

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

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

September 16, 2011

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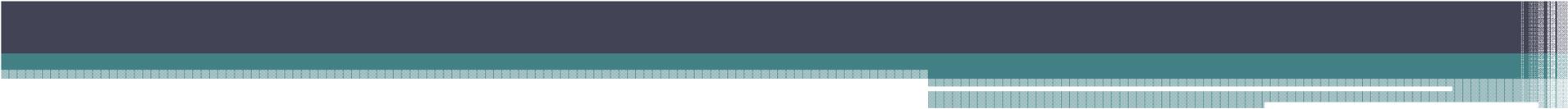


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VISN Collaborative Project Goal

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

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

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

Recent Immunizations
 Flu Outsid
 Influenza
 Influenza
 Influenza
 Influenza
 Influenza
 Influenza
 Influenza
 Influenza
 Influenza
 Pneumo-VAc
 Tetanus

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

⚠ 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.

subject
subject
subject

ions

SYNTHETIC PATIENT DATA ONLY; no PHI

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:

Date: MM/DD/YR Write back to Vista

Recommendations [Other Patient Information and Alerts](#)

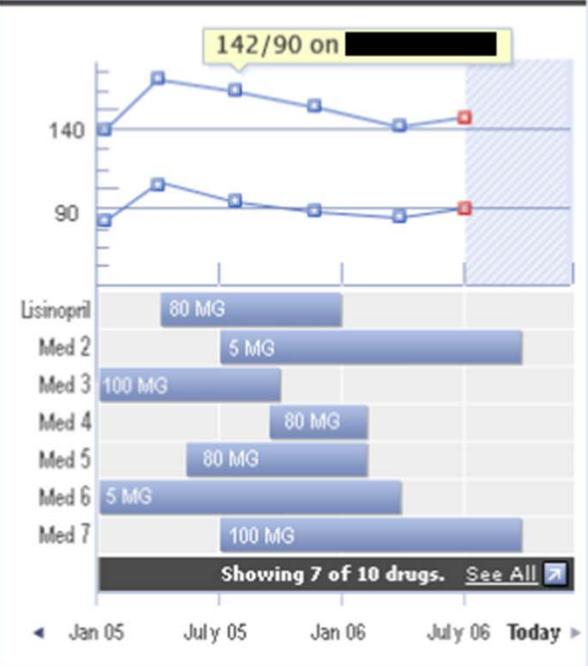
- Consider intensifying drug treatment: **BP Elevated** based on most recent available BP
- There appears to be a **Strong Contraindication** to a currently prescribed drug, evaluate clinical significance
- Bronchospasm is a **Strong Contraindication** or use of beta adrenergic receptor antagonists,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

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

Therapeutic Possibilities

Therapeutic Possibilities	Indications	Contraindications
<p>(CLICK FOR IMPORTANT PRESCRIPTION INFORMATION)</p> <p>Discontinue atenolol</p> <p>AND start one of the following drugs</p> <p><input checked="" type="checkbox"/> ACE Inhibitors (lisinopril)</p> <p><input checked="" type="checkbox"/> (non-DHP) Calcium Channel Blocker (diltiazem)</p> <p>Add one or more of the following drugs</p> <p><input checked="" type="checkbox"/> ACE Inhibitors (lisinopril)</p> <p><input checked="" type="checkbox"/> (non-DHP) Calcium Channel Blocker (diltiazem)</p> <p>Increase dosage of hydrochlorothiazide</p>	<p>Heart Failure EVIDENCE</p> <p>CKD</p> <p>Heart Failure EVIDENCE</p> <p>CKD EVIDENCE</p> <p>CKD</p> <p>Heart Failure EVIDENCE</p> <p>CKD EVIDENCE</p>	<p>Brochospastic disease</p> <p>Heart Failure</p>

Blood Pressure and Prescription History



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

Do not display advisory for this clinic visit again

SYNTHETIC PATIENT DATA

Awareness to Adherence Model

- The theoretical model we used for the path to guideline adherence is the “Awareness to Adherence” model, in which the clinician must have
 - Awareness of guideline
 - Agreement with guideline
 - Adoption of guideline
 - Adherence to guideline

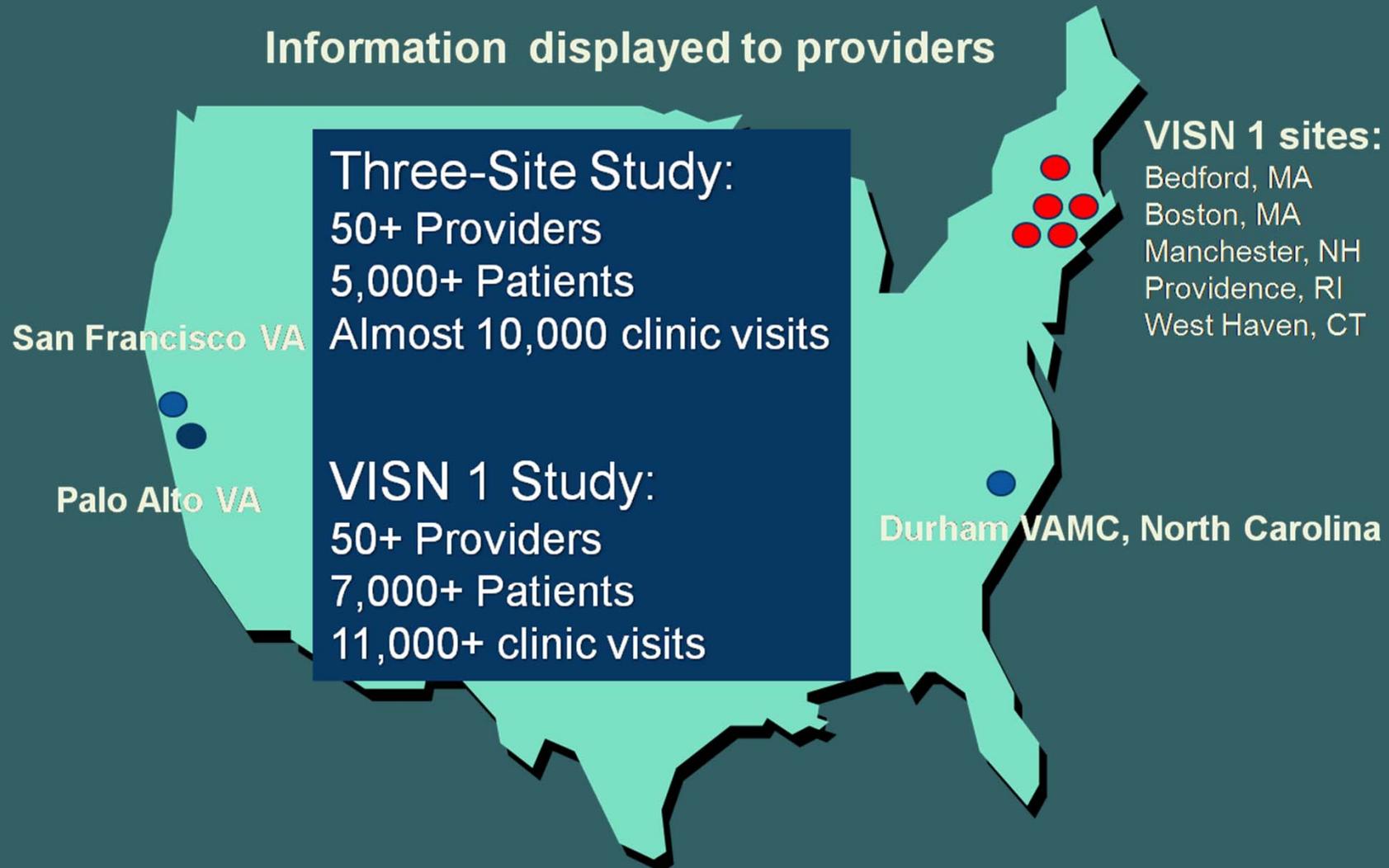
Pathman, D. E., T. R. Konard, et al. (1996). "The Awareness-to-Adherence Model of the Steps to Clinical Guideline Compliance: The Case of Pediatric Vaccine Recommendations." Medical Care 34 (9):873-889.

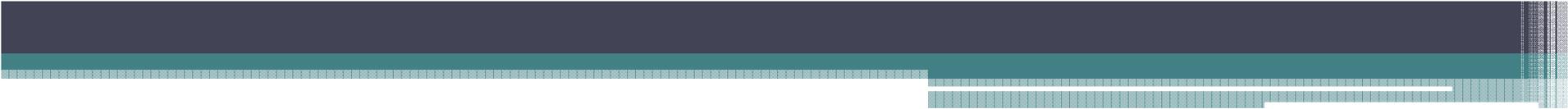
Informatics Support for Clinical Practice Guideline Implementation

<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
Agreement	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

ATHENA-HTN Implementation

Information displayed to providers





Our Operational Partners

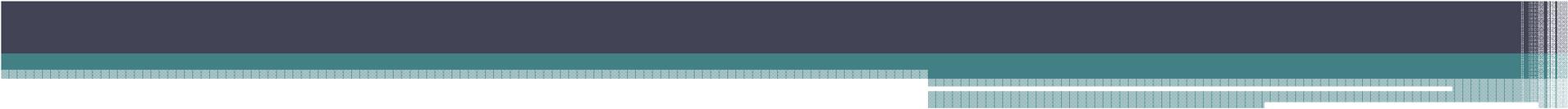
- VISN 1 New England Health Care Network
 - Our primary partnership
 - Note that our research group is across the continent, in California (in VISN 21)
- IRMS, which was re-organized into OI&T during the study
 - A partner to accomplish deployment of the system

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 (topic requested by the conference organizers)

- 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

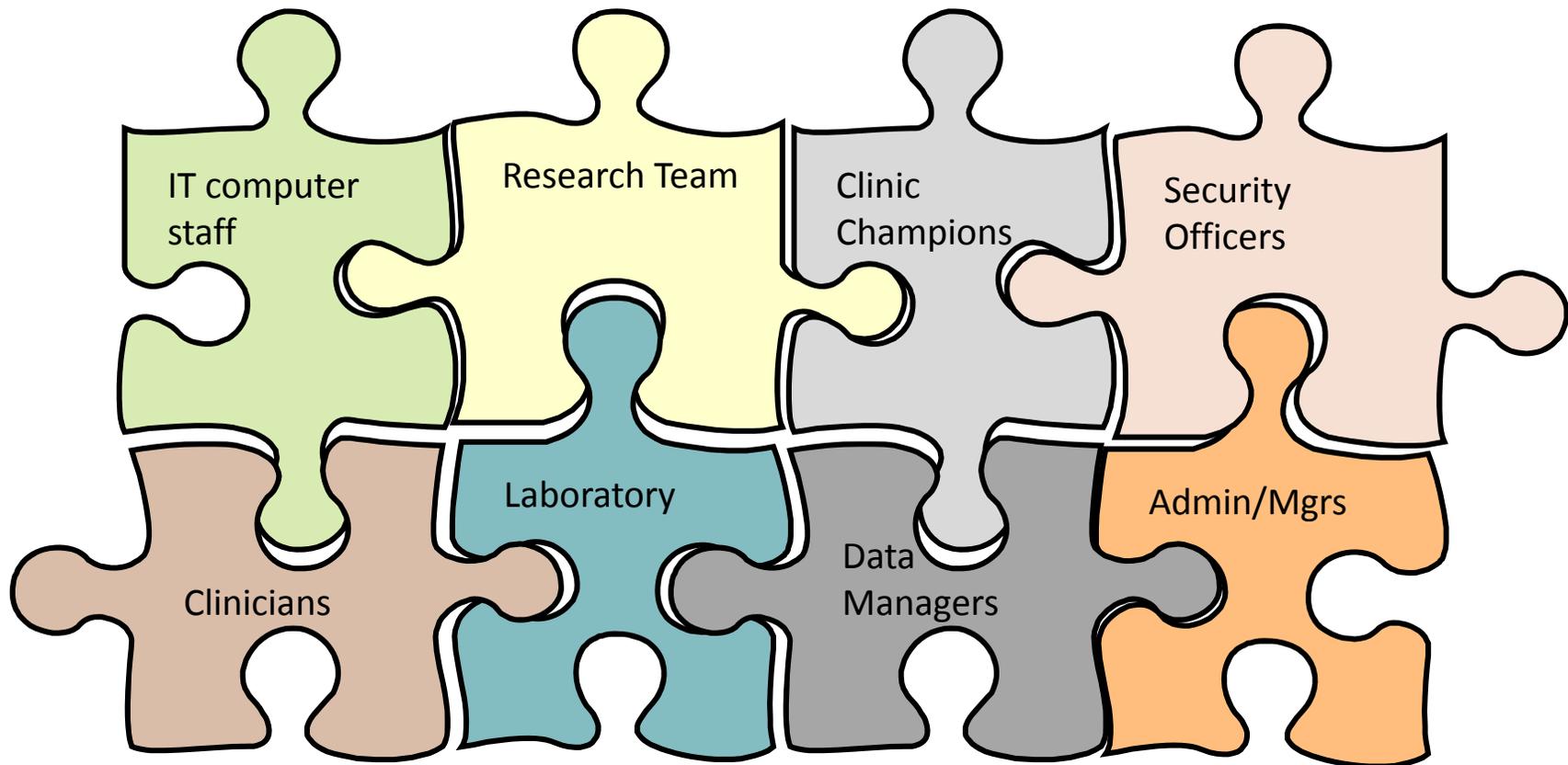
Deliverables

- 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

Working with Stakeholders: "SocioTechnical" Aspect



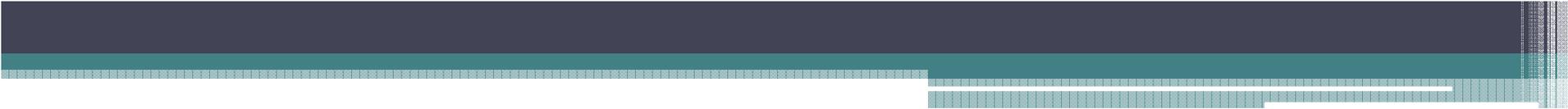
Berg, M. *Rationalizing Medical Work*. MIT Press 1997

Berg, M. Pt care info systems and health care work: a sociotechnical approach.

Int J Med Inform 1999

Funding Support ATHENA-CDS

- ATHENA-CDS supported in part by:
 - VA HSR&D IMV 04-062-2: VISN Collaborative for Improving Hypertension Management with ATHENA-HTN
 - VA HSR&D CPI 99-275: Guidelines for Drug Therapy of Hypertension: Multi-site Implementation Project
 - VA HSR&D CPG 97-006: Guidelines for Drug Therapy of Hypertension: Closing the Loop
 - VA HSR&D RRP 09-119: ATHENA-HF: Integrating Computable Guidelines for Complex Co-Morbidities
 - PAIRE at VA Palo Alto, Pilot Project for ATHENA-DM
 - VA HSR&D SDR 98-004 and VA HSR&D IMA 04-372; PI: Denise Hynes. ATHENA-CKD knowledge base.



Funding Support ATHENA-OT

- ATHENA-Opioid Therapy was supported by:
 - TRX 04-402: Decision Support for the Management of Opioid Therapy in Chronic Pain, from VA Health Service Research and Development Service (HSR&D)
 - RRP 09-144 : Implementation of ATHENA-OT Decision Support: Facilitators and Barriers, by VA HSR&D QUERI

Acknowledgements ATHENA-CDS

- **Brian Hoffman, MD co-principal investigator for initial ATHENA-HTN**
- **Stanford BioMedical Informatics Research (BMIR) EON Group**
 - **Mark Musen, Samson Tu, Ravi Shankar, Martin O'Connor, Aneel Advani**
- **ATHENA Group at VA Palo Alto**
 - **Bob Coleman, Susana Martins, Grace Yeh, Dallas Chambers, Martha Michel, Dan Wang**
 - **ATHENA OT Denise Daniels, Jodie Trafton, et al**
- **Former Fellows/Residents**
 - **Albert Chan, S. Nicki Hastings, Herb Szeto, Melissa Fischer, Michael Steinmann, Steve Lai, Nancy Lin (ATHENA-CDS)**
- **Physician offline and clinic testing and monitoring; subject matter experts, site-PI's**
 - **Lars Osterberg, Howard Strasberg, Eugene Oddone, Hayden Bosworth, Michael Shlipak, Paul Heidenreich, Michael Gould, Paul Conlin, and others**
- **VISN Collaborative MAVERIC staff and VISN 1 Colleagues**
- **VA OI&T (formerly IRMS)**
- **Statisticians: Phil Lavori and Alex Sox-Harris; Tyson Holmes**
- **Many others who have supported projects**
- **Funding: VA HSR&D (PI Goldstein) and NLM (PI Musen)**

Many Thanks to...

Mentors/Collaborators/Colleagues

- Phil Lavori, PhD
- Kate Lorig, PhD
- Ingram Olkin, PhD
- Michael Steinman, MD
- Judi Walsh, MD
- Carmen Peralta, MD
- Site PI's for multisite studies
- GRECC-based staff
- VAPAHCS CHCE:
 - Ruth Cronkite, PhD; Denise Daniels, PhD; John Finney, PhD; Susan Frayne, MD; Rudy Moos, PhD; Jodie Trafton, PhD

Former Trainees

- Aneel Advani, MD
- Albert Chan, MD
- Melissa Fischer, MD
- S. Nicki Hastings, MD
- Chris Johnson, MD
- Roni Zeiger, MD
- Nancy Lin, ScD

VA OI&T Jeff Shyshka, Eric Raffin,
Doug Wirthgen

VA HSR&D

VA Palo Alto Health Care System

Thank you!

See extra slides for further information,
and/or contact :

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or alyssa.corley@va.gov

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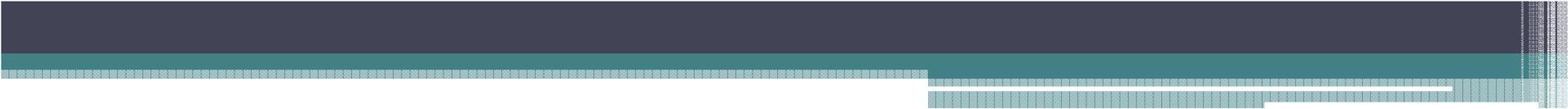
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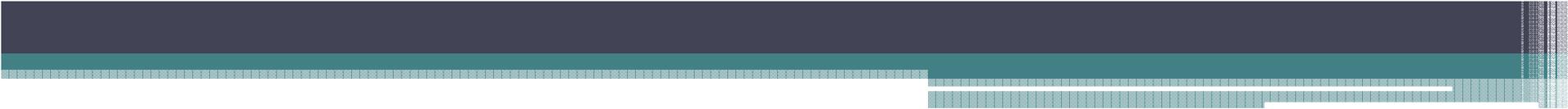
To Learn More About ATHENA-CDS and Decision Support Systems

- A list of cyberseminars about this project are available below or on the Sharepoint site for the VA HSR&D QUERI Enhancing Implementation Science meeting
 - http://www.hsr.d.research.va.gov/for_researchers/cyber_seminars/archives/vci-121608.pdf
 - http://www.hsr.d.research.va.gov/for_researchers/cyber_seminars/archives/vci-091906.pdf

Selected Literature Citations for ATHENA-HTN

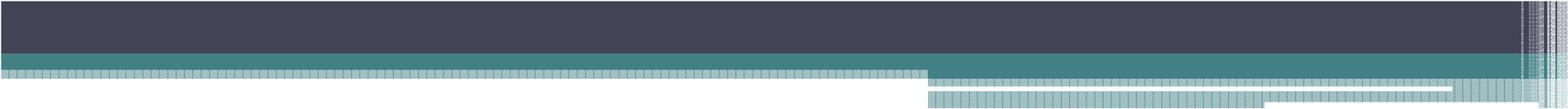
- Goldstein MK, Coleman RW, Tu SW, Shankar RD, O'Connor MJ, Musen MA, Martins SB, Lavori PW, Shlipak MG, Oddone E, Advani AA, Gholami P, Hoffman BB. Translating research into practice: organizational issues in implementing automated decision support for hypertension in three medical centers. *JAMIA* 2004;11(5):368-76.
- Goldstein MK. Using health information technology to improve hypertension management. *Curr Hypertens Rep* 2008; 10(3): 201-7.
- Bosworth HB, Powers BJ, Olsen MK, McCant F, Grubber J, Smith V, Gentry P, Rose C, Van Houtven C, Wang V, Goldstein MK, Oddone EZ. Home Blood Pressure Management and Improved Blood Pressure Control. *Arch Intern Med* 2011; 171 (13): 1173-1180.

Note: A full list of ATHENA-CDS references (27) is posted separately on the Sharepoint site for the HSR&D QUERI Enhancing Implementation Science meeting, or available from the research team.



References for ATHENA-OT System

- Michel M, Trafton JA, Martins S, Wang D., Tu S, Goldstein MK. (2008) Improving Patient Safety Using ATHENA-Decision Support System Technology: The Opioid Therapy for Chronic Pain Experience. Advances in Patient Safety: New Directions and Alternative Approaches, Agency for Healthcare Research and Quality (AHRQ).
- Trafton JA, Martins SB, Michel MC, Wang D, Tu SW, Clark DJ, Elliot J, Vucic B, Balt S, Clark ME, Sintek CD, Rosenberg J, Daniels D and Goldstein MK. (2010) Designing a computerized decision support system to match consensus guidelines for opioid therapy for chronic pain. *Implementation Science* 5:26.
- Trafton JA, Martins S, Michel M, Lewis E, Wang D, Combs A, Scates N, Tu S, Goldstein MK. (2010) Evaluation of the acceptability and usability of a decision support system to encourage safe and effective use of opioid therapy for chronic, non-cancer pain by primary care providers. *Pain Medicine* 11(4):575-85.
- Midboe AM, Lewis E, Cronkite R, Chambers D, Goldstein M, Kerns R, Trafton JA. (in press) Psychology perspectives on the design of health IT to improve decision-making, guideline adherence and care coordination in chronic pain management. *Translational Behavioral Medicine: Practice, Policy, Research*



Extra Slides

- For more background on project

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

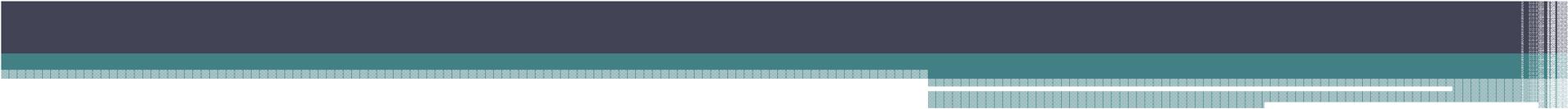
Goldstein MK et al JAMIA 2004

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.

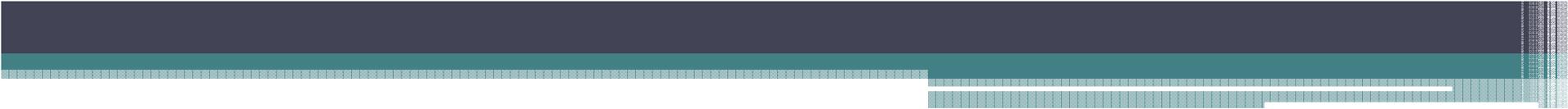
Were Clinicians Following Guidelines?

- 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

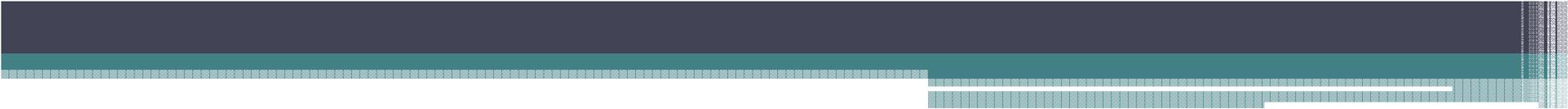
- Effective for monitoring therapy
- Fine-tune existing therapy by making recommendations to improve patient safety, adjust the dose, duration or form of prescribed drugs or increase the laboratory testing rates for patients on long-term therapy.
- Flag key safety issues
 - Alerting providers to high 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

Pearson SA et al BMC Health Services Research 2009



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

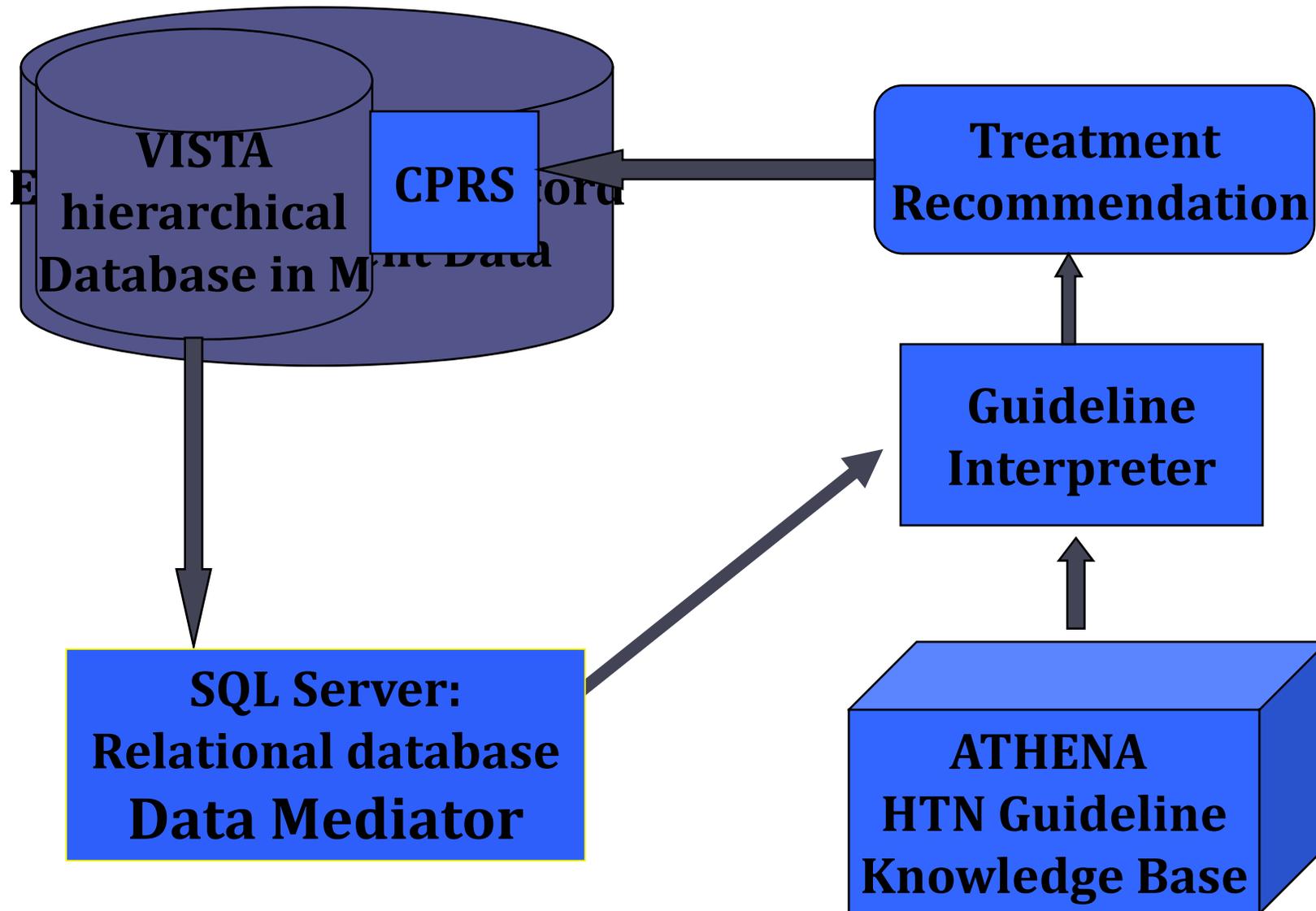
- To make advanced use of health information technology to assist with medical care, CDS should include, within workflow:
 - Rapid display of **pertinent** information about individual patients to the clinician
 - Rapid display of **relevant evidence-based advice/recommendations**
 - Sufficient clinical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

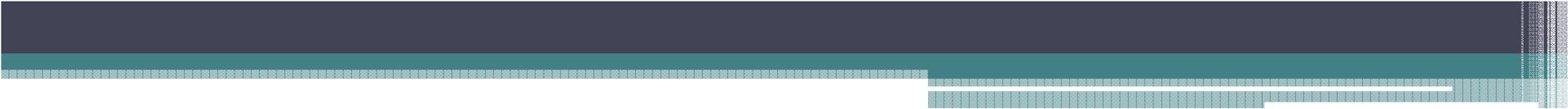
Goldstein et al Proc AMIA Symp. 2000;300-4
Shankar et al Medinfo. 2001;10:538-42
Goldstein et al Proc AMIA Symp. 2001;:214-8

ATHENA Architecture



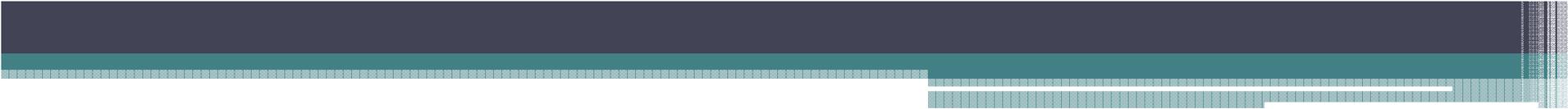
Additional ATHENA-KBs

- 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



“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.”

Osheroff JA, Teich JM, Middleton B, et al.
A Roadmap for National Action on Clinical
Decision Support. *JAMIA* 2007 Mar-
Apr;14(2):141-145



CDS Development Goals

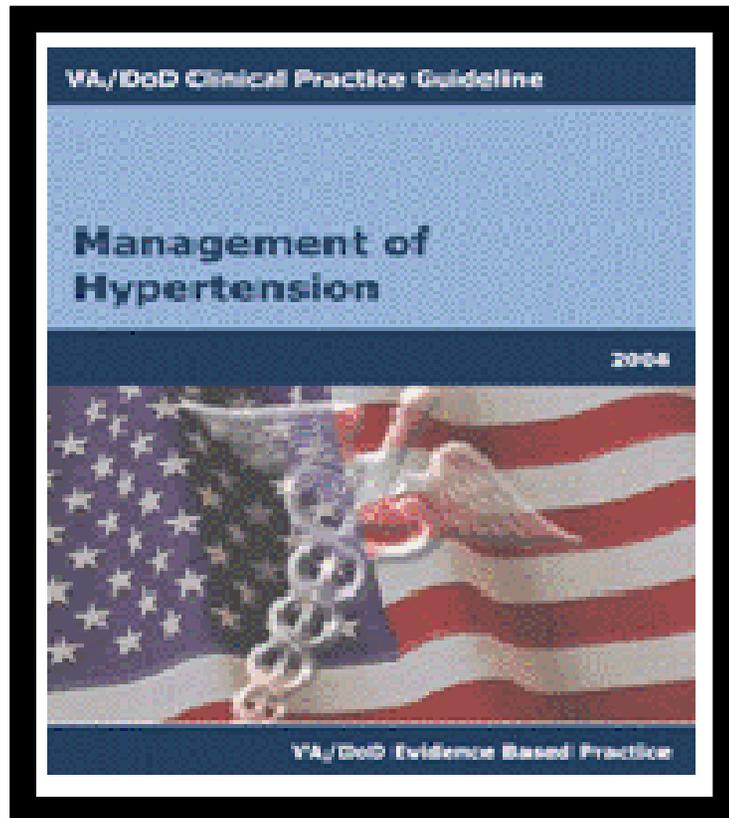
- To make advanced use of health information technology to assist with medical care, our goals in developing CDS included
 - Rapidly presenting pertinent information about individual patients to the clinician
 - Rapidly providing evidence-based advice
 - Accounting for clinical complexity

Patients with EHR Data



Individual Patient
Data

Clinical Practice Guideline



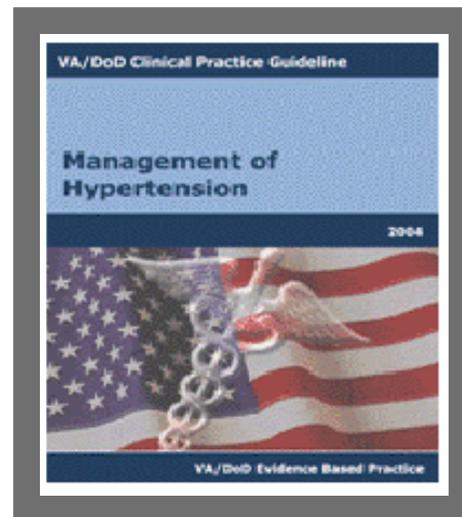
Encoded
Guideline for Care
of the Patient's
Disease

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

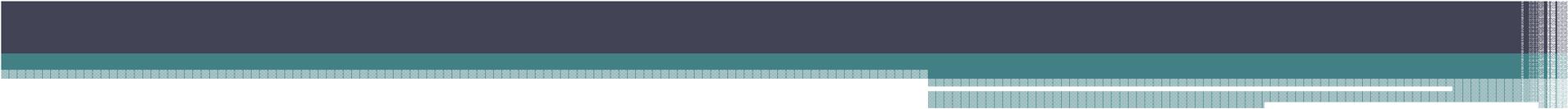
Individual Patient
Data



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