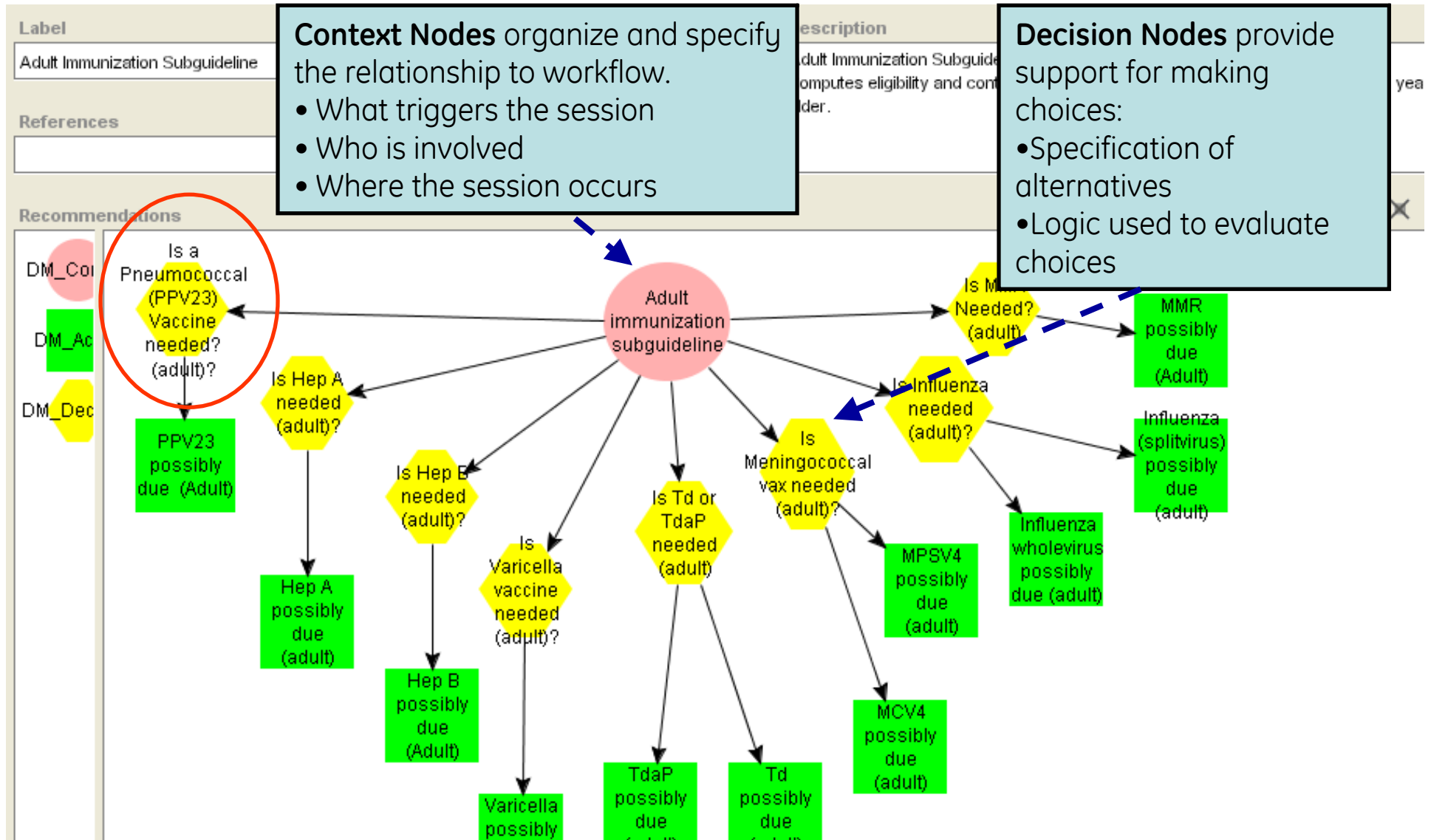
- What triggers the session
- Who is involved
- Where the session occurs



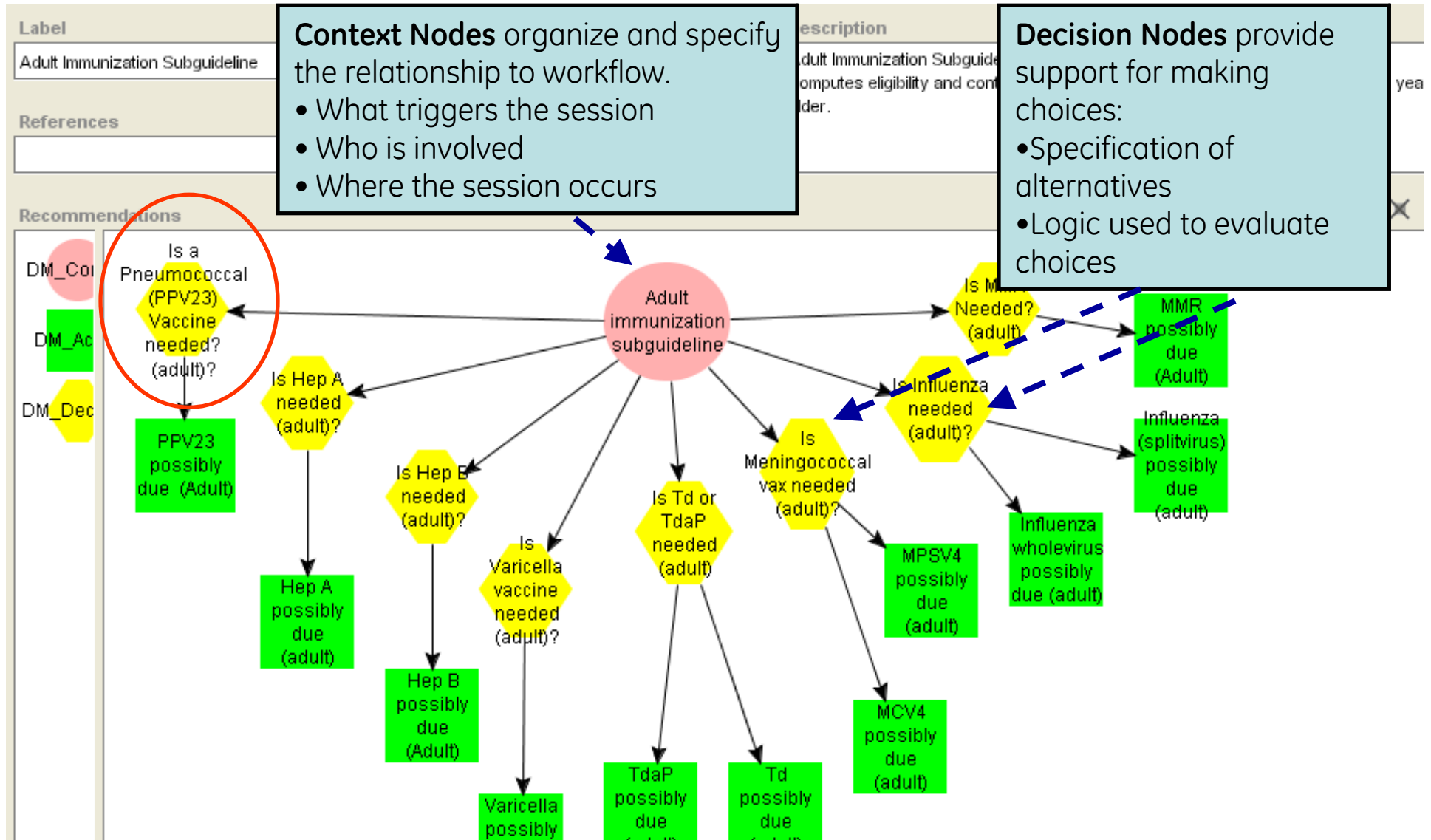
# Concepts in the Encoded Guideline: Protégé



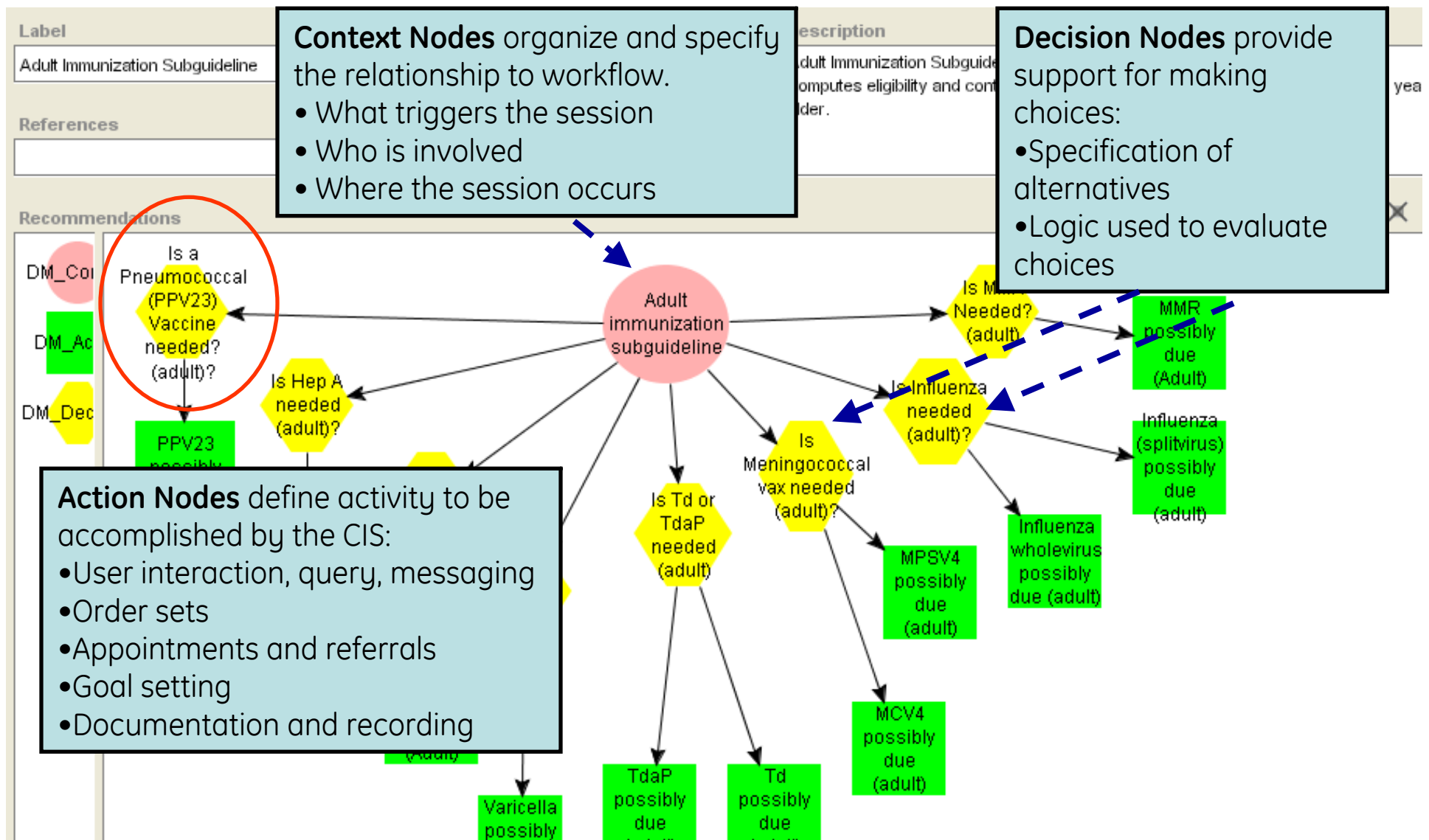
# Concepts in the Encoded Guideline: Protégé



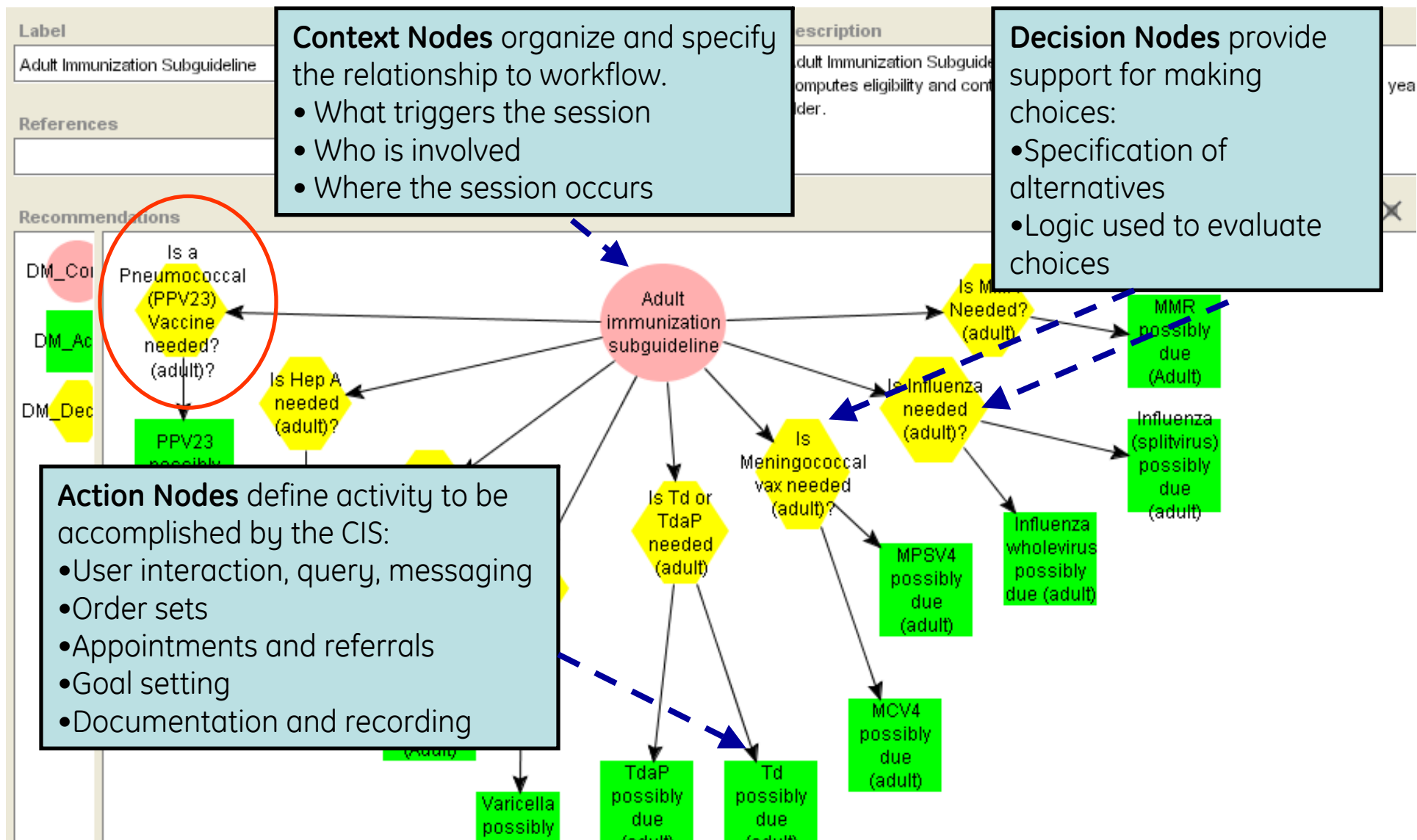
# Concepts in the Encoded Guideline: Protégé



# Concepts in the Encoded Guideline: Protégé



# Concepts in the Encoded Guideline: Protégé



# Adult Pneumococcal Vaccine Logic

Classes PAL Constraints Jess Facet Constraints Apelon DTS

Classes & Instances Forms Instance Tree String Search

**INSTANCE EDITOR**

For Instance: ◆ Pneumococcal (PPV23) vaccine general indications (adult) (instance of N\_ary\_Criterion, internal name is IMMS2004\_00161)

Label  
Pneumococcal (PPV23) vaccine general indications (adult)

Boolean Connective  
OR

Criteria

- ◆ Chronic heart disease
- ◆ Diabetes
- ◆ Hematologic malignancy
- ◆ Chronic renal failure
- ◆ Institutionalized
- ◆ Nephrotic syndrome
- ◆ CSF leak
- ◆ Terminal complement deficiencies
- ◆ Cochlear implant problem history
- ◆ Chronic liver disease
- ◆ Alcoholism
- ◆ Nursing home resident
- ◆ Chronic Pulmonary disease (excludes asthma)
- ◆ Hemodialysis (problem)
- ◆ Patient occupation: Healthcare professional
- ◆ Patient is American Indian or Alaskan native
- ◆ Functional or anatomic asplenia
- ◆ Immunosuppressive conditions

# Adult Pneumococcal Vaccine Logic

The screenshot shows the 'IINSTANCE EDITOR' window for the instance 'Pneumococcal (PPV23) vaccine general indications (adult)'. The interface includes a top navigation bar with tabs for 'Classes', 'PAL Constraints', 'Jess', 'Facet Constraints', and 'Apelon DTS'. Below this are tabs for 'Classes & Instances', 'Forms', 'Instance Tree', and 'String Search'. The main area is divided into two sections: 'Label' and 'Criteria'. The 'Label' section contains a text box with the instance name and a 'Boolean Connective' dropdown menu set to 'OR'. The 'Criteria' section is a list of conditions, each preceded by a diamond icon. The condition 'Functional or anatomic asplenia' is circled in red.

For Instance: ◆ Pneumococcal (PPV23) vaccine general indications (adult) (instance of N\_ary\_Criterion, internal name is IMMS2004\_00161)

Label  
Pneumococcal (PPV23) vaccine general indications (adult)

Boolean Connective  
OR

Criteria

- ◆ Chronic heart disease
- ◆ Diabetes
- ◆ Hematologic malignancy
- ◆ Chronic renal failure
- ◆ Institutionalized
- ◆ Nephrotic syndrome
- ◆ CSF leak
- ◆ Terminal complement deficiencies
- ◆ Cochlear implant problem history
- ◆ Chronic liver disease
- ◆ Alcoholism
- ◆ Nursing home resident
- ◆ Chronic Pulmonary disease (excludes asthma)
- ◆ Hemodialysis (problem)
- ◆ Patient occupation: Healthcare professional
- ◆ Patient is American Indian or Alaskan native
- ◆ Functional or anatomic asplenia
- ◆ Immunosuppressive conditions

## Functional or Anatomic Asplenia

◆ Functional or anatomic asplenia (instance of N\_ary\_C...

Label

Functional or anatomic asplenia

Boolean Connective

OR ▼

Criteria

- ◆ Functional asplenia
- ◆ Congenital asplenia
- ◆ Sickle cell disease
- ◆ Asplenia syndrome
- ◆ Hyposplenism
- ◆ Splenectomy problem history

## Functional or Anatomic Asplenia

◆ Functional or anatomic asplenia (instance of N\_ary\_C...

Label

Functional or anatomic asplenia

Boolean Connective

OR

Criteria

- ◆ Functional asplenia
- ◆ Congenital asplenia
- ◆ Sickle cell disease
- ◆ Asplenia syndrome
- ◆ Hyposplenism
- ◆ Splenectomy problem history

# Functional Asplenia

Functional asplenia (disorder) [SNOMED CT] (instance of CodedValue)

Name	Documentation	Constraints
Functional asplenia (disorder) [SNOME		

Role: Abstract

Code	DisplayName
38096003	Functional asplenia (disorder)

CodeSystemName	CodeSystem
SNOMED CT	SNOMED CT

CodedSystemVersion

# Functional Asplenia

Functional asplenia (disorder) [SNOMED CT] (instance of CodedValue)

Name	Documentation	Constraints
Functional asplenia (disorder) [SNOME		
Role Abstract		
Code 38096003	Displayname Functional asplenia (disorder)	
CodeSystemName SNOMED CT	CodeSystem SNOMED CT	
CodedSystemVersion		

# SAGE Protégé Tool for Vocab. Inventory

The screenshot shows the SAGE Protégé tool interface. The window title is "ImmunoCycle5\_3v27Neb Protégé 3.1.1". The menu bar includes File, Edit, Project, Window, Apelon, PAL Constraints, Tools, and Help. The toolbar contains various icons for file operations and navigation. The main workspace is divided into several panes:

- Knowledge Acquisition:** Sage, Classes, PAL Constraints, Jess, Facet Constraints, Apelon DTS.
- Knowledge Tree:** Classes & Instances, Forms, Instance Tree, String Search, Instances.

The active file is "sage-database.xml". Below the panes, there are buttons for "run", "reset guideline", and "reset data". A dropdown menu shows "Inpatient hospital admission event".

The main area displays a query and its results in a table:

Query	Value
AdverseReaction:Presence:Allergic Reaction (disorder) [SNOMED CT]:Anaphylaxis (disorder) [SNOMED CT]:Alum (substance) [SNOMED CT]	false
AdverseReaction:Presence:Allergic Reaction (disorder) [SNOMED CT]:Anaphylaxis (disorder) [SNOMED CT]:Diphtheria and tetanus toxoids and acellular pertussis (product) [SNOMED CT]	false
AdverseReaction:Presence:Allergic Reaction (disorder) [SNOMED CT]:Anaphylaxis (disorder) [SNOMED CT]:Diphtheria and tetanus toxoids with pertussis, combined use (product) [SNOMED CT]	false
AdverseReaction:Presence:Allergic Reaction (disorder) [SNOMED CT]:Anaphylaxis (disorder) [SNOMED CT]:Diphtheria toxoid (product) [SNOMED CT]	false
AdverseReaction:Presence:Allergic Reaction (disorder) [SNOMED CT]:Anaphylaxis (disorder) [SNOMED CT]:Diphtheria+tetanus vaccine (product) [SNOMED CT]	false
AdverseReaction:Presence:Allergic Reaction (disorder) [SNOMED CT]:Anaphylaxis (disorder) [SNOMED CT]:Egg protein (substance) [SNOMED CT]	false
AdverseReaction:Presence:Allergic Reaction (disorder) [SNOMED CT]:Anaphylaxis (disorder) [SNOMED CT]:Gelatin (substance) [SNOMED CT]	false

At the bottom, there are tabs for "Steps", "Log", "Results", and "Codes". The "Log" tab is active, showing a list of problem codes:

```

Problem: CODE=SNOMED CT 309465005
Problem: CODE=SNOMED CT 312609001
Problem: CODE=SNOMED CT 313039003
Problem: CODE=SNOMED CT 315550009
Problem: CODE=SNOMED CT 359612003
Problem: CODE=SNOMED CT 36138009
Problem: CODE=SNOMED CT 36989005
Problem: CODE=SNOMED CT 38096003
Problem: CODE=SNOMED CT 398293003
Problem: CODE=SNOMED CT 405843009
Problem: CODE=SNOMED CT 417348000
Problem: CODE=SNOMED CT 42035005
Problem: CODE=SNOMED CT 4740000
Problem: CODE=SNOMED CT 52254009
Problem: CODE=SNOMED CT 52448006
    
```

A "Submit" button is located at the bottom right of the interface.

# SAGE Protégé Tool for Vocab. Inventory

The screenshot shows the SAGE Protégé tool interface. The window title is "ImmunoCycle5\_3v27Neb Protégé 3.1.1". The menu bar includes File, Edit, Project, Window, Apelon, PAL Constraints, Tools, and Help. The toolbar contains various icons for file operations and navigation. The main workspace is divided into several panes:

- Knowledge Acquisition:** Sage, Classes, PAL Constraints, Jess, Facet Constraints, Apelon DTS.
- Knowledge Tree:** Classes & Instances, Forms, Instance Tree, String Search, Instances.

The active file is "sage-database.xml". Below the panes, there are buttons for "run", "reset guideline", "reset data", and a dropdown menu showing "Inpatient hospital admission event".

A query is displayed in a table with two columns: "Query" and "Value".

Query	Value
AdverseReaction:Presence:Allergic Reaction (disorder) [SNOMED CT]:Anaphylaxis (disorder) [SNOMED CT]:Alum (substance) [SNOMED CT]	false
AdverseReaction:Presence:Allergic Reaction (disorder) [SNOMED CT]:Anaphylaxis (disorder) [SNOMED CT]:Diphtheria and tetanus toxoids and acellular pertussis (product) [SNOMED CT]	false
AdverseReaction:Presence:Allergic Reaction (disorder) [SNOMED CT]:Anaphylaxis (disorder) [SNOMED CT]:Diphtheria and tetanus toxoids with pertussis, combined use (product) [SNOMED CT]	false
AdverseReaction:Presence:Allergic Reaction (disorder) [SNOMED CT]:Anaphylaxis (disorder) [SNOMED CT]:Diphtheria toxoid (product) [SNOMED CT]	false
AdverseReaction:Presence:Allergic Reaction (disorder) [SNOMED CT]:Anaphylaxis (disorder) [SNOMED CT]:Diphtheria+tetanus vaccine (product) [SNOMED CT]	false
AdverseReaction:Presence:Allergic Reaction (disorder) [SNOMED CT]:Anaphylaxis (disorder) [SNOMED CT]:Egg protein (substance) [SNOMED CT]	false
AdverseReaction:Presence:Allergic Reaction (disorder) [SNOMED CT]:Anaphylaxis (disorder) [SNOMED CT]:Gelatin (substance) [SNOMED CT]	false

Below the query table, there are tabs for "Steps", "Log", "Results", and "Codes". The "Codes" tab is active, displaying a list of SNOMED CT codes:

- Problem: CODE=SNOMED CT 309465005
- Problem: CODE=SNOMED CT 312609001
- Problem: CODE=SNOMED CT 313039003
- Problem: CODE=SNOMED CT 315550009
- Problem: CODE=SNOMED CT 359612003
- Problem: CODE=SNOMED CT 36138009
- Problem: CODE=SNOMED CT 36000005
- Problem: CODE=SNOMED CT 38096003
- Problem: CODE=SNOMED CT 388293003
- Problem: CODE=SNOMED CT 405843009
- Problem: CODE=SNOMED CT 417348000
- Problem: CODE=SNOMED CT 42035005
- Problem: CODE=SNOMED CT 4740000
- Problem: CODE=SNOMED CT 52254009
- Problem: CODE=SNOMED CT 52448006

The code "38096003" is circled in red. A "Submit" button is located at the bottom right of the interface.

## Guideline Concepts ↔ Patient Record

- Concepts must be defined in order to find them in the electronic patient record
- There is variation in data representation across EMRs
  - Concepts used
  - Structures to hold concepts
  - Usage customs
- A standard representation allows translation of concepts for inclusion in database queries

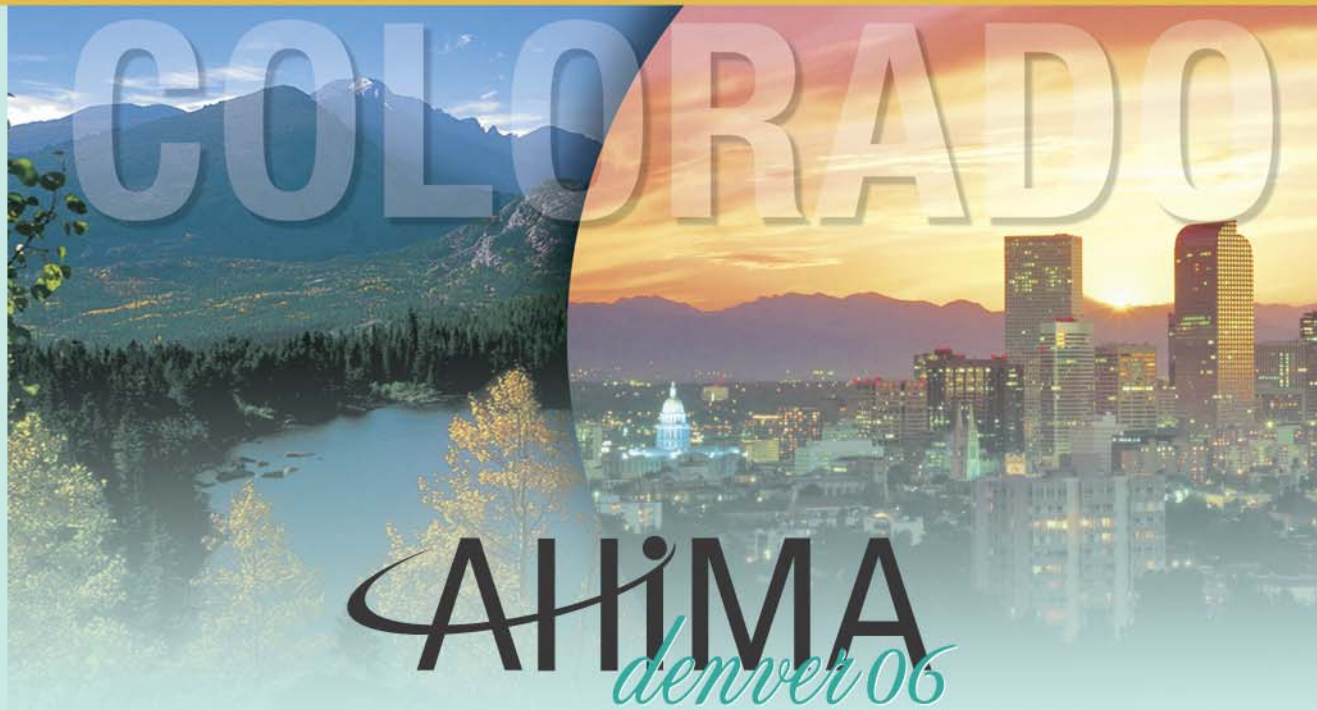
## Example: Possible Representations of a Patient's Diabetes Mellitus

- Entry on Problem List
  - Diabetes Mellitus type II
- Observation
  - Lab Value of Fasting Glucose > 125 mg/dL or
  - Lab value for two-hour 75-g oral glucose tolerance test > 200 mg/dL
- Entry in Diagnoses & Procedures list
  - Diabetes Mellitus type II

## Example: Possible Representations of a Patient's Diabetes Mellitus

- Entry on Problem List
  - Diabetes Mellitus type II
- Observation
  - Lab Value of Fasting Glucose  $> 125$  mg/dL or
  - Lab value for two-hour 75-g oral glucose tolerance test  $> 200$  mg/dL
- Entry in Diagnoses & Procedures list
  - Diabetes Mellitus type II

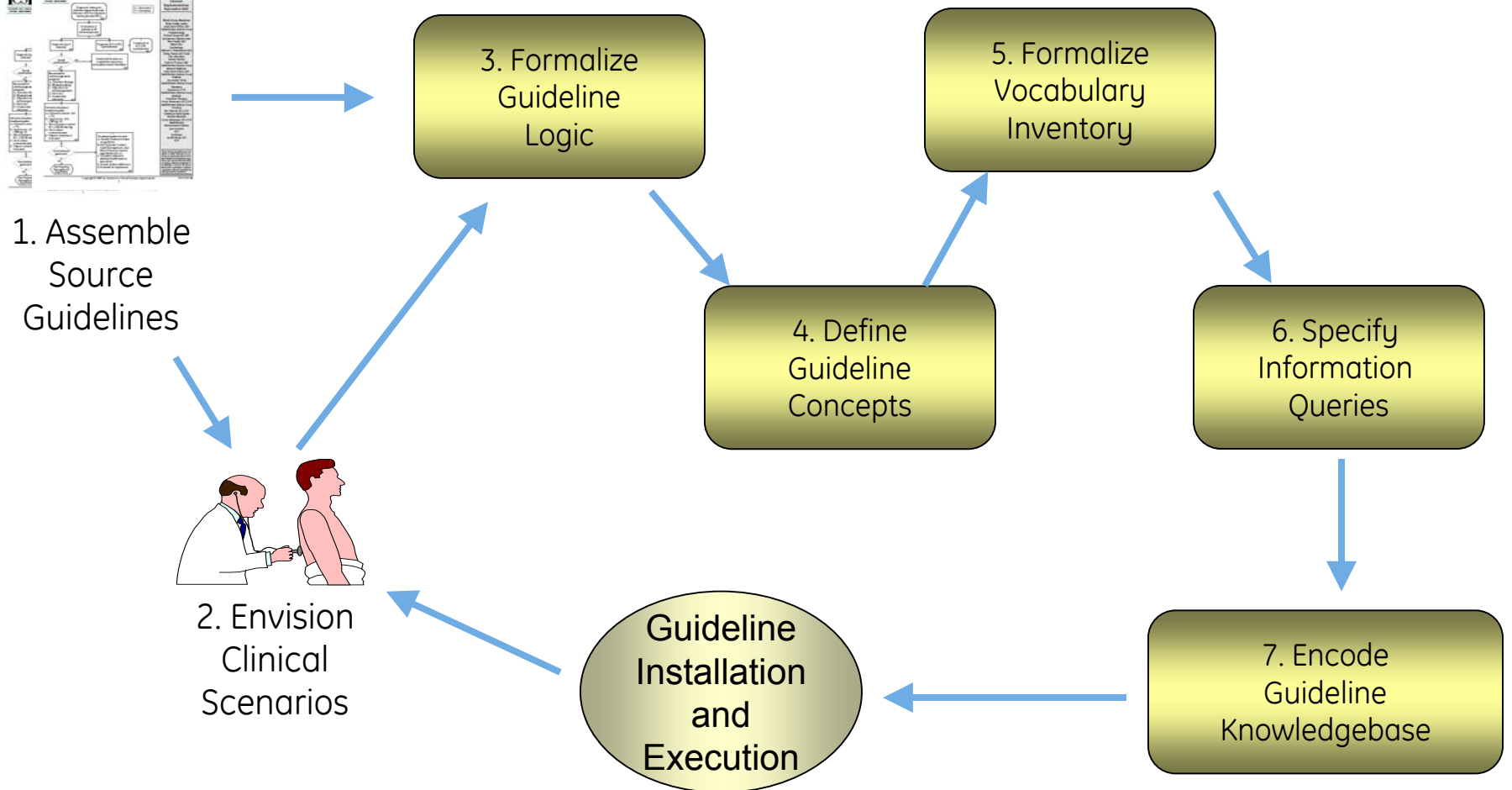
**Data engineers must map standard guideline concept representations to local concepts and structures**



Annual Convention and Exhibit  
October 7--12, 2006

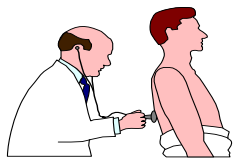
## Making terminology work locally

Mark Nyman, MD





1. Assemble Source Guidelines



2. Envision Clinical Scenarios

3. Formalize Guideline Logic

4. Define Guideline Concepts

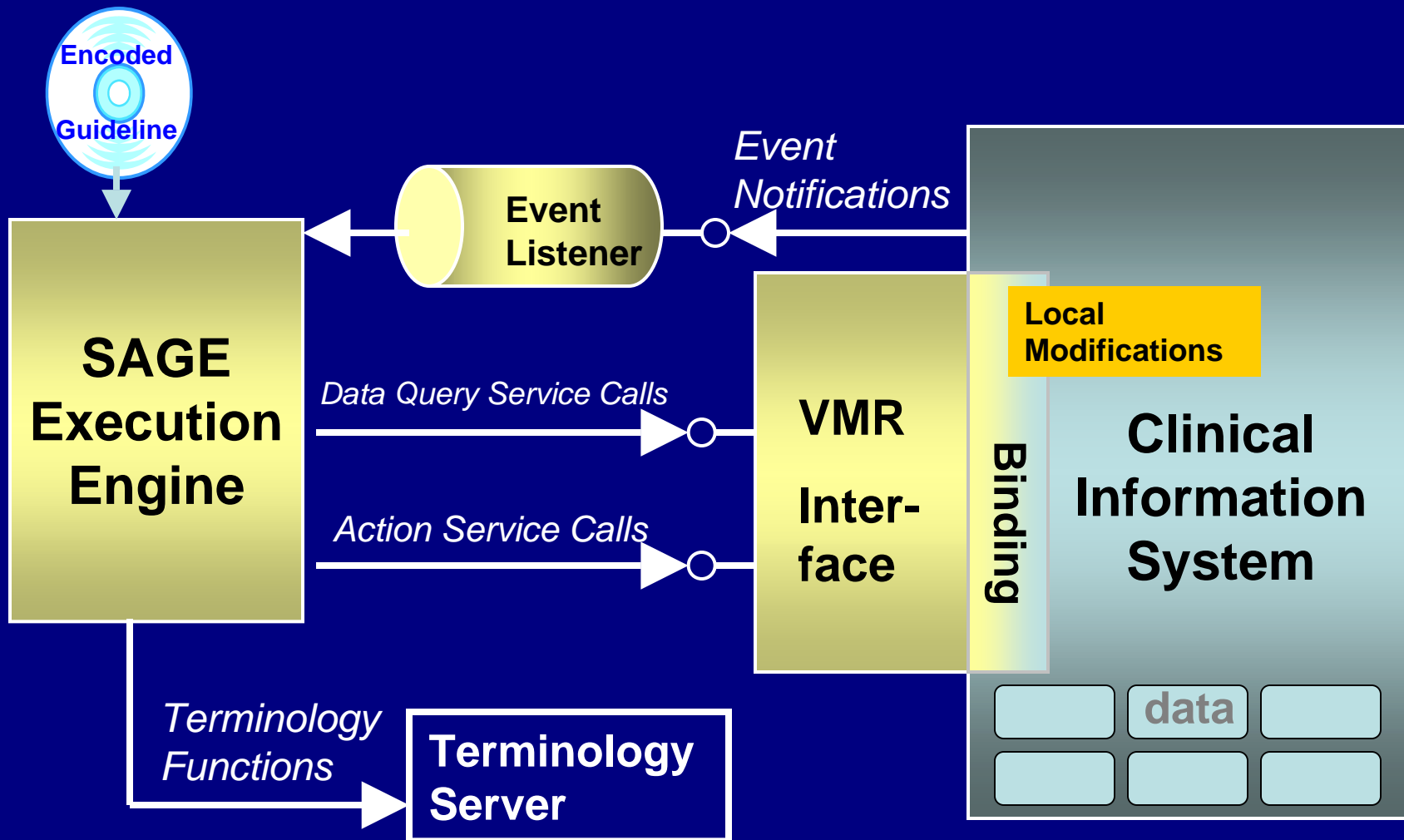
5. Formalize Vocabulary Inventory

6. Specify Information Queries

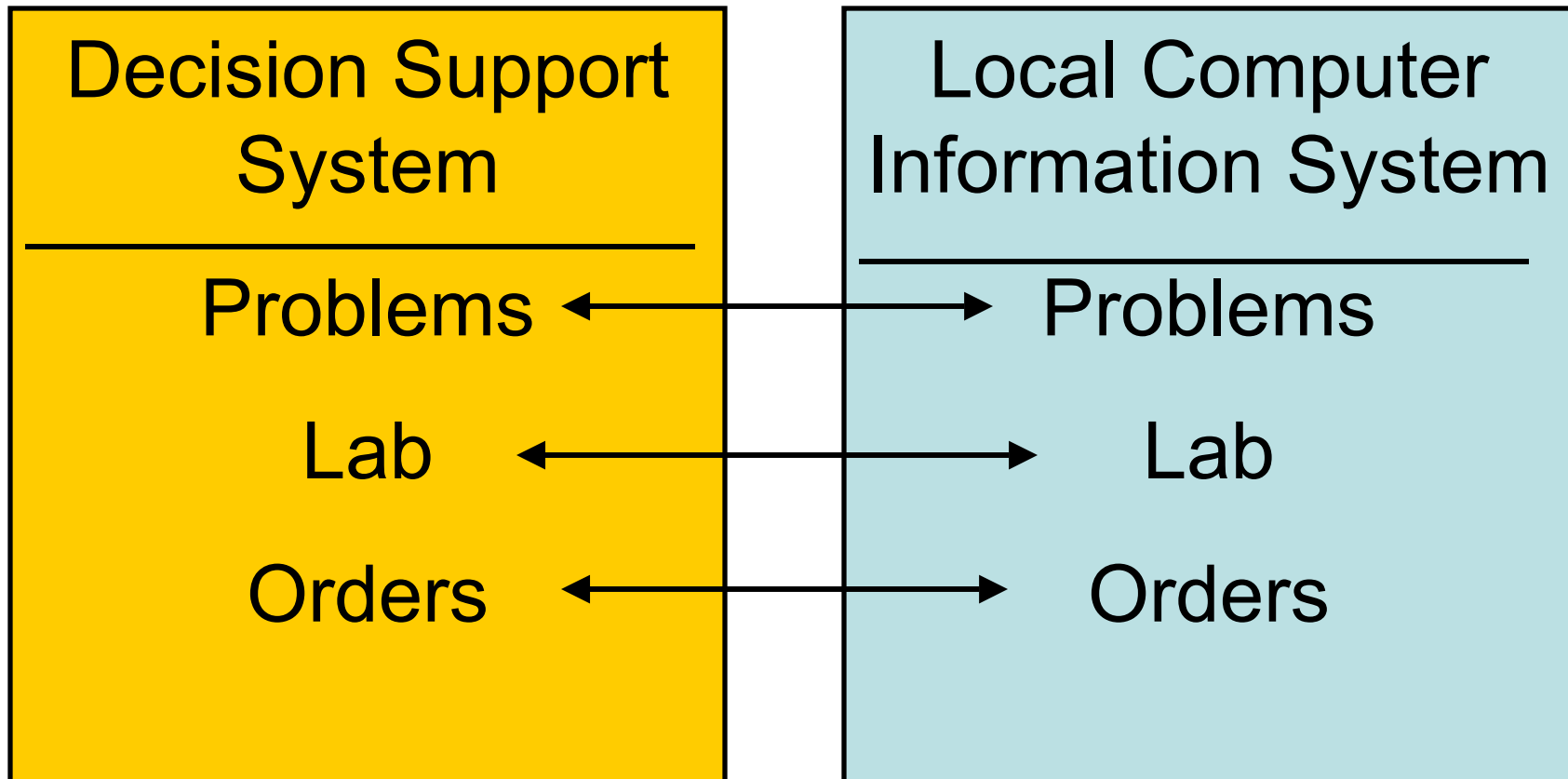
7. Encode Guideline Knowledgebase

Guideline Installation and Execution

# SAGE Guideline Deployment System Execution Architecture



# Mapping



# Example: Mapping of Problems

Diabetes



## SNOMED: diabetes

<input checked="" type="checkbox"/>	73211009	diabetes mellitus
<input type="checkbox"/>	237620003	abnormal metabolic state in diabetes mellitus
<input type="checkbox"/>	11530004	brittle diabetes
<input type="checkbox"/>	70694009	diabetes mellitus AND insipidus with optic atrophy AND deafness
<input type="checkbox"/>	5969009	diabetes mellitus associated with genetic syndrome
<input type="checkbox"/>	91352004	diabetes mellitus due to structurally abnormal insulin
<input type="checkbox"/>	199223000	diabetes mellitus during pregnancy, childbirth and the puerperium
<input type="checkbox"/>	190324002	diabetes mellitus NOS with no mention of complication
<input type="checkbox"/>	46635009	diabetes mellitus type 1
<input type="checkbox"/>	44054006	diabetes mellitus type 2
<input type="checkbox"/>	372069003	diabetes mellitus with complication
<input type="checkbox"/>	190321005	diabetes mellitus with no mention of complication
<input type="checkbox"/>	190417004	diabetes mellitus with other specified manifestation
<input type="checkbox"/>	111552007	diabetes mellitus without complication
<input type="checkbox"/>	123763000	Houssay's syndrome
<input type="checkbox"/>	408539000	insulin autoimmune syndrome
<input type="checkbox"/>	359939009	maternal diabetes mellitus
<input type="checkbox"/>	49817004	neonatal diabetes mellitus
<input type="checkbox"/>	190336008	other specified diabetes mellitus with coma
<input type="checkbox"/>	190382000	other specified diabetes mellitus with multiple complications
<input type="checkbox"/>	190420007	other specified diabetes mellitus with other specified complications
<input type="checkbox"/>	33559001	pineal hyperplasia AND diabetes mellitus syndrome
<input type="checkbox"/>	82260000	Pregestational diabetes mellitus AND/OR impaired glucose tolerance, modified White classification
<input type="checkbox"/>	8801005	secondary diabetes mellitus
<input type="checkbox"/>	190383005	unspecified diabetes mellitus with multiple complications
<input type="checkbox"/>	275918005	unstable diabetes
<input type="checkbox"/>	191045007	[X]Other specified diabetes mellitus
<input type="checkbox"/>	200505002	[X]Pre-existing diabetes mellitus, unspecified
<input type="checkbox"/>	191048009	[X]Unspecified diabetes mellitus with renal complications

## Local CIS

2202566	DM	2202588	DM Type1 Nephrotic Syndrome
2202567	DM Type2	2202589	DM Type1 Nephropathy
2202568	DM w/o Complications	2202590	DM Type2 Nephropathy Uncontrolled
2202569	DM Type1	2202591	DM Type1 Nephropathy Uncontrolled
2202570	DM Type2 Uncontrolled	2202592	DM Retinopathy
2202571	DM Type1 Uncontrolled	2202593	DM Retinopathy Proliferative
2202572	DM Ketoacidosis	2202594	DM Type2 Cataract
2202573	DM Type2 Ketoacidosis	2202596	DM Retinopathy Background
2202574	DM Type1 Ketoacidosis	2202598	DM Retinopathy Macular Edema
2202577	DM Type2 Hyperosmolarity	2202599	DM Type2 Retinopathy
2202578	DM Type1 Hyperosmolarity	2202600	DM Type2 Retinopathy Background
2202581	DM Coma	2202601	DM Type2 Retinopathy Prolif

## MAP

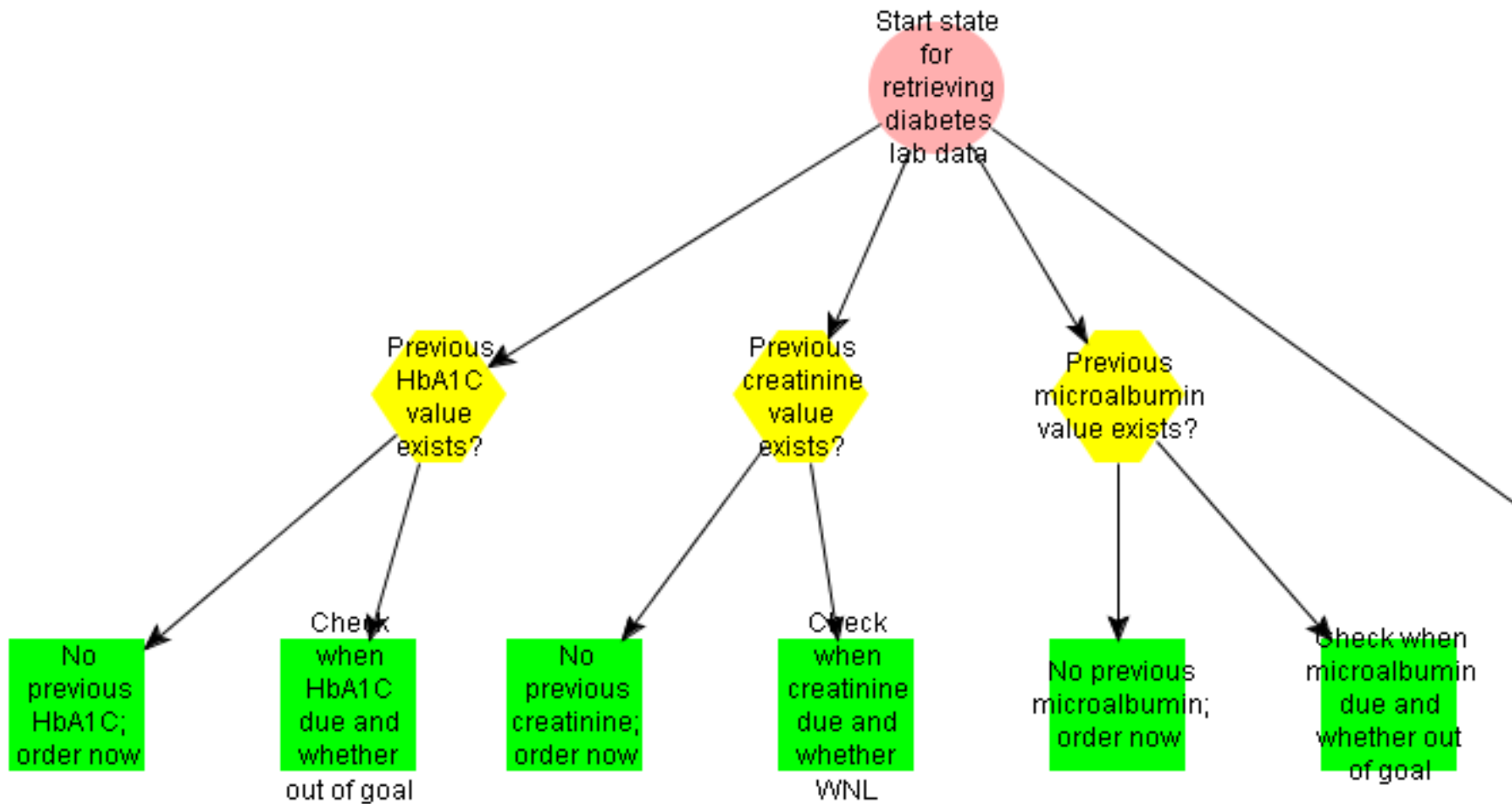
SNOMED #	Term	CIS #	Description
46635009	Diabetes mellitus type 1	2202569	DM type 1
44054006	Diabetes mellitus type 2	2202567	DM type 2

# Example: Mapping of Lab Observations

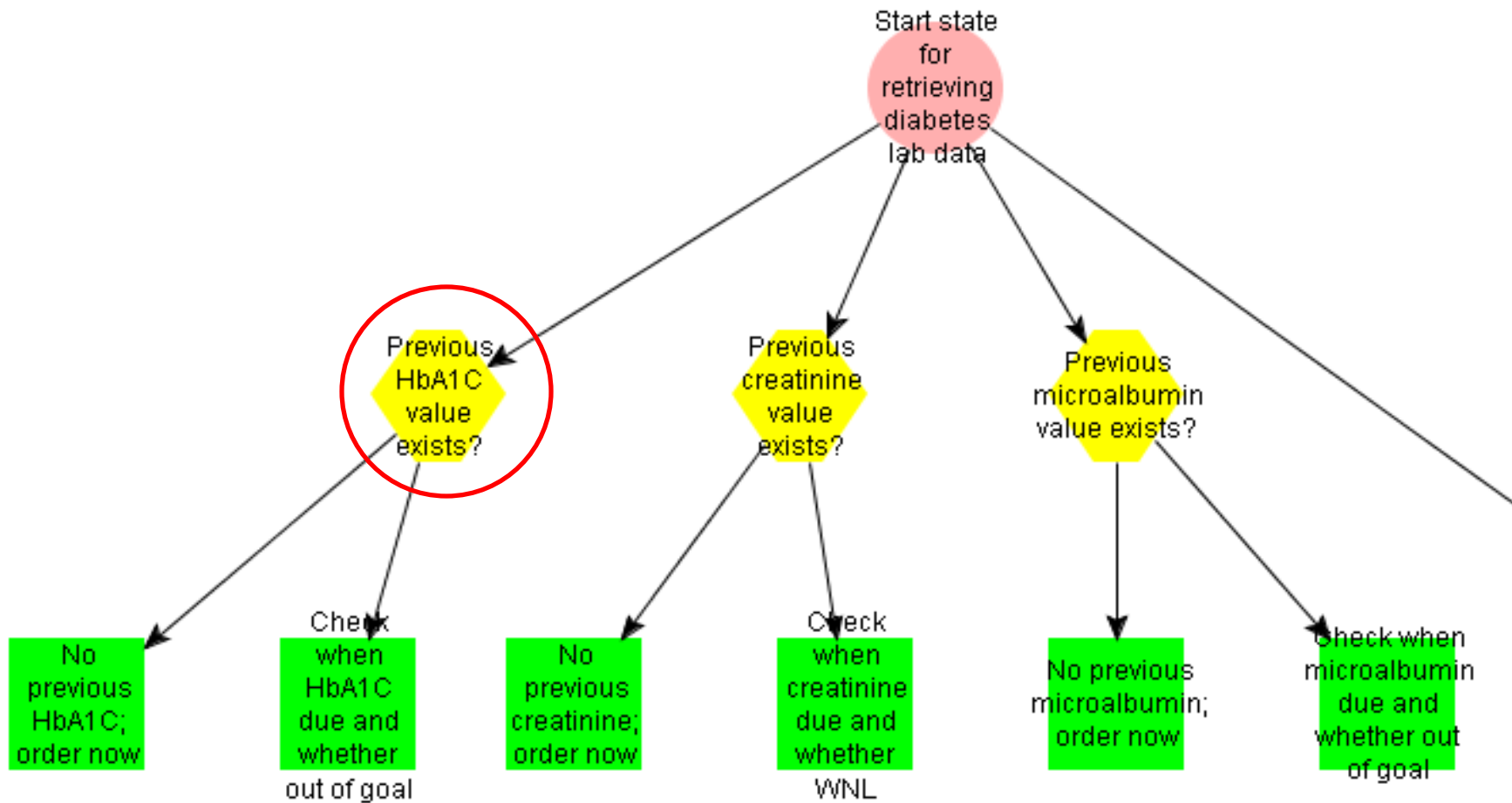
Hgb A1c



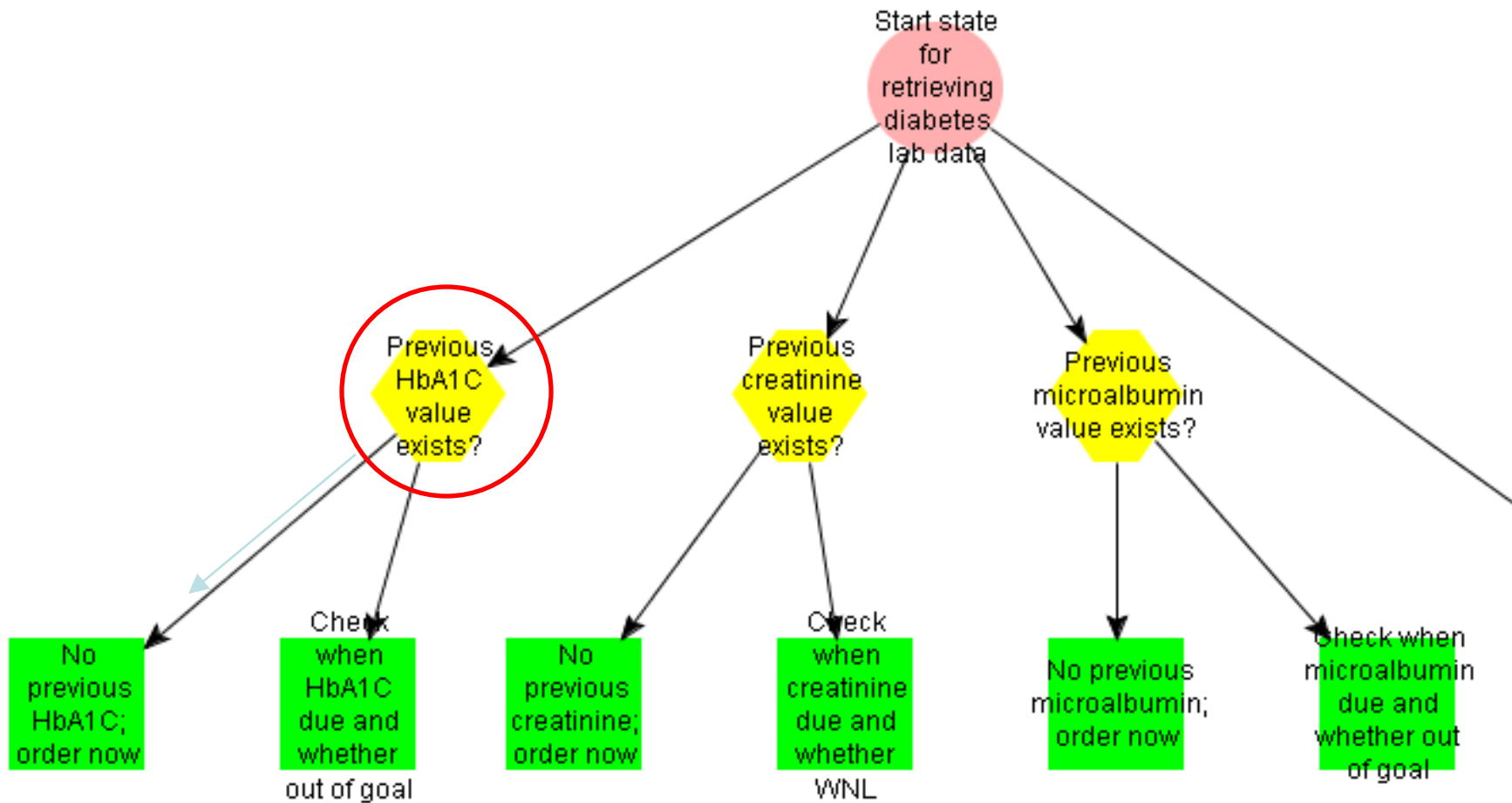
# Retrieve Sub-guideline



# Retrieve Sub-guideline



# Retrieve Sub-guideline



## Mayo Lab Code for Hgb A1c

LOINC	Unit code name	Unit code	Performed/reported
4548-4	Hemoglobin A1C, B	82080	Central Clinical Lab/in MICS
4548-4	Hemoglobin A1C, B	80947	Clinical Trials/not in MICS
4548-4	Hemoglobin A1C, B	124055	New England/not in MICS
4548-4	Hemoglobin A1C, B	82990	Kasson/in MICS

## Mayo Lab Code for Hgb A1c

LOINC	Unit code name	Unit code	Performed/reported
4548-4	Hemoglobin A1C, B	82080	Central Clinical Lab/in MICS
4548-4	Hemoglobin A1C, B	80947	<del>Clinical Trials/not in MICS</del>
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4548-4	Hemoglobin A1C, B	80947	<del>Clinical Trials/not in MICS</del>
4548-4	Hemoglobin A1C, B	124055	<del>New England/not in MICS</del>
4548-4	Hemoglobin A1C, B	82990	Kasson/in MICS

## Translation Table

/mapping/@context	/mapping/from/concept	/mapping/from/concept/@label	/mapping/to/@label	Mayo Lab Code	/mapping/to
observation	LOINC:4548-4	Hemoglobin A1C	Hemoglobin A1C, B (Rochester)	82080-ROCLIS	6105267
			Hemoglobin A1C, B (Kasson)	82990-ROCLIS	6105673

## Translation Table

/mapping/@context	/mapping/from/concept	/mapping/from/concept/@label	/mapping/to/@label	Mayo Lab Code	/mapping/to
observation	LOINC:4548-4	Hemoglobin A1C	Hemoglobin A1C, B (Rochester)	82080-ROCLIS	6105267
			Hemoglobin A1C, B (Kasson)	82990-ROCLIS	6105673
observation	LOINC:17855-8	Hemoglobin A1C, calculated	Hemoglobin A1C, B	15958-ROCLIS	6112899

## Translation Table

/mapping/@context	/mapping/from/concept	/mapping/from/concept/@label	/mapping/to/@label	Mayo Lab Code	/mapping/to
observation	LOINC:4548-4	Hemoglobin A1C	Hemoglobin A1C, B (Rochester)	82080-ROCLIS	6105267
			Hemoglobin A1C, B (Kasson)	82990-ROCLIS	6105673
			Hemoglobin A1C, B	15958-ROCLIS	6112899

# Example: Mapping of Lab Orders

Hgb A1c



# Instance of Order

Order HbA1C (instance of Order, internal name is SAGEDiabetes\_01586)

<b>Label</b>	<b>Condition</b>
Order HbA1C	No existing order for HbA1C
<b>Code</b>	<b>Vmr Class</b>
HEMOGLOBIN A1C/HEMOGLOBIN.TOTAL:MFR:PT:BLD:QN:...	VMROrder
<b>EffectiveTime</b>	<b>PriorityCode</b>
<b>RepeatNumber</b>	<b>Order Frequency</b>
<b>Nurse Or Lab Draw</b>	<b>Department Responsible For Order</b>

Always Display

## Translation Table

/mapping/@cont ext	/mapping/ from/concept	/mapping/from/ concept/@label	/mapping/to/@l abel	Mayo Lab Code	/mapping/to
order	LOINC:4 548-4	Hemoglobin A1C	Hemoglobin A1C,B	82080- ROCLISO	XSERVI #

## Mapping Challenges

- Mismatch in vocabularies
- Mismatch of data representation
- Absence of data elements in the CIS

## Potential Solutions

- Mismatch in vocabularies
  - Petition change in standard
  - Change local vocabulary
- Mismatch of data representation
  - Search the problem list
- Absence of data elements in the CIS
  - Query the user
  - Accept absence

Thanks for your attention..  
Questions?