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
**ATHENA Hypertension Advisory**

**Recommendations**

- **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*

**Recommendations**

- 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 therefore benefit from this drug therapy

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

**Therapeutic Possibilities**

- **Discontinue atenolol**
  - AND start one of the following drugs
    - **ACE Inhibitors (lisinopril)**
    - **(non-DHP) Calcium Channel Blocker (diltiazem)**
  - Add one or more of the following drugs
    - **ACE Inhibitors (lisinopril)**
    - **(non-DHP) Calcium Channel Blocker (diltiazem)**
  - Increase dosage of hydrochlorothiazide

**Indications**

- **Heart Failure**
- **CKD**

**Contraindications**

- **Brochospastic disease**
- **Heart Failure**

**Blood Pressure and Prescription History**

- **142/90 on [Date]**

**References Sources**

- **Update**

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

**Visit again**

**Exit**
ATHENA is driven by coded data

Patient Data

CDS

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

A computer-interpretable clinical practice guideline or clinical protocol.

Role
Concrete

Template Slots

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VA/JNC-VII Hypertension Guideline

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.

February, 2009

Clinical Algorithm
- hypertension management diagram

Eligibility Criteria
- presence of diagnosis of hypertension
- absence of renovascular disease
- no diagnosis of pregnancy
- Absence of Secondary Hypertension
- absence of spinal cord injury

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

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
- cartopril
ATHENA HTN Knowledge Base

Identifier
VA/JNC-VII Hypertension Guideline

Title
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Authors
NIH NHLBI Joint National Committee
Mary Goldstein, MD

Version
February, 2009

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hypertension management diagram

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

Drug Usages
ACE_Inhibitors
Alpha_beta_blockers
Alpha_blockers
Angiotensin_II_receptor_blockers
Beta-Blockers-Cardioselective
Beta-Blockers_non-cardioselective

Ischemic Heart Disease and DBP<60

pressure not adequately controlled; intensify drug treatment
continue with one-drug regimen
on one drug, consider substituting drug

no indicated drug?
current med contraindicated, substitute

one-drug-therapy choices

on one anti-hypertensive drug

step up choices
**ATHENA Hypertension Advisory**

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

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**Indications**
- Heart Failure (EVIDENCE)
- CKD

**Contraindications**
- Brochospastic disease
- Heart Failure

**Blood Pressure and Prescription History**

**Lisinopril**
- 80 MG
- 50 MG
- 5 MG
- 100 MG
- 80 MG
- 50 MG
- 100 MG

**Date:**
- Jan 05
- July 05
- Jan 06
- July 06
- Today

**Showing 7 of 10 drugs.** See All
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