

QUERI Enhancing Implementation Science Meeting
Panel on Developing Effective Partnerships with Operations

VISN Collaborative Project with ATHENA- HTN Clinical Decision Support (CDS)

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Mary K. Goldstein, MD, MSc

Director, Geriatrics Research Education and Clinical Center (GRECC)

VA Palo Alto Health Care System, Palo Alto, California

Professor of Medicine (Center for Primary Care & Outcomes Research), Stanford University



Contents of this presentation are views of the authors and not necessarily those of the Department of Veterans Affairs

VISN Collaborative Project Goal

HSR&D IMV-04-062 VISN Collaborative for Improving Hypertension Management with ATHENA-HTN (PI: Goldstein; Co-PI's Hoffman, Miller)...and many collaborators...

- **Long-term goal**
 - To contribute to improved health care for Veterans with hypertension
- **Specific project goal**
 - To implement clinical practice guidelines for hypertension management in primary care using clinical decision support (CDS) integrated with the electronic health record

Distinguishing What is Being Implemented from the Vehicle for Implementation

- **What we were implementing**
 - VA-DoD and JNC guidelines for managing primary hypertension
 - favoring VA-DoD guideline where the guidelines differed
- **Vehicle for implementation**
 - ATHENA-HTN, a clinical decision support system that integrates with an electronic health record



Visit Not Selected

Current Provider Not Selected

Primary Care Team Unassigned

Flag

VistaWeb

Remote Data



Postings

WA

Active Problems

Allergies / Adverse Reactions

Postings

Penicillin

Allergies

- Obesity, Unsp
- Chronic Airway Obstruc
- Unspecified Drug-Induc
- Depressive Disorder Ne
- Diabetes
- Hypertension

subject
subject
subject

ATHENA Hypertension Advisory

Patient SSN Name [Patient Summary](#)

Most Recent BP in Database **158/85** Date

ENTER a New BP Date [Update Advisory](#) [Update & Save BP to CPRS](#)

Guideline Goal: SBP < 140 and DBP < 80 [presence of diabetes mellitus]
BP apparently NOT UNDER CONTROL, based on most recent available BP.

[Recommendations](#) [Precautions](#) [Assumptions](#) [Lifestyle](#) [Adherence](#) [Glossary](#) [BP-Prescription Graphs](#)

Recommendation: **Recommend ADDING antihypertensive medication: BP ELEVATED based on most recent available BP; F/up 1month.**
RECOMMENDATIONS DO NOT APPLY TO PREGNANT WOMEN (or women likely to become pregnant or nursing mother).

Compelling Indication
 Relative Indication
 Strong Contraindication
 Relative Contraindication
 Adverse Events

Consider one of the following therapeutic possibilities:	Click here for important ...	Reasons	Click here to provide ...
Add Thiazide Diuretic (HCTZ)	Info	<input checked="" type="checkbox"/> Diabetes <input checked="" type="checkbox"/> 1st line drug for hypertension	Feedback
Add ACE Inhibitors(lisinopril)	Info	<input checked="" type="checkbox"/> Diabetes_Mellitus	Feedback
Add Cardioselective Beta Blocker (atenolol)	Info	<input type="checkbox"/> Diabetes_Mellitus	Feedback
Add DHP Calcium Channel Blocker (felodipine, nifedipine)	Info	<input type="checkbox"/> Diabetes_Mellitus	Feedback
Add Angiotensin II Receptor Blocker (irbesartan)	Info	<input type="checkbox"/> Diabetes_Mellitus	Feedback

Your comments for the Guidelines Team (optional and welcome!)

Do not display Advisory for this clinic visit again.

[Recommendations considered](#)
 [No Read](#)
 [Not a clinical priority today](#)

Complete clinical information may not be available through the computer system. Please use all the information that you have about the patient together with your clinical judgment to decide on the best therapy for this patient.

Active Medications

- Non-WA Warfarin Inj
- Non-WA Yohimbine Hcl 5.4

Recent Immunizations

- Flu Outsid
- Influenza
- Pneumo-VAc
- Tetanus

ions

SYNTHETIC PATIENT DATA ONLY; no PHI



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 therefore benefit from this drug therapy

Review lifestyle modifications with the patient. See the [Lifestyle](#) page.

Therapeutic Possibilities

Indications

Contraindications

(CLICK FOR IMPORTANT PRESCRIPTION INFORMATION)

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

Heart Failure [EVIDENCE](#)
 CKD

Heart Failure [EVIDENCE](#)
 CKD [EVIDENCE](#)

CKD

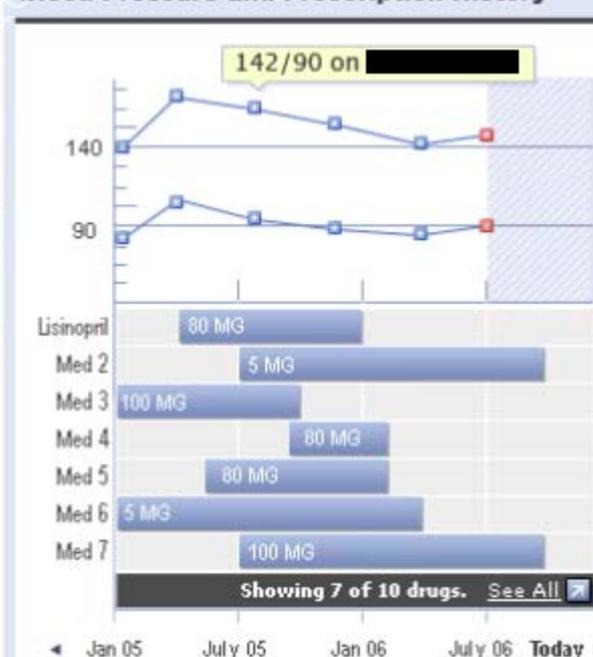
Heart Failure [EVIDENCE](#)
 CKD [EVIDENCE](#)

Brochospastic disease

Heart Failure

Heart Failure

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

SYNTHETIC PATIENT DATA

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, consectetur adipiscing

ATHENA-HTN Implementation

Information displayed to providers

Three-Site Study:
50+ Providers
5,000+ Patients
Almost 10,000 clinic visits

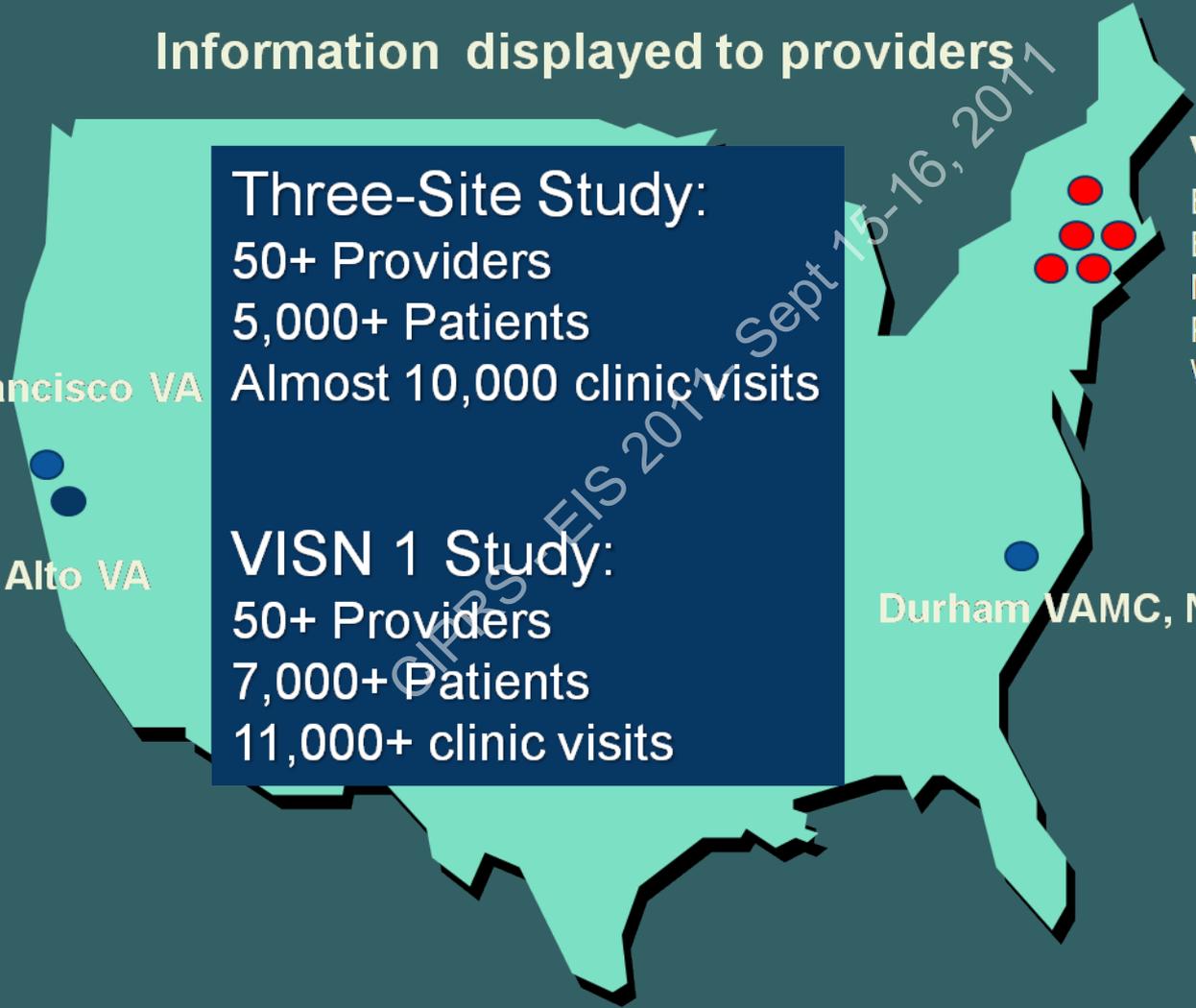
VISN 1 Study:
50+ Providers
7,000+ Patients
11,000+ clinic visits

VISN 1 sites:
Bedford, MA
Boston, MA
Manchester, NH
Providence, RI
West Haven, CT

San Francisco VA

Palo Alto VA

Durham VAMC, North Carolina



Comments EIS 2017 Sept 15-16, 2017

Our Operational Partners

- **VISN 1 New England Health Care Network**
 - **Our primary partnership**
 - **Note that our research group is across the continent, in California (in VISN 21)**
- **IRMS, which was re-organized into OI&T during the study**
 - **A partner to accomplish deployment of the system**

VISN 1 Partnership

- HSR&D funding mechanism for “VISN Collaboratives”
 - Well-designed process that fostered collaboration between investigators and VISN
 - Required a senior VISN leader as a co-PI
 - Started with a planning grant followed by full proposal
- VISN 1 CMO very interested in improving hypertension management and also in research collaborations

IRMS/OI&T Partners

- Previous implementation with letter of support from Chief of IRMS (who later became informatics lead for VISN and then Region)
- Previous experience engaging Chief of IRMS at other VAMCs leading to successful deployment
- In VISN Collaborative project, VISN CMO facilitated relationship with VISN IRMS/OI&T
 - Identified point of contact (POC) for VISN who in turn identified POC at each VAMC
 - Discussed with VISN CIO when needed

Negotiation of Research/Academic Products

- Intellectual property not an issue since we develop for open-source
 - Non-proprietary
- During phase of recruiting site-PI's, discussed plans for co-authorship
 - Referenced standards for what types of participation warrant co-authorship versus acknowledgment

Deliverables

- Update the computable knowledge base of hypertension evidence-based recommendations
 - Included VISN leadership and VISN 1 experts to vet the knowledge in the system
- Install the system on VISN 1 servers and establish linkages to VistA data
- Deploy the system
 - Tacit understanding of expectation that we would not do anything that would detract from the ongoing clinical workflow and responsibilities of the PCPs

Implementation Facilitators and Barriers

- **Organizational component of study**
 - Roles, routines, rules, etc
- **Facilitators**
 - Well-designed funding mechanism with close involvement of senior VISN leader
 - Identification and use of correct organizational channels
 - Primary care leadership; IRMS points of contact
- **Barriers**
 - Intertwined OI&T reorganization and security issues
 - Limited contact with/access to PCPs

Thank you!

2017 - Sept 15-16, 2017

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Clinician Reaction to ATHENA-HTN

- Clinicians used the system extensively
 - Speaks to usability and usefulness
- Clinicians reported ATHENA-HTN affected their prescribing decisions (questionnaire)
- Free-text feedback entered to GUI during patient care
 - Identify barriers to following the guidelines
 - Identify areas for CDS improvement

Lin ND et al AMIA 2006

Chan A et al AHRQ Patient Safety 2005

Goldstein MK et al JAMIA 2004

References #1

- http://www.openclinical.org/aisp_athena.html
- <http://protege.stanford.edu/>
- Goldstein MK. Using health information technology to improve hypertension management. *Curr Hypertens Rep.* 10(3): 201-7; 2008.
- Trafton JA et al. Designing an automated clinical decision support system ... *Implement Sci.* Apr 12;5:26; 2010 PMID: PMC28968045.

References #2

- Goldstein MK et al. Translating research into practice. JAMIA 11(5): 368-76; 2004.
- Martins SB et al. Offline testing of the ATHENA Hypertension decision support system knowledge base to improve the accuracy of recommendations. AMIA Annual Symp Proc. 539-43; 2006. PMCID: PMC 1839611.
- Tu SW et al. Modeling data and knowledge in the EON guideline architecture. Stud Health Technol Inform 84: 280-4; 2001.

References #3

- Chan AS et al. Post-fielding surveillance of a guideline-based decision support system. In *Advances in Patient Safety: From Research to Implementation*.
<http://www.ahrq.gov/qual/advances/index.html#Contents>
- Myers GJ. *The Art of Software Testing* (2nd ed.) John Wiley and Sons, New Jersey, 2004.

Why Hypertension?

- Excellent evidence base for the guidelines
- Evidence at that time that clinicians were not following the guidelines
- Strong institutional interest in quality improvement for hypertension management
 - Alignment with organization's priorities
- Our interest in hypertension
 - Group visits for hypertension; other hypertension projects

Why Clinical Decision Support?

- Effecting change in clinician behavior requires more than just education
- Evidence of effect from some forms of CDS
- Conceptual framework Awareness to Adherence
 - CDS as a means to support each step of the model
 - Examples:
 - Awareness – CDS points out when patient's management is not guideline adherent
 - Adoption – facilitates having the relevant patient information available at the time of clinical decision making. Reinforces what is already known and provides education in new areas
 - Adherence – reminding function, while taking account of clinical complexity far beyond the clinical reminders

Assessment and Treatment for Healthcare: Evidence-based Automation - Clinical Decision Support: ATHENA-CDS

Started with hypertension

Designed as a model with plan from the start for extension to other clinical domains

Built ATHENA-Hypertension (HTN)

VA collaboration with Stanford University

Athena in Greek mythology is a symbol of good counsel, prudent restraint, and practical insight

Goldstein MK, Coleman RW, Tu SW, et al.
Translating research into practice.
JAMIA 2004 Sep-Oct;11(5):368-76

Goldstein MK. *Current Hypertension Reports*.
2008.

Were Clinicians Following Guidelines?

- **Changing physician practice requires more active steps than simply making guideline available**
 - Lomas, J., G.M. Anderson, K. Domnick-Pierre, E. Vayda, M.W. Enkin, and W.J. Hannah, *Do Practice Guidelines Guide Practice? The effect of a consensus statement on the practice of physicians.* NEJM, 1989. **321**:1306-1311.
- **Clinicians not aware of their own rate of guideline adherence**
 - Steinman, M.A., M.A. Fischer, M.G. Shlipak, H.B. Bosworth, E.Z. Oddone, B.B. Hoffman, and M.K. Goldstein, *Clinician awareness of adherence to hypertension guidelines.* Am J Med, 2004. **117**(10): p. 747-54.

Value of CDS

- Effective for monitoring therapy
- Fine-tune existing therapy by making recommendations to improve patient safety, adjust the dose, duration or form of prescribed drugs or increase the laboratory testing rates for patients on long-term therapy.
- Flag key safety issues
 - Alerting providers to high severity drug interactions, contraindications with other medications and cautions against prescribing particular medications for the elderly
- Provided quality use of medicine messages
 - Alterations to durations of therapy and/or form of prescribed drugs

Providing Care to Patients with Chronic Disease

- **An Activated, Informed Patient working with a Prepared Health Care Professional/Team**
 - Wagner, E., B. Austin, and M. Von Korff, *Organizing care for patients with chronic illness*. The Millbank Quarterly, 1996. **74**(4): p. 511-544.

Design Goal for ATHENA-CDS

- To make advanced use of health information technology to assist with medical care, CDS should include, within workflow:
 - Rapid display of **pertinent** information about individual patients to the clinician
 - Rapid display of **relevant evidence-based advice/recommendations**
 - Sufficient clinical nuance for **clinical complexity**

Making Clinical Knowledge Computable

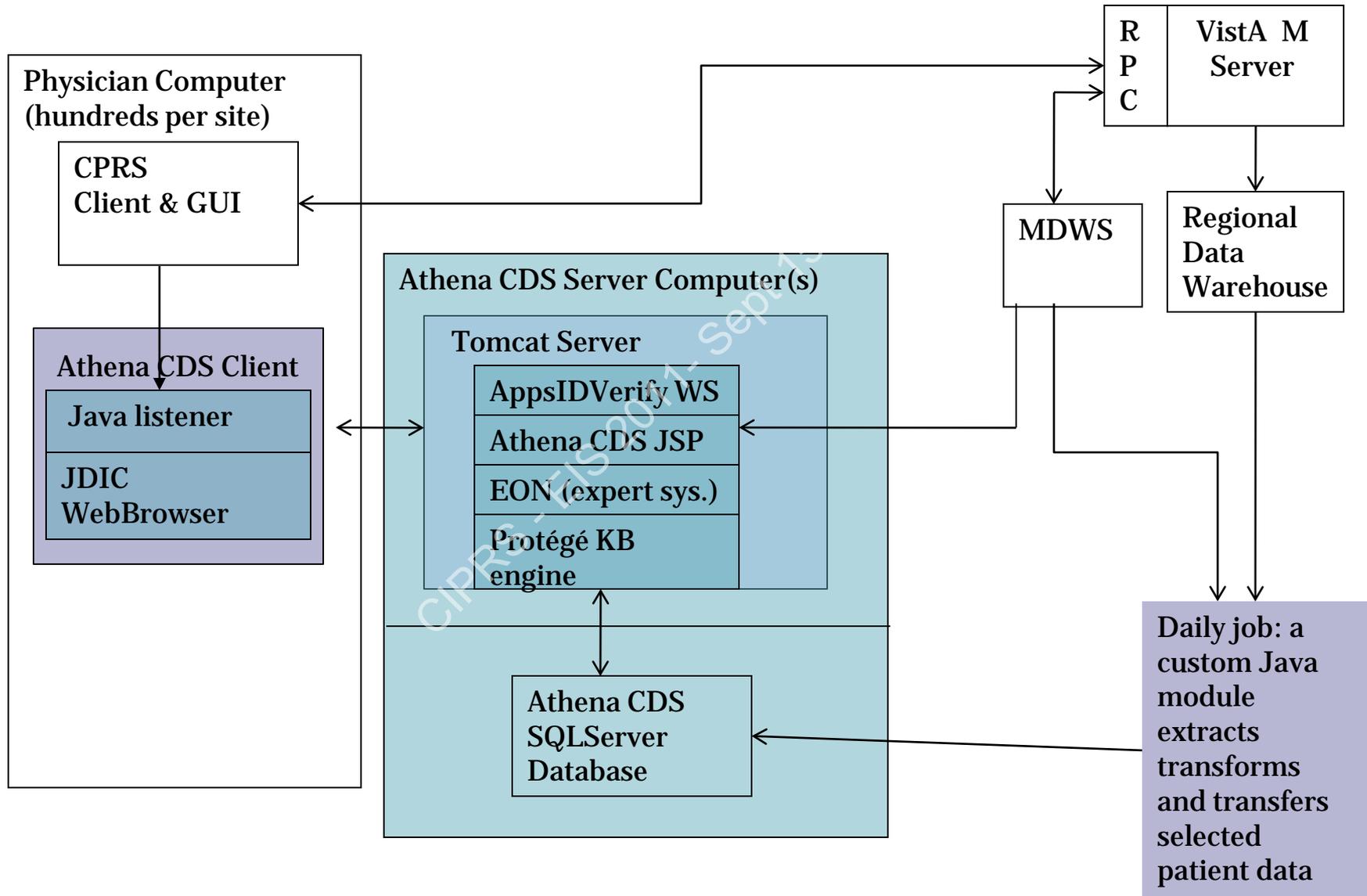
- Encode clinical knowledge into computer-interpretable “knowledge base”
- ATHENA-HTN Knowledge Base built with Protégé
 - Open-source Java tool for creation of customized knowledge-based applications
 - Developed Stanford Biomedical Informatics Research (BMIR)
 - <http://protege.stanford.edu/overview/>

Goldstein et al Proc AMIA Symp. 2000;300-4

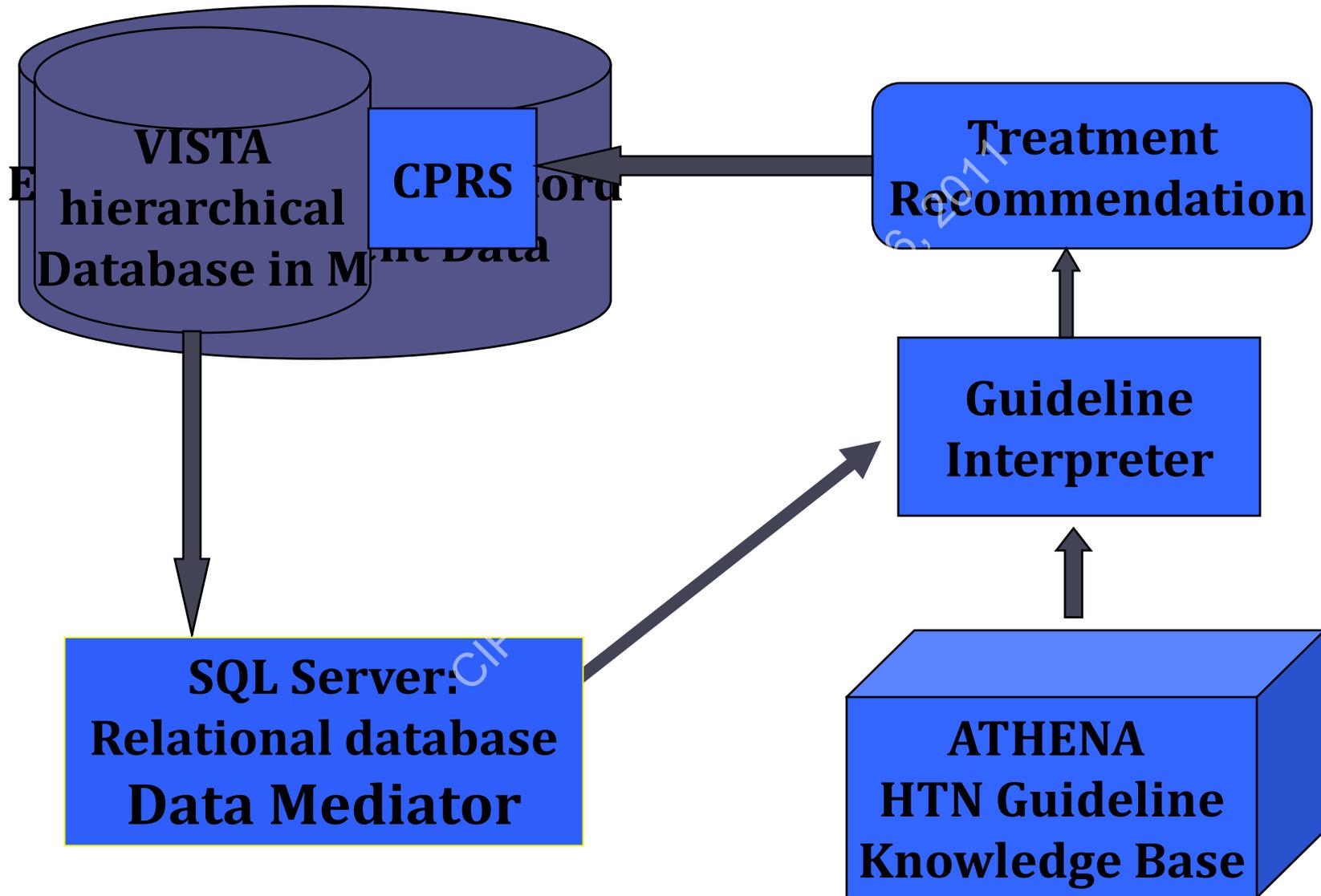
Shankar et al Medinfo. 2001;10:538-42

Goldstein et al Proc AMIA Symp. 2001;:214-8

Athena CDS Architecture



ATHENA Architecture



Additional ATHENA-KBs

- ATHENA-Knowledge Bases
- Hypertension
- Managing non-cancer chronic pain with emphasis on safe use of opioids
- Type 2 diabetes
 - Modules for foot care, eye care, glycemic control
- Heart Failure
- Chronic kidney disease



White Paper ■

A Roadmap for National Action on Clinical Decision Support

JEROME A. OSHEROFF, MD, JONATHAN M. TEICH, MD, PhD, BLACKFORD MIDDLETON, MD, MPH, MSc, ELAINE B. STEEN, MA, ADAM WRIGHT, DON E. DETMER, MD, MA

Abstract This document comprises an AMIA Board of Directors approved White Paper that presents a roadmap for national action on clinical decision support. It is published in JAMIA for archival and dissemination purposes. The full text of this material has been previously published on the AMIA Web site (www.amia.org/inside/initiatives/cds). AMIA is the copyright holder.

■ J Am Med Inform Assoc. 2007;14:141-145. DOI 10.1197/jamia.M2334.

“Clinical decision support (CDS) provides clinicians, staff, patients, or other individuals with knowledge and person-specific information, intelligently filtered or presented at appropriate times, to enhance health and health care.”

Medicine (Emergency Medicine) Harvard University (JMT), Boston, MA; Clinical Informatics R&D, Partners Healthcare System, and Brigham & Women's Hospital, Harvard Medical School (BM), Boston, MA; Editorial and Research Consultant, American Medical

Clinical decision support (CDS) provides clinicians, staff, patients, or other individuals with knowledge and person-specific information, intelligently filtered or presented at appropriate times, to enhance health and health care.

CDS Development Goals

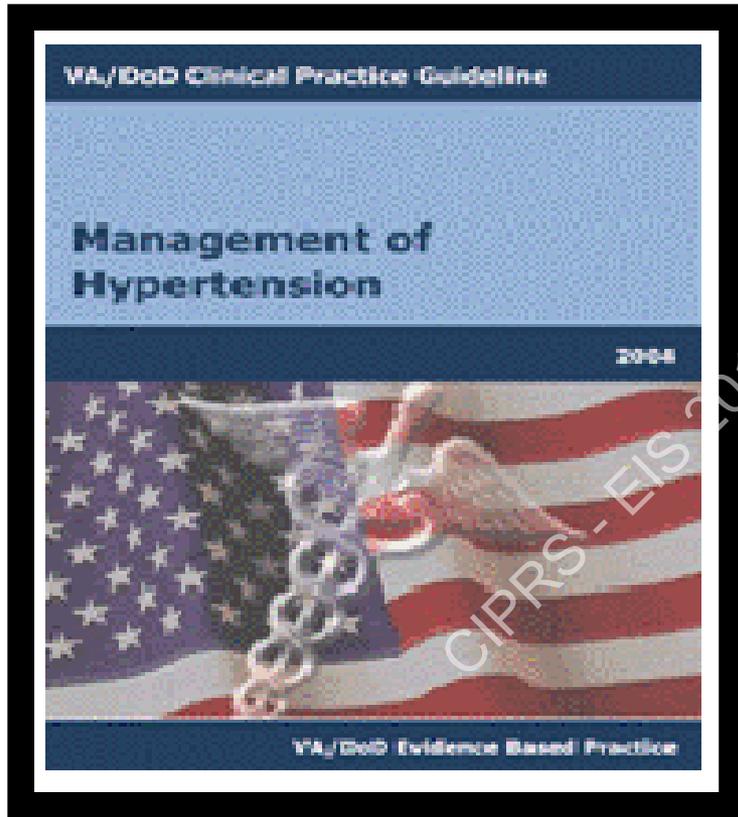
- To make advanced use of health information technology to assist with medical care, our goals in developing CDS included
 - Rapidly presenting pertinent information about individual patients to the clinician
 - Rapidly providing evidence-based advice
 - Accounting for clinical complexity

Patients with EHR Data



Individual Patient
Data

Clinical Practice Guideline



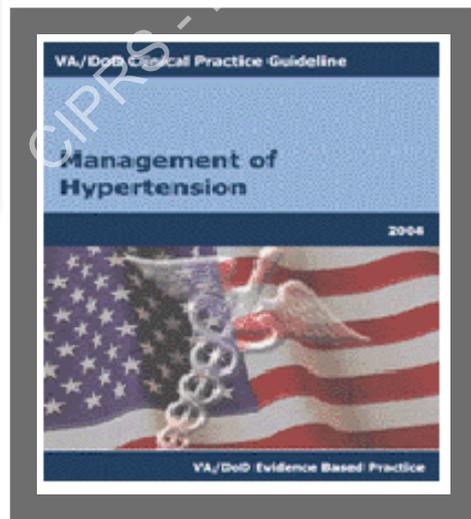
**Encoded
Guideline for Care
of the Patient's
Disease**

http://www.healthquality.va.gov/Hypertension_Clinical_Practice_Guideline.asp

**Individual Patient
Data**



**Applying
Guidelines to
Individual
Patients**



**Encoded
Guideline for Care
of the Patient's
Disease**

Complexity of Clinical Care

- **Clinicians want to**
 - **Keep up with the latest research**
 - **Have patient data readily available**
 - **Have tools to visualize complex clinical information**
- **Patients are increasingly complex**
- **Medical Literature is huge and expanding**
- **Link information technology with clinical care**
 - **Information highly tailored to the patient being seen**
 - **Presented quickly to the clinician within the workflow**