

# Guideline-Based Decision Support for Hypertension with ATHENA DSS

## Organizational Issues in Implementation

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Views expressed are those of the speaker and not necessarily those of the Department of Veterans Affairs or other funding agencies or affiliated institutions

# Imagine you have a new informatics tool to share...



**Interactive Visualization and Exploration of  
Time-oriented Clinical Data Using a  
Distributed Temporal-Abstraction  
Architecture**

Yuval Shahar, et al 2003  
Available in pubmedcentral

# Where to Start?

- You have a cool new tool to improve quality of health care, for example,
  - to help clinicians with complex decisions
  - to transfer research knowledge into practice faster
  - to help quality managers analyze clinical data
- The IT tool is designed to integrate with the electronic databases/medical record
- How to get started implementing it?

# Goals/Objectives of Session

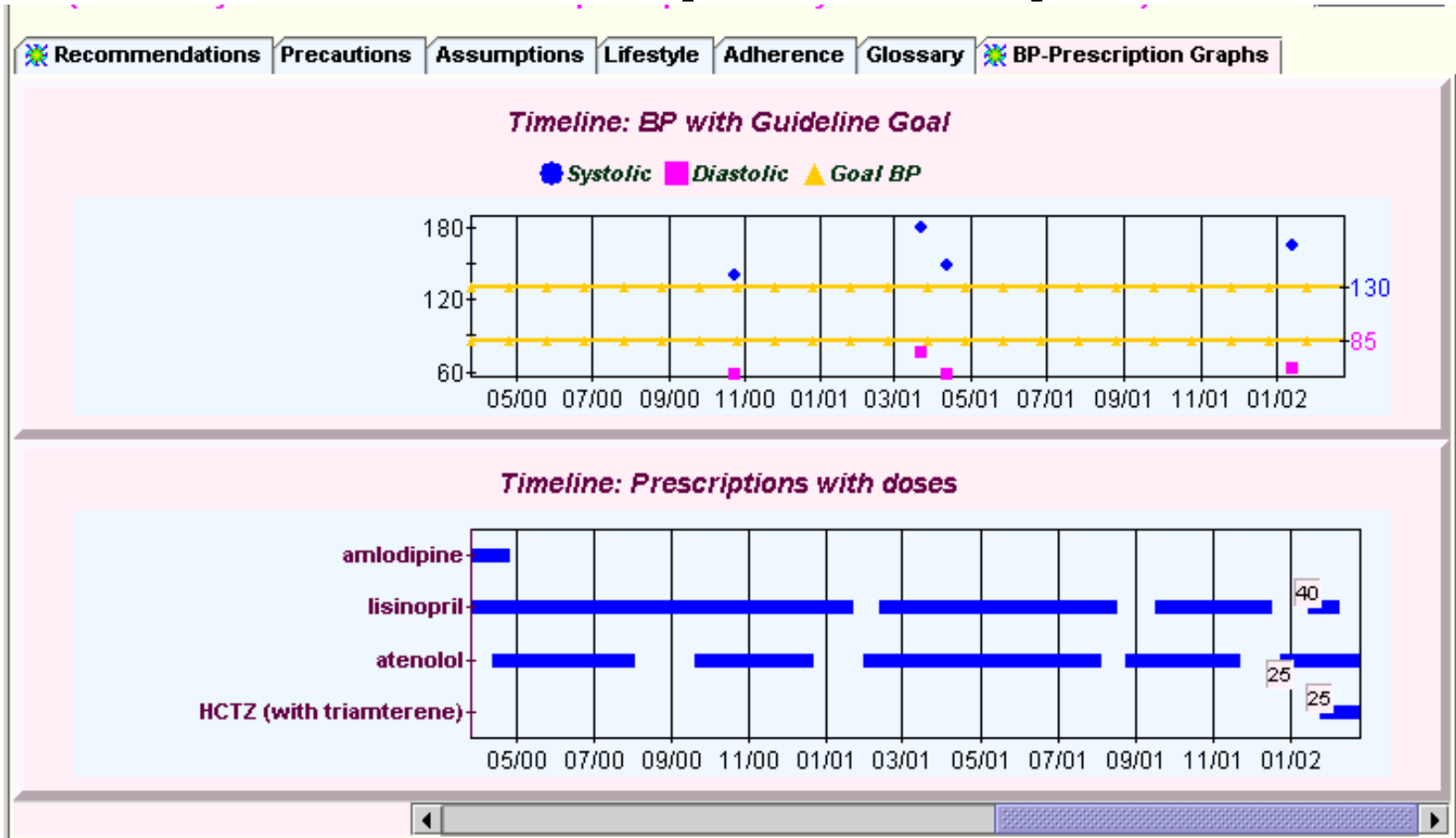
- Overall goal
  - to share experience implementing information technology (IT) for clinical quality improvement (QI)
- Objectives: at end of session, participants should be able to...
  - consider sociotechnological approach to implementing IT in VA health care settings
  - identify several key stakeholders

# Perspective

- Physician/health services researcher
- Drawing on expertise of others from wide variety of fields (interdisciplinary)
  - computer science/medical informatics
  - biostats
  - sociology
  - ...and more



# ATHENA Hypertension Advisory: BP- Prescription Graphs



Goldstein, M. K. and B. B. Hoffman (2003). Graphical Displays to Improve Guideline-Based Therapy of Hypertension. Hypertension Primer. J. L. Izzo, Jr and H. R. Black. Baltimore, Williams & Wilkins.

# What is ATHENA DSS?

- Automated decision support system (DSS)
  - Knowledge-based system automating guidelines
    - Built with EON technology for guideline-based decision support, developed at Stanford Medical Informatics
  - For patients with primary hypertension who meet eligibility criteria
- Patient specific information and recommendations at the point of care
- Purpose is to improve hypertension control and prescription concordance with guidelines
  - **Athena in Greek mythology is a symbol of good counsel, prudent restraint, and practical insight**

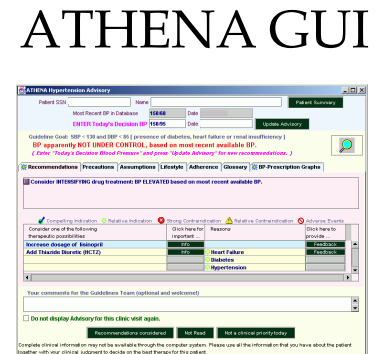
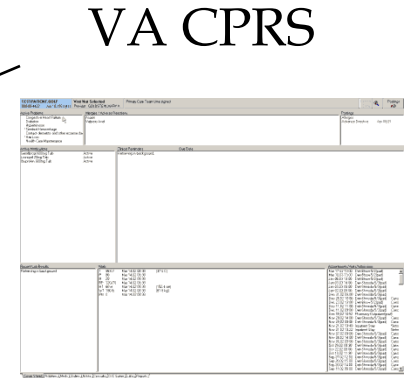
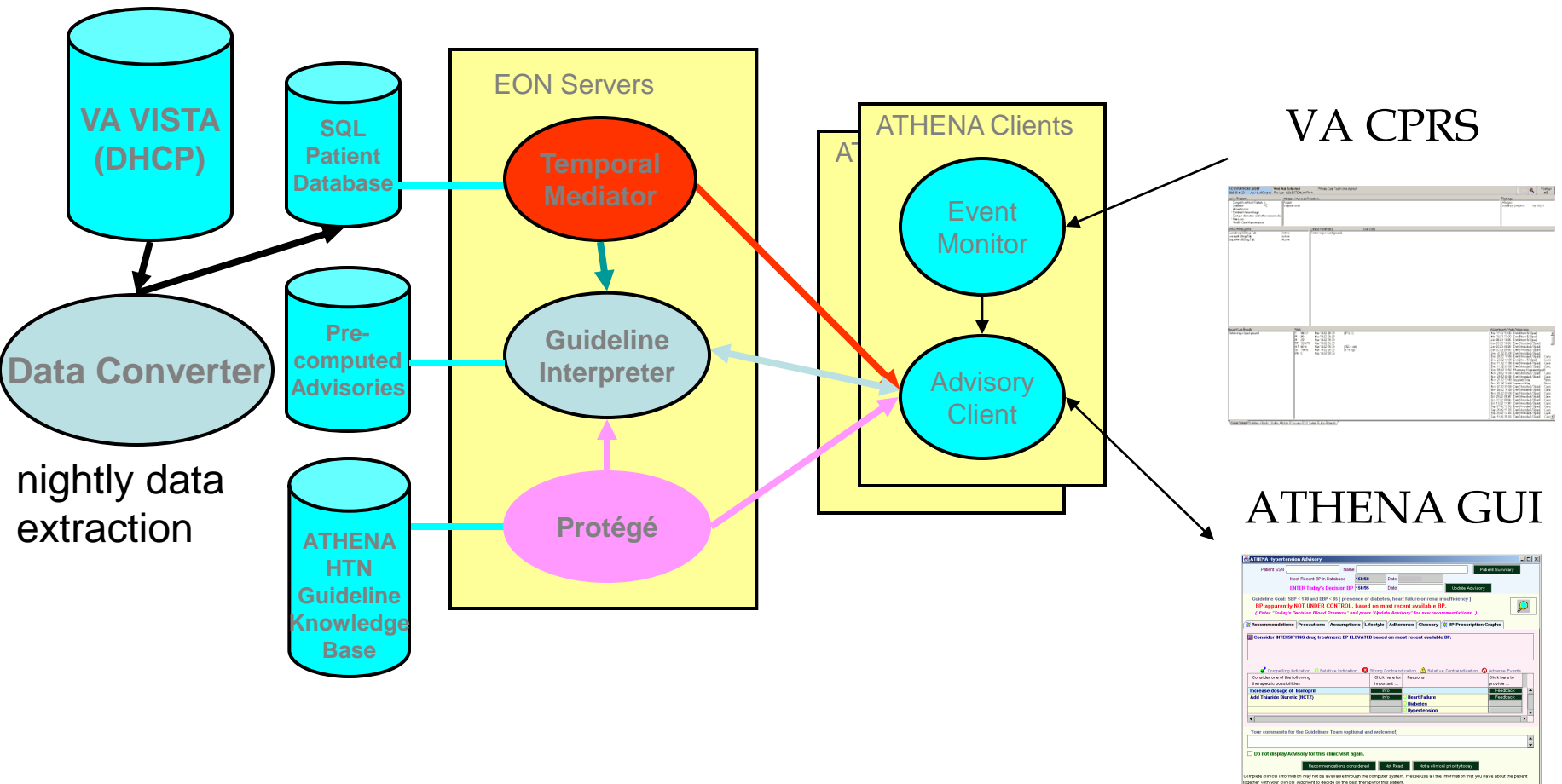


# Sites for Clinical Trial

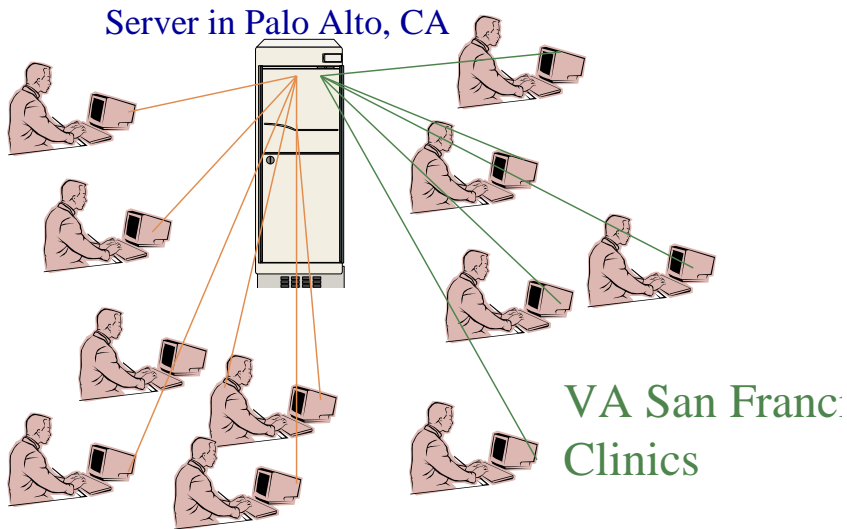
Palo Alto (in 7 cities), San Francisco, and Durham VAMC's (total 9 separate sites)



# Building ATHENA System From EON Components



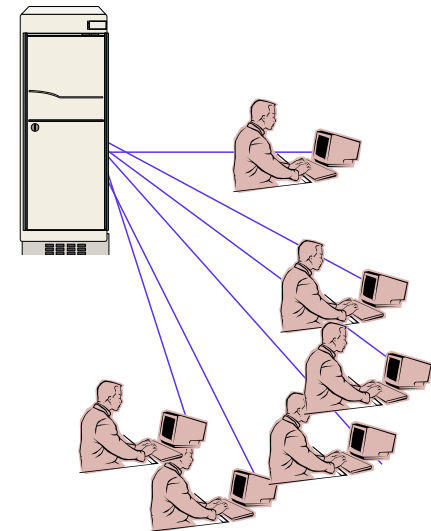
# Server-Client



## VA Palo Alto Clinics:

- Palo Alto
- Menlo Park
- San Jose
- Monterey
- Livermore
- Stockton
- Modesto

## Server in Durham, NC



## Durham VA Clinics

# Developing a Model Program

**To Provide a Model Program that can be extended to other clinical areas**

**We selected hypertension as a model for guideline implementation because...**

- **Hypertension is highly prevalent in adult medical practice**
- **There are excellent evidence-based guidelines for management**
- **There is also evidence that the guidelines are not well-followed**
  - **a big ‘improvability gap’ in IOM terms**
- **Steinman, M.A., M.A. Fischer, M.G. Shlipak, H.B. Bosworth, E.Z. Oddone, B.B. Hoffman and M.K. Goldstein, Are Clinicians Aware of Their Adherence to Hypertension Guidelines? Amer J. Medicine 117:747-54, 2004.**

# Path to Guideline Adherence

The theoretical model we use for the path to guideline adherence is the “Awareness to Adherence” model, in which the clinician must

- Awareness of guideline
- Acceptance of guideline
- Adoption of guideline
- Adherence to guideline

**Pathman, D. E., T. R. Konard, et al. (1996). "The Awareness-to-Adherence Model of the Steps to Clinical Guideline Compliance." Medical Care 34:873-889.**

## Informatics Support for Clinical Practice Guideline Implementation

<i>Step</i>	<i>Facilitators</i>	<i>Informatics Support</i>
Awareness	<i>Priming Activities</i> such as profiling of baseline performance	Profiling from pharmacy and diagnosis database
Acceptance	Active education such as Academic Detailing; Clinical Opinion Leaders	Present evidence relevant to patient; allow opinion leaders to browse knowledge
Adoption	<i>Enabling strategies</i> such as incorporation into clinic workflow	Integration with existing EMR
Adherence	<i>Reinforcing Strategies</i> such as reminders	Point-of-care patient-specific advisories

# Challenge of Using IT for Quality Improvement

- Technical challenges of using information technology for quality improvement (QI)
  - Difficult to integrate new forms of decision support into legacy data systems and electronic record interfaces
  - We had many design requirements in order to meet research goals and institutional goals
  - A “sociotechnical” challenge to implement

**Goldstein, M., R. Coleman, S. Tu, et. Al. Translating Research Into Practice: SocioTechnical Integration of Automated Decision Support for Hypertension in Three Medical Centers. JAMIA 11: 368-76, 2004.  
Available in pubmedcentral**

# Decision Support for Common Chronic Diseases

The physician often seen as wondering about a clinical question and then seeking out decision support:



The “Field of Dreams” approach to medical informatics implementations:

*If you build it, they will come*



# Will it Be Used?

- Once decision support is integrated technologically, will clinicians use it?
- Many clinical decision support systems are used only a tiny percent of time available
  - For example, physicians viewed a hyperlipidemia guideline only 20 of 2610 visit opportunities (0.8%)
    - Maviglia SM, Z.R., Paterno M, Teich JM, Bates DW, Kuperman GJ, *Automating Complex Guidelines for Chronic Disease: Lessons Learned*. J Am Med Inform Assoc, 2003. **10**: p. 154-165.
    - (note that even infrequent use may still be beneficial at very low cost)

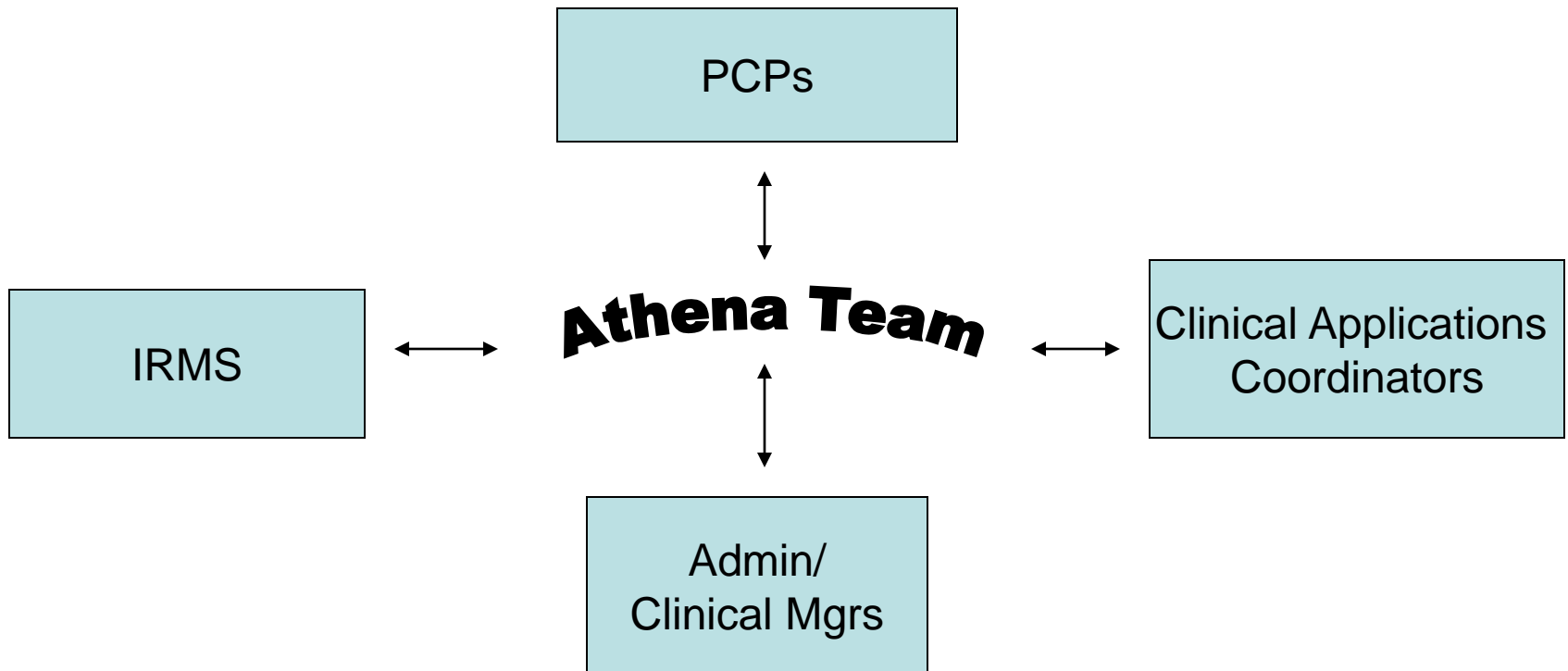
# “Sociotechnical”\* Success

- Technical success
  - generates correct recommendations offline
  - extracts and uses patient data correctly
  - integrates with CPRS to display for the right
    - Patient, provider, clinical location, time window
  - logs the data needed for research evaluation
- “Sociological” success
  - clinicians find it usable and useful

\*Berg, M., *Patient care information systems and health care work: a sociotechnical approach*. Int J Med Inf, 1999. **55**(2): p. 87-101.

Berg, M., *Rationalizing Medical Work: Decision-Support Techniques and Medical Practices*. Inside Technology, ed. W.E. Bijker, W.B. Carlson, and T. Pinch. 1997, Cambridge, Massachusetts: The MIT Press.

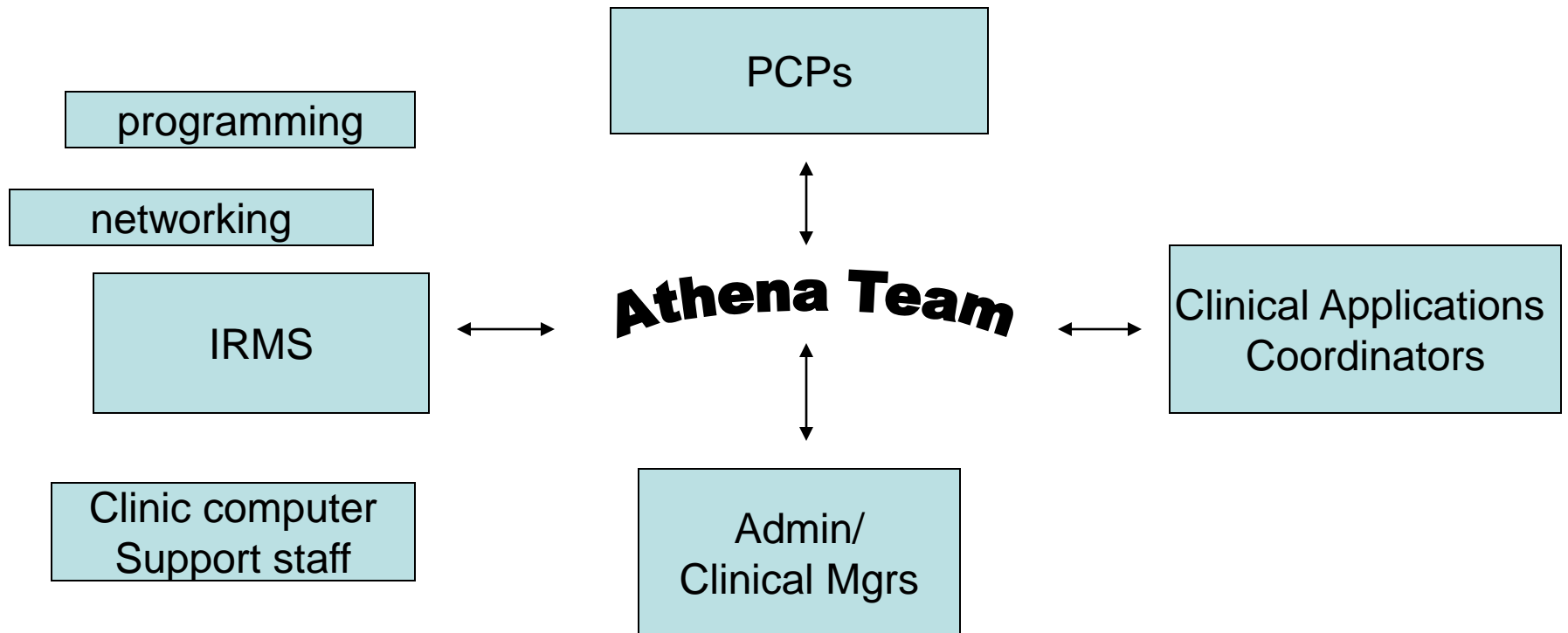
# Working with Stakeholders



# Some Technical Challenges

- Extracting clinical data from VistA
- Generating a popup window that appears in CPRS
  - At the right time, in the right clinic settings, for the right clinician, about the right patient
- Logging data about activity in the system
- Security issues
- Maintaining a system that is not on IRMS standard priority list

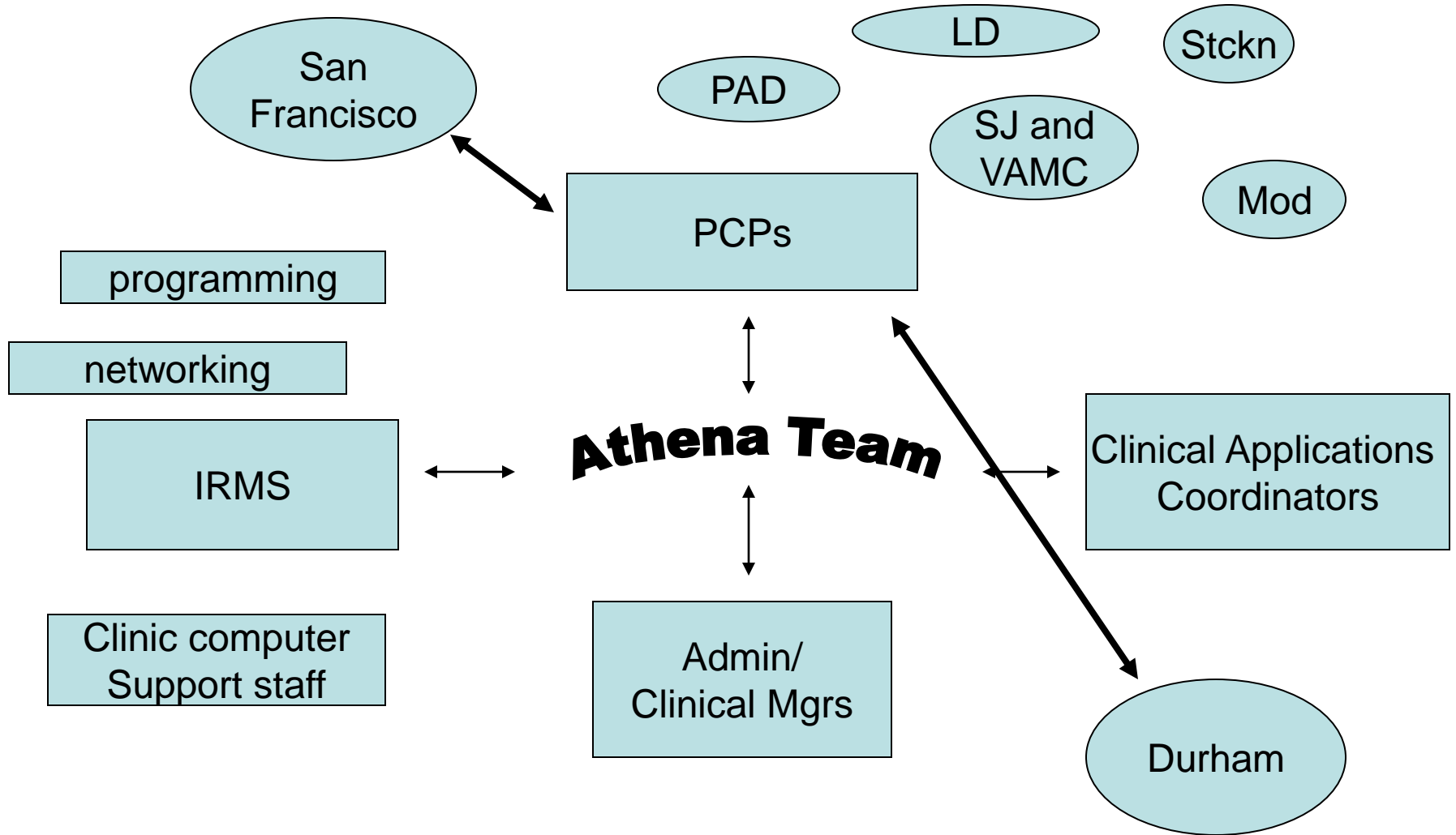
# Working with Stakeholders



# Some of the Social Challenges

- Clinicians extremely time-pressured in clinic
  - Strike balance between ease of access to system and ease of ignoring it
- Enormous variability in comfort with computers
  - And virtually no training time available
- Disagreements about the guidelines
  - some want VA GLs, some want JNC

# Working with Stakeholders

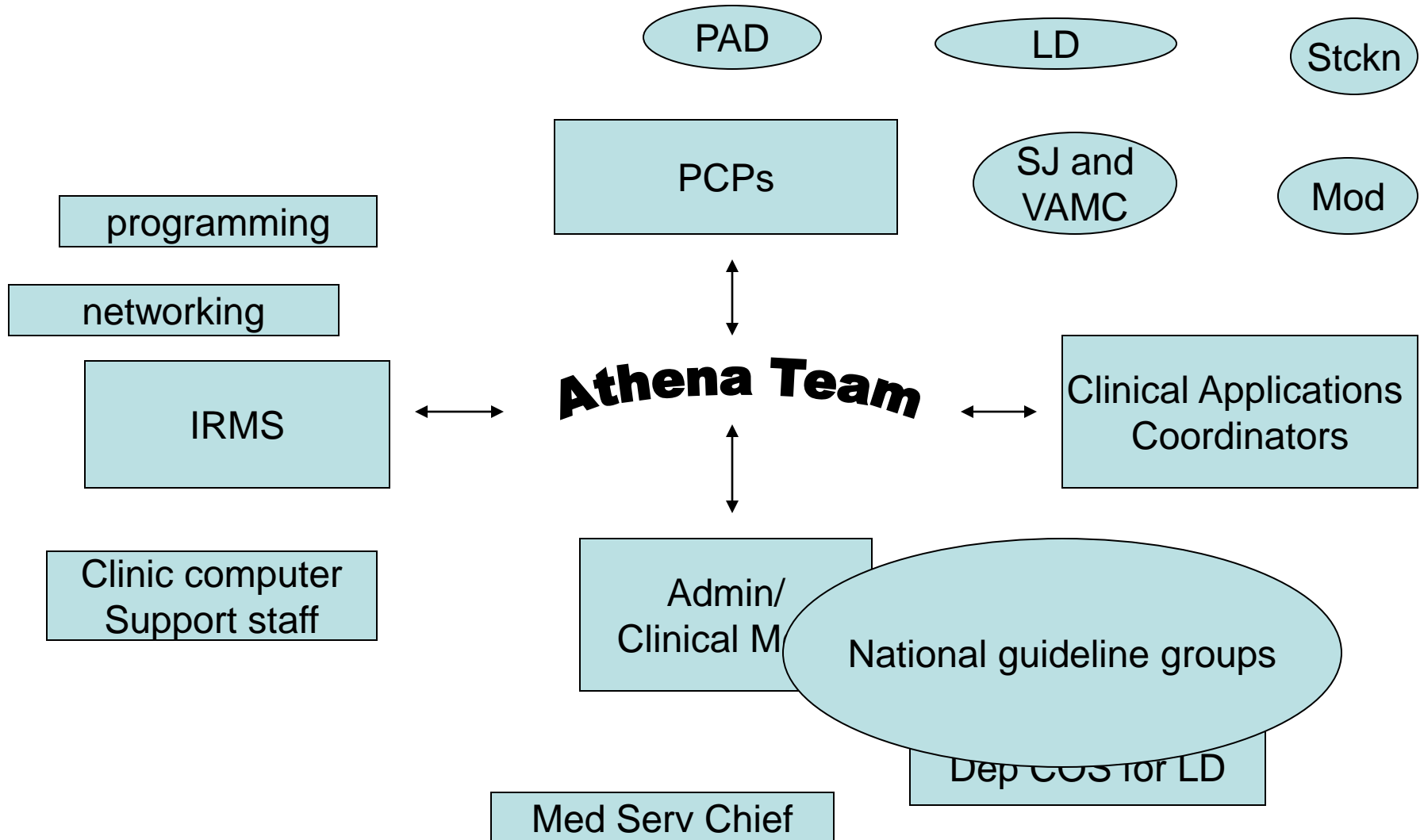


# Taking on the Sociotechnical Challenge

- Aligning with institutional goals
  - Discuss with local stakeholders
  - VA performance standards and guidelines
- Speaking the language(s)
  - understanding that different computer worlds are worlds apart
    - Identify a bridge person to span the gap between IRMS expertise and non-VA programmers
- Iterative Design
  - With opportunity for re-design cycles after input from key clinical staff
  - Don't test in clinic prematurely
    - Do your offline testing first
  - Test with typical users, not just early adopters
  - Recognize need for continual adaptation to our evolving informatics infrastructure



# Working with Stakeholders



# VA Guidelines



[CPG Home](#)



Clinical Practice Guideline  
Hypertension in Primary Care Update04

OOP < [CPG](#) < [HTN](#)

Guideline Reference		Download Center	
	<a href="#">View Online</a>	word	pdf
Overview	<a href="#">Information about the HTN guideline</a>		
Guideline	<a href="#">Complete guideline online (Interactive site)</a>		<input checked="" type="checkbox"/>
Algorithms	<a href="#">The HTN-CPG algorithms</a>		
Summary	<a href="#">Summary of recommendations July 2005</a>		<input checked="" type="checkbox"/>
Pocket Card	<a href="#">HTN-Pocket Card - [PDF format] July 2005</a>		<input checked="" type="checkbox"/>
Key Points	<a href="#">The key points addressed by the HTN guideline</a>		<input checked="" type="checkbox"/>
Reminders	<b>Definition of clinical reminders:</b> 1. <a href="#">HTN Lifestyle Education</a> 2. <a href="#">HTN Elevated BP &gt; 140/90</a> 3. <a href="#">HTN Elevated BP &gt; 160/100</a>		
Archive	<a href="#">Hypertension Guideline - 1999</a>		
		<a href="#">Help</a>	

Related Performance Issues	Related Guidelines
Measures	<a href="#">The HTN measures - Technical Manual</a>
Database Questions	<a href="#">EPRP database question FY2004</a>
Reports	<a href="#">Available on Intranet Only</a>
	<div style="background-color: #e6e6fa; padding: 5px; margin-bottom: 5px;"> <a href="#">Ischemic Heart Disease</a></div> <div style="background-color: #e6e6fa; padding: 5px; margin-bottom: 5px;"> <a href="#">Stroke Rehabilitation</a></div> <div style="background-color: #e6e6fa; padding: 5px; margin-bottom: 5px;"> <a href="#">Chronic Heart Failure</a></div> <div style="background-color: #e6e6fa; padding: 5px; margin-bottom: 5px;"> <a href="#">Diabetes Mellitus</a></div> <div style="background-color: #e6e6fa; padding: 5px;"> <a href="#">End-Stage Renal Disease</a></div>

**Guideline Community**

**Related Resources**

	<a href="#">JNC-7 - The Seventh Report of the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure.</a>
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**Benchmark**

# Speaking the Language

- Recruit a VA staff person who is able to talk with both IRMS and non-VA programmers
  - Who understands VistA file structures
- Recognize that Office of Information has a complex and sophisticated process for managing projects
  - And many competing demands
- High-level support is important to have but is not enough

# Understanding the Clinical Workflow

- Computer timestamps and clock time
- Conceptualizations of workflow in computer systems versus actual workflow
- (see next few slides)

**The effects of CPOE on ICU workflow: an observational study.** CH Cheng, MK Goldstein, E Geller, and RE Levitt. AMIA Annu Symp Proc. 2003; 2003: 150–154. available in pubmedcentral.

# Computer system workflow diverges from actual workflow

**Computer system  
workflow**



**Actual workflow**

*Reconciliation*

# Coordination redundancy: Entering and interpreting orders

*In 97 interruptions of RN to MD, 25% were reminders*

# Planning the Timeline

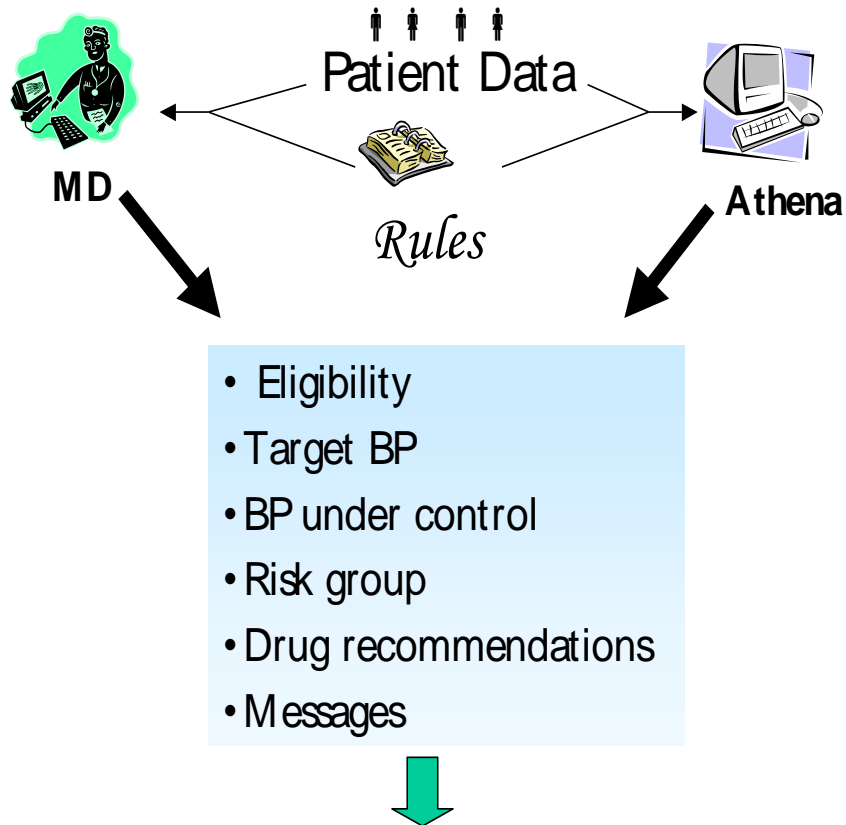
- Conceptualization of tasks sequentially
  - Develop system
  - Test offline for accuracy and usability
  - Deploy in production system, limited to users who are testing it
  - Test in production system (in clinic)
  - Go live for clinical trial
- In reality, many tasks have subtasks that must be done concurrently with tasks from later in sequence

# Usability and Usefulness Evaluation in Lab Setting

- Martins, S., et al., *Evaluation of KNAVE-II: a tool for intelligent query and exploration of patient data*. Medinfo, 2004. 11(Pt 1): p. 648-652.



# Evaluation Flowchart



**Comparison MD versus ATHENA**

Martins SB et al Proc AMIA 2006 in press

# “Physician Testers” in Clinical Setting

- Project-friendly physicians who test the system in early stages in clinic
  - Understanding it is not yet complete
  - Must be prepared to make changes in response to their comments
  - Some of these physicians become champions for the system
- Include clinical managers in early testing

# Consensus Conference Calls

- Knowledge updates required in light of newly published clinical trials or new guidelines
  - Need a knowledge management process for vetting new material and deciding what will be incorporated
  - Make this process known to the clinicians who are end-users (especially local opinion leaders)
  - Invite local input to the discussion
  - Encode with a system that allows for easy updating

Goldstein, M.K., B.B. Hoffman, et al, *Implementing clinical practice guidelines while taking account of changing evidence: ATHENA DSS, An easily modifiable decision-support system for managing hypertension in primary care.* AMIA Symp: 300-4, 2000.

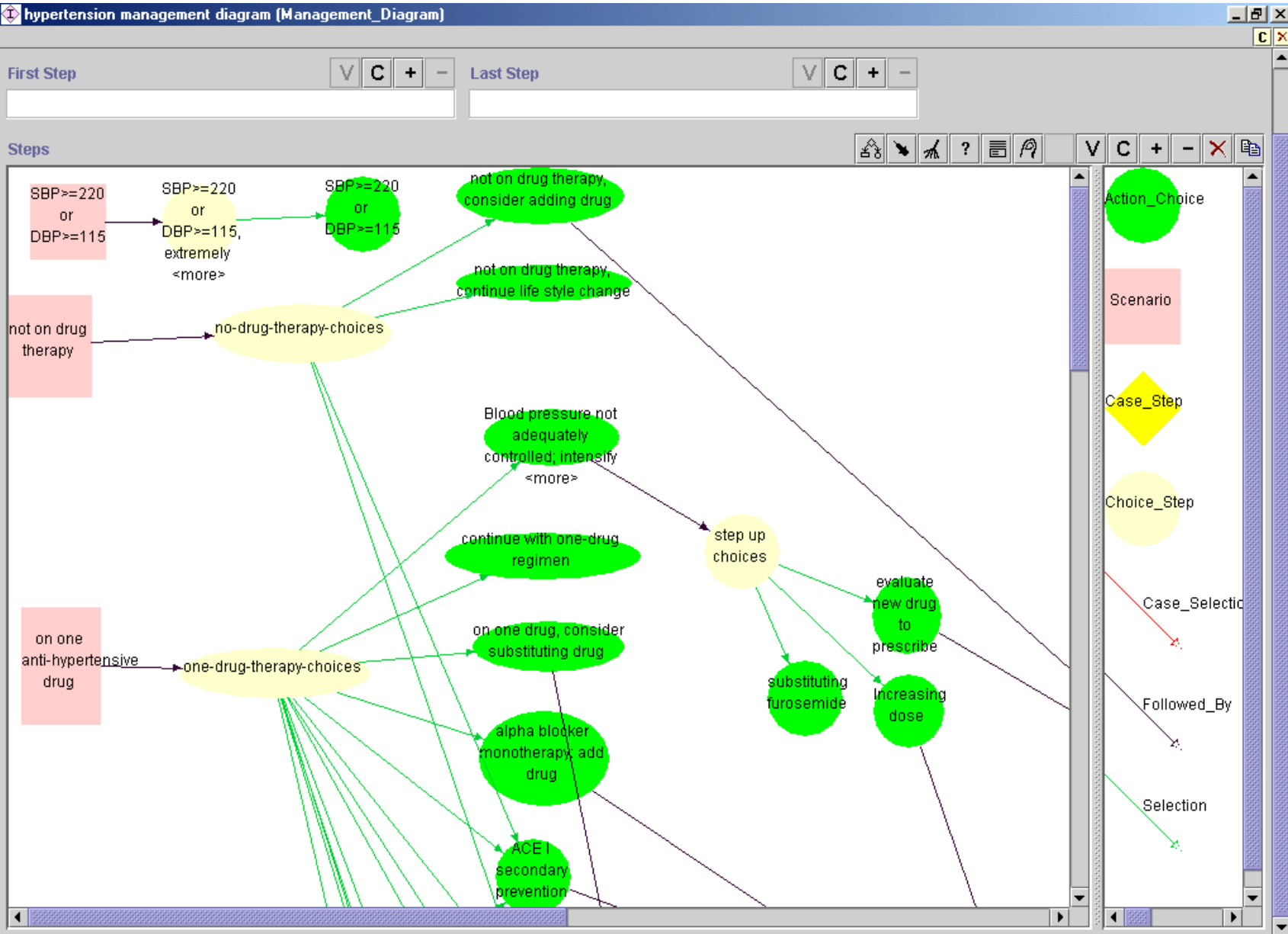
athena\_hypertension Protégé-2000 [C:\ATHENADSS\domain\_model\athena\_hypertension.pprj]

Project Edit Window Help PAL Constraints

HTNAdvisory Classes & Instances Knowledge Acquisition Classes Forms PAL Queries PAL Constraints

JNC-VI Hypertension Guideline (ATHENA\_Hypertension\_Guideline)

<p><b>Label</b></p> <p>JNC-VI Hypertension Guideline</p>	<p><b>Eligibility Criteria</b></p> <ul style="list-style-type: none"> <li>presence of diagnosis of hypertension</li> <li>absence of renovascular disease</li> <li>no diagnosis of pregnancy</li> <li>creatinine &lt; 2.5</li> <li>Absence of Secondary Hypertension</li> <li>absence of spinal cord injury</li> <li>absence of narcolepsy</li> <li>Not taking cyclosporine</li> </ul>
<p><b>Title</b></p> <p></p>	<p><b>Goal</b></p> <ul style="list-style-type: none"> <li>BP target patient with DM, CHF or CRI</li> <li>BP target for patient without DM, CHF, and CRI</li> </ul>
<p><b>Version</b></p> <p>October, 2002</p>	
<p><b>Clinical Algorithm</b></p> <p>hypertension management diagram</p>	
<p><b>Authors</b></p> <p>NIH NHLBI Joint National Committee Mary Goldstein, MD Brian Hoffman, MD Susana Martins, MD MSc Robert Coleman, MS</p>	<p><b>Patient Characterization</b></p> <ul style="list-style-type: none"> <li>Risk_Group_A</li> <li>Risk_Group_B</li> <li>Risk_Group_C</li> <li>Potassium-Low</li> </ul>
<p><b>Drug Classes</b></p> <ul style="list-style-type: none"> <li>ACE Inhibitor</li> <li>Metoprolol and terazosin</li> <li>Alpha Beta Blocker</li> <li>Alpha Blocker</li> <li>Angiotensin II Receptor Blocker</li> <li>Cardioselective Beta Blocker</li> <li>Non-cardioselective Beta Blocker</li> <li>DHP Calcium Channel Blocker</li> </ul>	<p><b>Guideline Drugs</b></p> <ul style="list-style-type: none"> <li>acebutolol</li> <li>amilofride</li> <li>amlodipine</li> <li>amlodipine besylate</li> <li>atenolol</li> <li>captopril</li> <li>carvedilol</li> <li>clonidine</li> </ul>



# Eliciting Clinician Feedback

- Clinical Applications Coordinator (CAC) involvement at initial launch for large group
- Ongoing monitoring over time\*
  - Real-time feedback about the patient being seen
    - Collected thru the display window
    - Must commit to reviewing regularly
    - Respond to all comments
    - Immediately address problems

\*Chan, A., S. Martins, R. Coleman, H. Bosworth, E. Oddone, M. Shlipak, S. Tu, M. Musen, B. Hoffman, and M. Goldstein, *Post Fielding Surveillance of a Guideline-Based Decision Support System*, in *Advances in Patient Safety: From Research to Implementation. Vol. 1. Research Findings AHRQ Publication Number 05-0021-1*, K. Henriksen, et al., Eds. 2005, AHRQ: Rockville, MD 20850. p. 331-339.

# Adapting to the Evolving IT Infrastructure

Example:

Basis for triggering a popup display window

Current method:

- CPRS Open Architecture broadcast of CPRS events via Windows messaging
- IRMS was going to deactivate this and change to CCOW-compliant Context Vault
  - We developed a version that works with context vault
- Problem of no user information in Context Vault and inconsistent implementation
  - Reverting to Windows messaging

# Continuing Challenges

- No infrastructure support for lab
  - scramble from project to project
    - Scant funds for development, so doing the work of implementation and clinical trial
  - need to fund staff through multiple projects
- Funding gap
  - National Library of Medicine (NLM) funds new informatics (basic science of informatics)
  - HSR&D/AHRQ fund implementations for clinical trials with patient outcomes
  - Who funds all the work in between?



# Additional Learning Resources for Clinical Decision Support

- Want to learn more about knowledge-based decision support?
  - Short Course (one afternoon) at Society for Medical Decision Making in Boston October 2006
- Want to hear more about a wide variety of clinical decision support tools for health professionals and for patients?
  - Symposium and Workshop at Society for Medical Decision Making in Boston October 2006
- AMIA meeting November 2006
  - barriers to following guidelines (Lin N et al); offline testing (Martins SB et al); CPOE (Zeiger/Johnson et al); decision tool in development for use on a patient portal (Das A et al); and others

# Review of Objectives

- at end of session, participants should be able to...
  - consider sociotechnological approach to implementing IT in VA health care settings
  - identify several key stakeholders

# Working with Stakeholders

