CDS needs NLP—because we need to be looking not just where the light is

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We know how to do rules well

IF:

An order for a contrast-enhanced FLUOROSCOPY is received AND

The patient’s serum BUN level is HIGH AND

The patient’s serum CREATININE level is HIGH,

THEN:

Send a message to the patient's physician via electronic mail indicating a possible adverse effect of contrast agent use in this setting.

Which means we're really good at identifying

- Drug–drug interactions
- Contraindicated drugs
- Alternative medications at time of order entry
- Abnormal laboratory results
- Opportunities for immunizations or preventive services

But we continue to look for our keys where the light is

- We are really good at finding CDS opportunities that are amenable to rule-based solutions that act on coded data
- We blithely ignore that rule bases are “brittle” and hard to for developers to maintain
- We are not yet addressing the decision-support challenges required by an aging patient population

Where simple rules fail us

- Guidelines for chronic disease where
  - Treatment unfolds over time
  - Interventions depend on response to previous therapy and the state of the disease
- Attempting to apply evidence-based practice in the setting of
  - Polypharmacy
  - Multimorbidity
- Making decisions when there are no guidelines

WINDOW FRAME

ATHENA Hypertension Advisory

References Sources

Patient Name XXXX-XX-XXXX View Patient Summary

Recommendations | Lifestyle | Adherence | Assumptions | Patient Summary

! Blood Pressure apparently not under control:
Based on last measurement of **145/92** taken 87 days ago on mm/dd/yyyy

CARDIO RISK FACTOR* **23% High**

*Estimated 10 Year cardiovascular risk factor for this patient Explain

Enter a new BP: [ ] Update
Date: MM/DD/YR Write back to Vista

Recommendations

Other Patient Information and Alerts

- Consider intensifying drug treatment: **BP Elevated** based on most recent available BP
- There appears to be a **Strong Contraindication** to a currently prescribed drug, evaluate clinical significance
- Bronchospasm is a **Strong Contraindication** or use of beta adrenergic receptor antagonists, although many patients tolerate and teherefore benefit from this drug therapy

Review lifestyle modifications with the patient. See the Lifestyle page.

Therapeutic Possibilities (CLICK FOR IMPORTANT PRESCRIPTION INFORMATION)	Indications	Contraindications
Discontinue atenolol	Heart Failure EVIDENCE CKD	Brochospastic disease
AND start one of the following drugs		
ACE Inhibitors (lisinporil)	Heart Failure EVIDENCE CKD EVIDENCE	
(non-DHP) Calcium Channel Blocker (diltiazem)	CKD	Heart Failure
Add one or more of the following drugs		
ACE Inhibitors (lisinporil)	Heart Failure EVIDENCE CKD EVIDENCE	
(non-DHP) Calcium Channel Blocker (diltiazem)	CKD	Heart Failure
Increase dosage of hydroclorothiazide		

Compelling Indication Relative Indication Relative Contraindication Strong Contraindication Adverse Effects

Don't forget you know the patient better than we do message utpat lorem ipsum dolor sit amet, consecteteur adipiscing

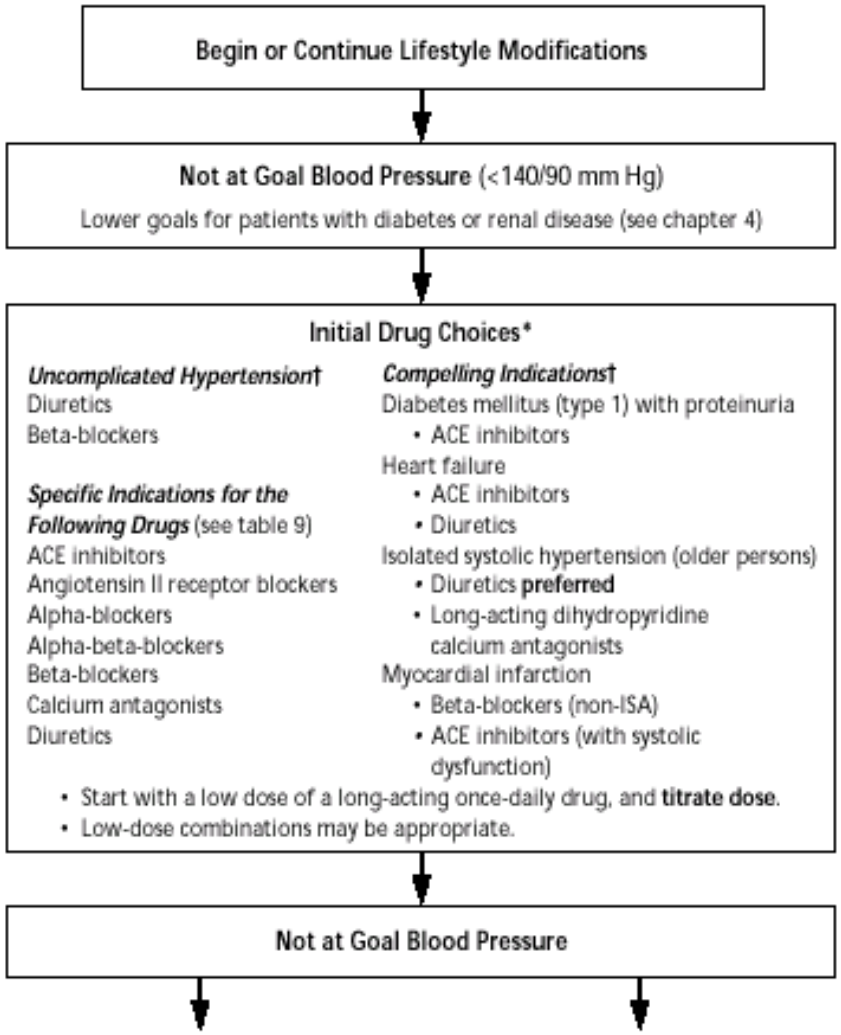
Blood Pressure and Prescription History

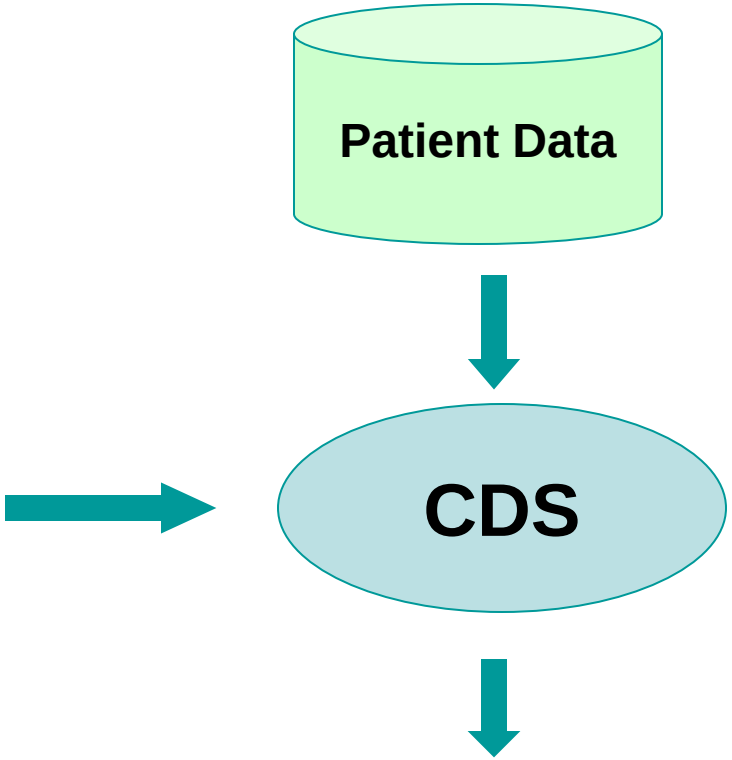
Do you have feedback for the Research team? Thank you!

[ ]

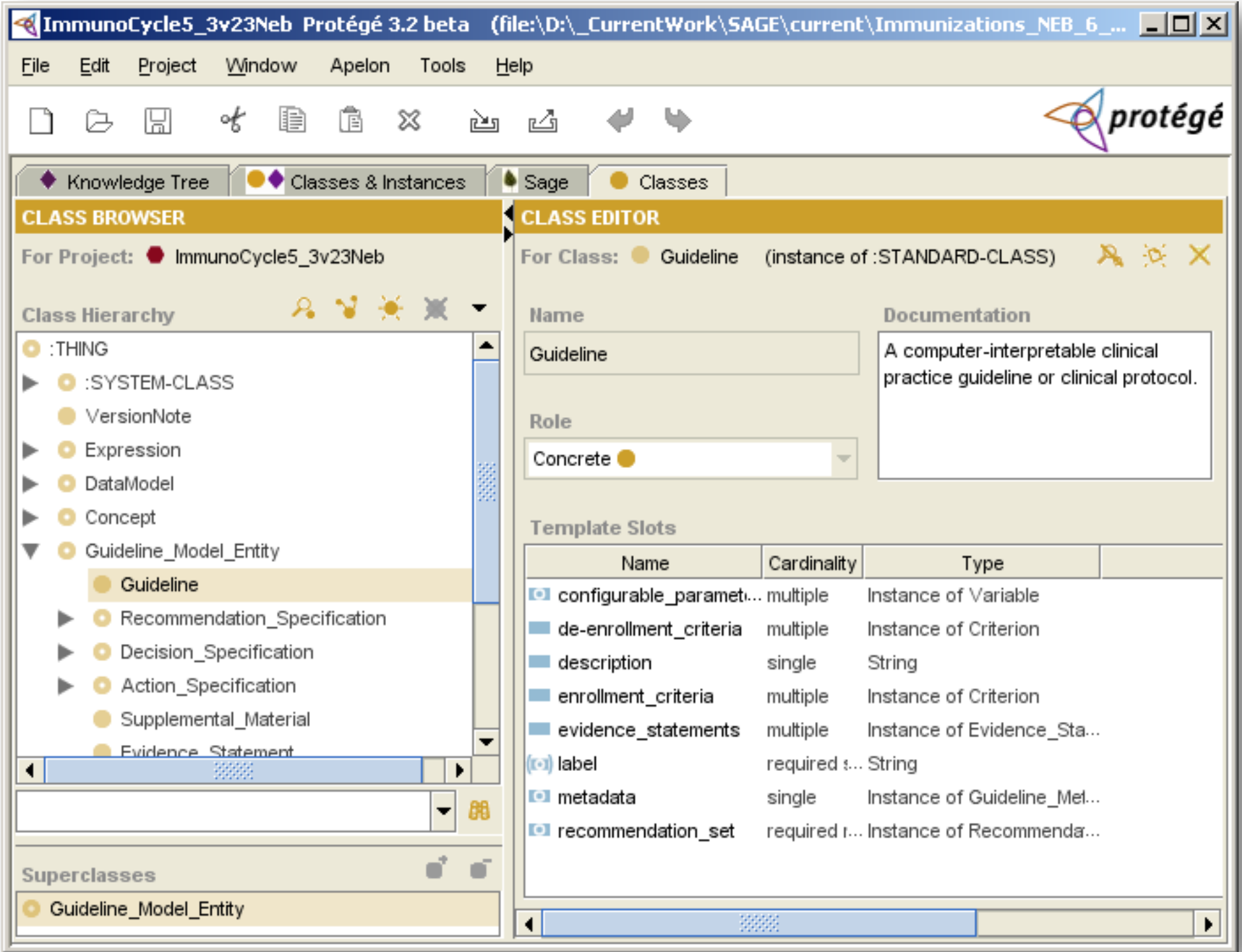
Do not display advisory for this clinic visit again Exit

ATHENA is driven by coded data





Consider adding an ACE Inhibitor because of a compelling indication (heart failure)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protégé
Knowledge Tree
Classes & Instances
Sage
Classes
CLASS BROWSER
For Project: ImmunoCycle5_3v23Neb
Class Hierarchy
:THING
:SYSTEM-CLASS
VersionNote
Expression
DataModel
Concept
Guideline_Model_Entity
Guideline
Recommendation_Specification
Decision_Specification
Action_Specification
Supplemental_Material
Evidence_Statement
Superclasses
Guideline_Model_Entity
CLASS EDITOR
For Class: Guideline (instance of :STANDARD-CLASS)
Name
Guideline
Documentation
A computer-interpretable clinical practice guideline or clinical protocol.
Role
Concrete
Template Slots
Name
Cardinality
Type
configurable_paramet...
multiple
Instance of Variable
de-enrollment_criteria
multiple
Instance of Criterion
description
single
String
enrollment_criteria
multiple
Instance of Criterion
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Instance of Guideline_Mel...
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Identifier

VA/JNC-VII Hypertension Guideline

Title

The clinical information from this system is advisory only and is intended to supplement the knowledge of health care professionals regarding the management of hypertension. It is not intended to replace sound clinical judgment or individualized patient care in delivery of healthcare services.

Authors

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Susana Martins, MD MSc

Version

February, 2009

Eligibility Criteria

- presence of diagnosis of hypertension
- absence of renovascular disease
- no diagnosis of pregnancy
- Absense of Secondary Hypertension
- absence of spinal cord injury

Clinical Algorithm

- hypertension management diagram

Goal

- BP target patient with diabetes mellitus
- BP target for patient without diabetes mellitus

Patient Characterization

- Risk_Group_A
- Risk_Group_B
- Risk_Group_C
- Home_BP

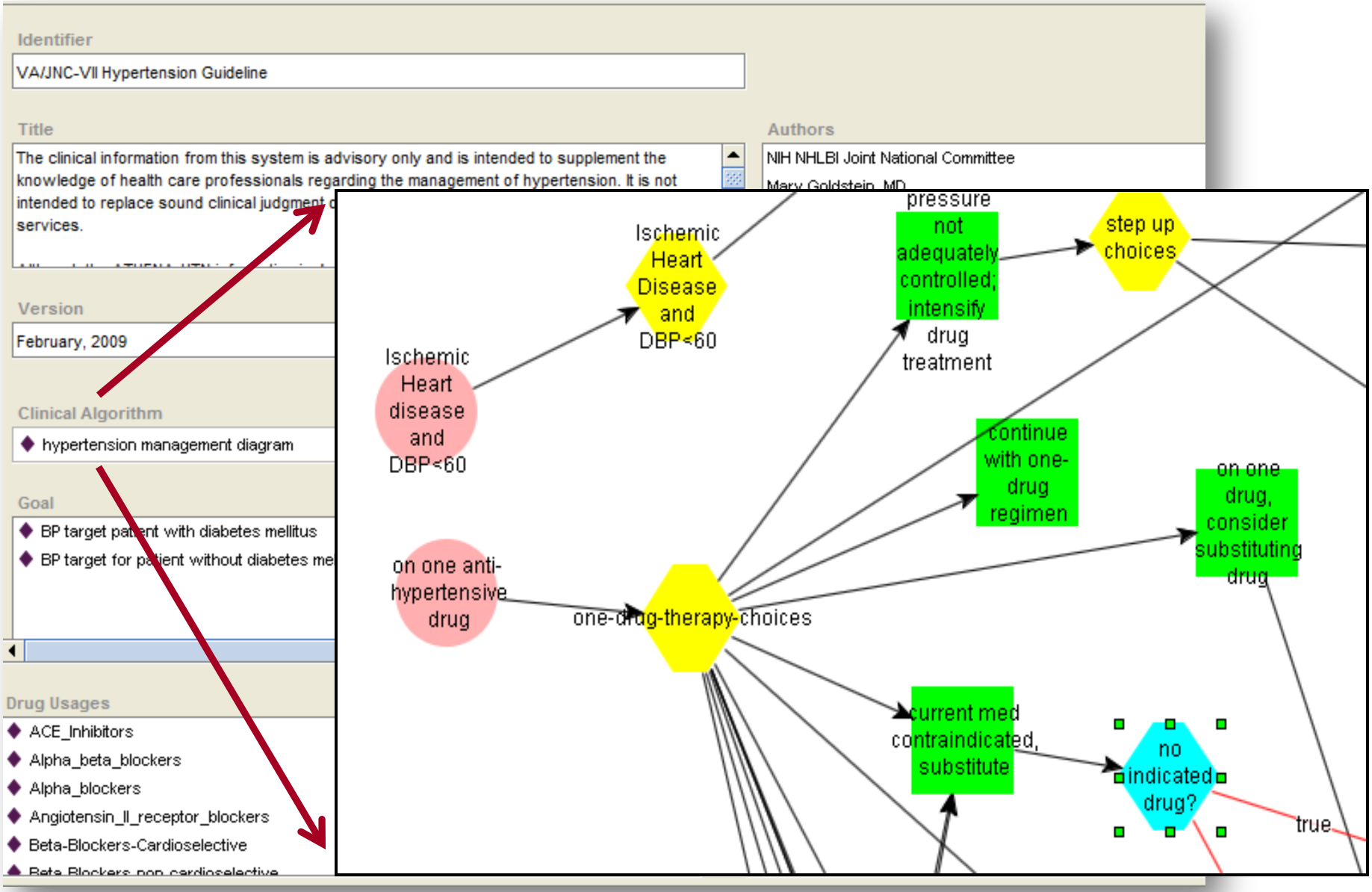
Drug Usages

- ACE_Inhibitors
- Alpha_beta_blockers
- Alpha_blockers
- Angiotensin_II_receptor_blockers
- Beta-Blockers-Cardioselective
- Beta_Blockers_non_cardioselective

Guideline Drugs

- acebutolol
- amiloride
- amlodipine
- amlodipine besylate
- atenolol
- captopril

ATHENA HTN Knowledge Base



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Blood Pressure and Prescription History

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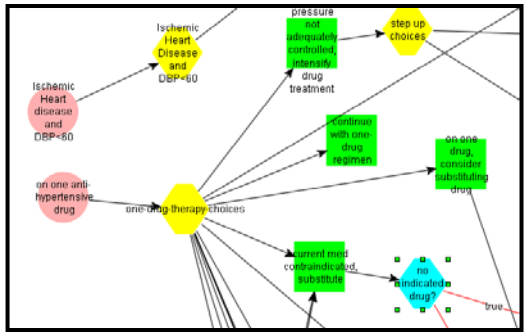
What's missing from the coded data?

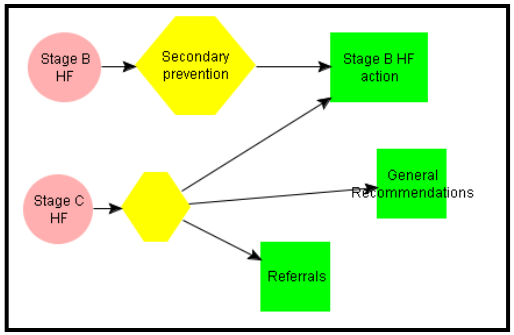
- Patient preferences
- Provider preferences
- Patients' social support and other factors that affect adherence to treatment
- Use of over-the-counter medications and of drugs prescribed elsewhere
- Comorbidity
- The clinical practice guidelines according to which the patient is being treated!

ATHENA addresses individual practice guidelines in isolation

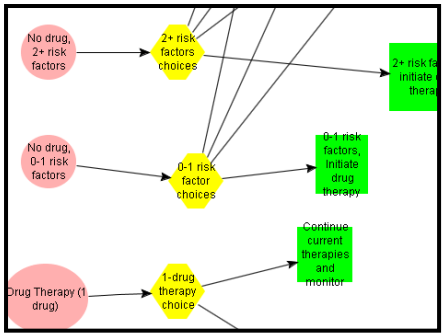
ATHENA Hypertension



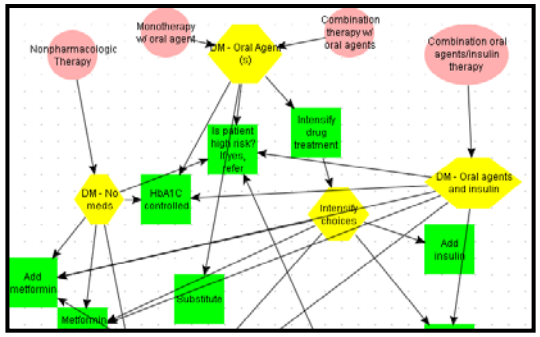
ATHENA Heart Failure



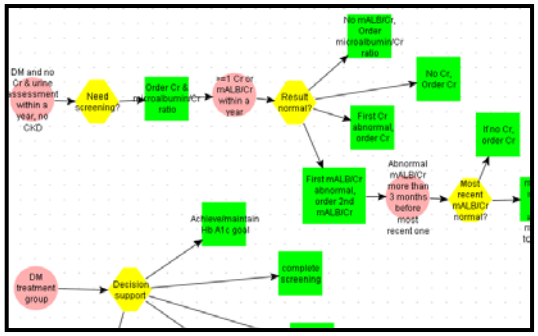
ATHENA Hyperlipidemia



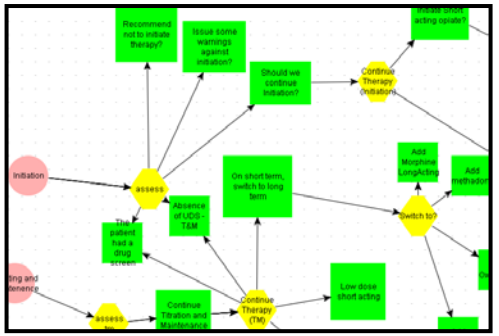
ATHENA Diabetes



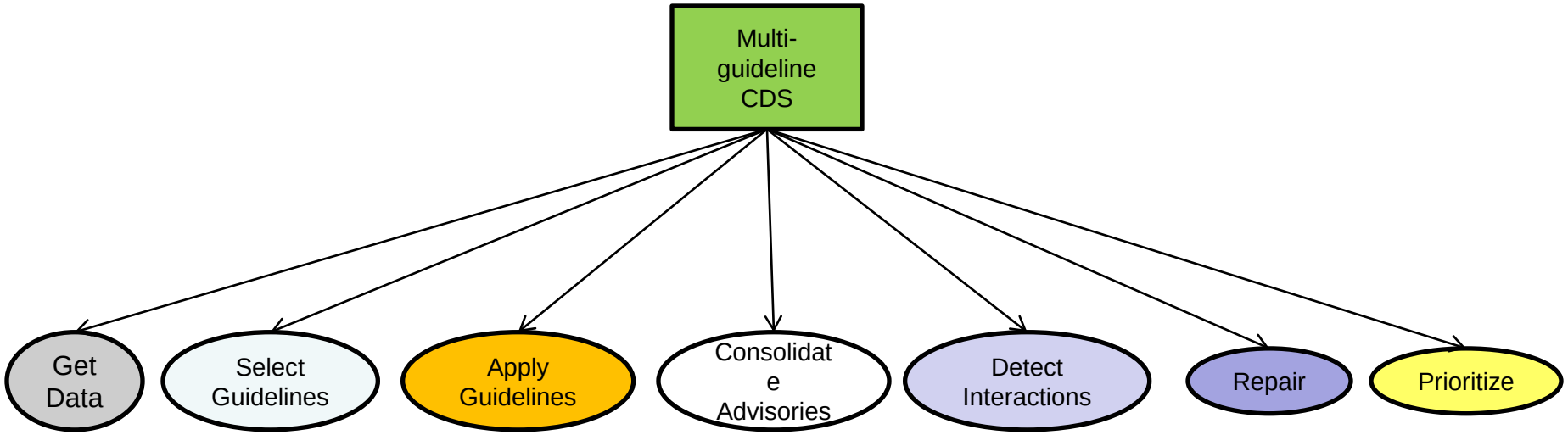
ATHENA Renal Disease



ATHENA Opioid Therapy



New research addresses application of more than one guideline to patients who have co-morbid conditions



But dealing with multiple co-morbidities is hard

- There rarely is evidence to support decision making in the setting of co-morbidity
- Understanding the *relative* effects of co-morbidity on patient functional status involves considerable nuance
- Decision models can become explosively complicated
- Decision making, in the absence of formal evidence, needs to be informed by stored experience with similar complex patients

CDS needs NLP

- To incorporate all the non-coded data that bear on decision making
- To identify historical cases of patients with similar co-morbidity and similar treatment situations
- To help CDS to address all situations for which patients and providers need advice—not just those that can be framed as single situation–action rules

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ENGINEERING A LEARNING HEALTHCARE SYSTEM

A Look at the Future

Workshop Summary

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