

EBMeDS

**Evidence-Based Medicine
electronic Decision Support**

**Context-Sensitive Guidance
at the point of care**

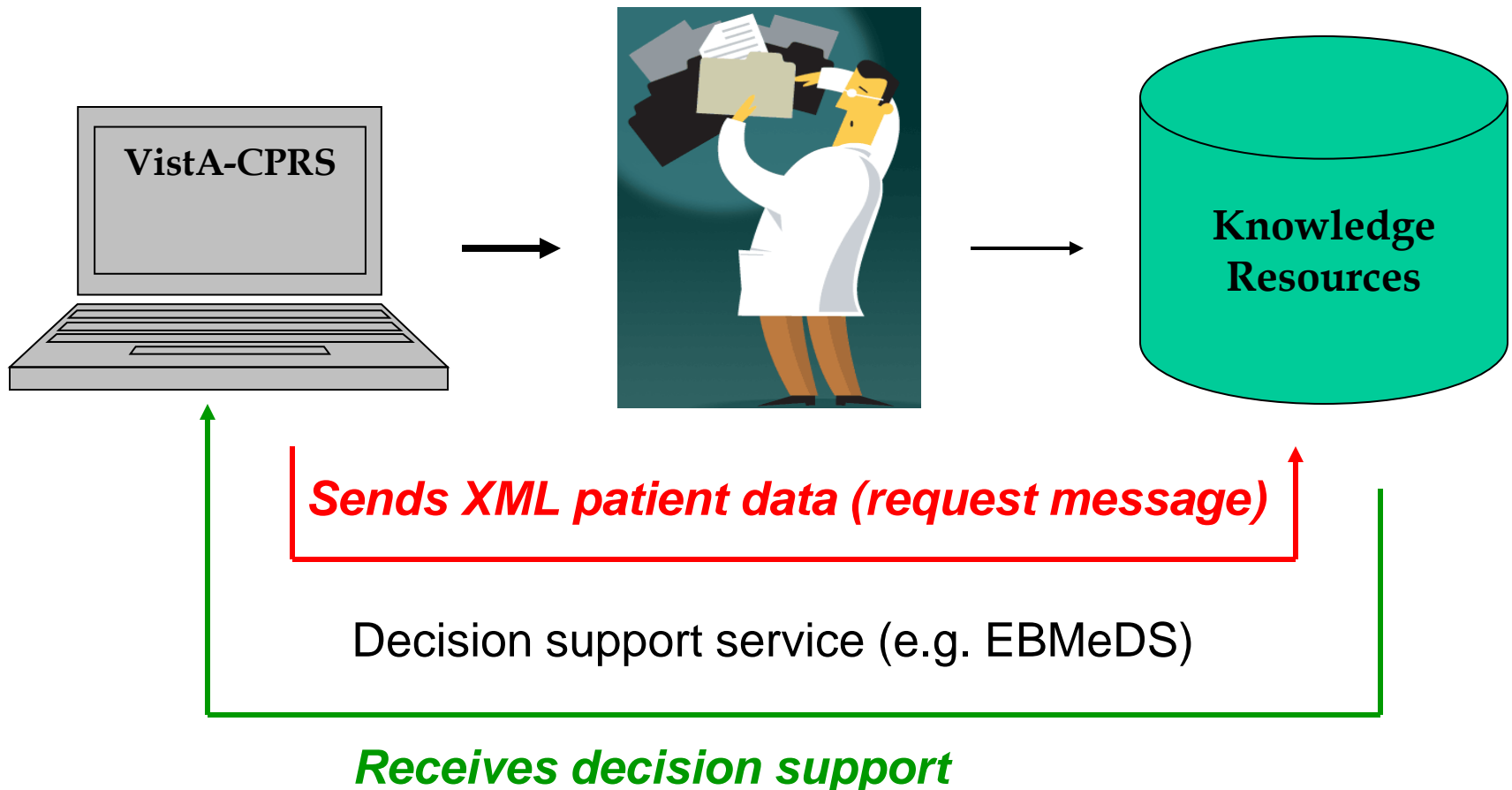
Syed Tirmizi, MD
Associate Professor
George Mason University

What is EBMeDS?

- A plug-in open-source **decision support service** that can be integrated with any electronic health record (EHR) or personal health record (PHR)
- A collaborative **tool for authoring and commenting** on decision support contents

Automatic, patient-specific guidance

Knowledge is pushed to the user



Objective of EBMeDS

The right information for the professional or patient

- automatically
- at the right place
- at the right time

The EBMeDS decision support service

- Based on best EBM sources
 - The Cochrane Library
 - EBM Guidelines
 - InfoPOEMs
- Open source
 - Both knowledge and functionality built in simple text files, using JavaScript
- Customizable with local contents
- Integrated with any system containing patient data (EHR or PHR)
 - Using a simple XML message interface



Easy to use clinical guidelines supported by sound scientific evidence

EBM Guidelines is a unique, concise and easy-to-use collection of clinical guidelines for primary care combined with the best available evidence. Continuously updated EBM Guidelines follows the latest developments in clinical medicine and brings evidence into practice.

The collection includes:

- Almost 1000 concise primary care practice guidelines covering a wide range of medical conditions. Both diagnosis and treatment are included.
- Over 3000 high-quality evidence summaries supporting the given recommendations – a specific feature of the guidelines is the use of evidence codes (graded from A where strong evidence exists and further research is unlikely to change the conclusion, to D where the evidence is weak and the estimate of effect is uncertain).
- A library of 1000 high-quality photographs and images of all common and many rare dermatological conditions, electrocardiograms and eye pictures.
- All reviews from The Cochrane Database of Systematic Reviews cited within **EBM Guidelines** are provided in full text.

EBM Guidelines is the key source of practical information for primary care and a powerful tool reflecting real clinical experience.

[Special subscription fee for General Practitioners](#)

What's new in EBMG

[Browse](#) | [Vocabulary](#) | [History](#) | [Clear](#)

☐ Updates only

Browse database contents

⊕ EBM Guidelines	959
⊕ Evidence summaries	3849
⊕ Pictures	1193
⊕ Audio samples	77
⊕ Videos	72
⊕ Programs	11

EBM Guidelines
provides the evidence
summaries for EBMeDS

2233 Cochrane reviews
are summarized

130 Cochrane reviews
are linked to EBMeDS
rules by 10/2009





Internet

What does EBMMeDS provide?

- Decision support messages (reminders, prompts, alerts) automatically based on data in the EHR or personal health record (PHR)
- Links to guidelines, evidence summaries and Cochrane reviews from codes in the electronic health record (EHR)
- Calculators and forms with data filled from the EHR

O'Connor, Betty

NHS no.:  052157-9456  Age: 52

CRN:

[Patient search](#) [Visit History](#) [Library](#) [Attachments](#) [Patient folders](#) [Logout](#)[Information](#) [Visits](#) [Appointments](#) [Diagnoses](#) [Medication](#) [Measurements](#) [Patient summary](#)

Diagnoses

[Decision support](#) 

30.05.2008 **Non-insulin-dependent diabetes mellitus, duration 1 years**
04.01.2008 Migraine, unspecified
04.11.1992 Predominantly allergic asthma

Acute diagnoses

Procedures and treatments

12.06.2008 Total cholecystectomy nec

Previous visits and episodes

Annual review 05.06.2008

Medication and dosage

04.01.2009	Beclometasone 200microgram inhalation powder capsules	1 + 1 /day
12.06.2008	Enalapril 20mg tablets	1 /day
30.05.2008	Simvastatin 40mg tablets	1 /day

Measurements

Target

Height (cm)	179 cm (6/5/2008)
Weight (kg)	94 kg (6/2/2008)
BMI	29.3 (6/2/2008)
BP (Systolic)	138 mmHg (6/3/2008)
BP (Diastolic)	72 mmHg (6/3/2008)
GHbA1C	7.2 % (3/31/2008)
fS-Chol	3.9 mmol/l (3/31/2008)
fS-Chol-HDL	1.2 mmol/l (3/31/2008)
fS-Trigly	2.17 mmol/l (3/31/2008)

Medicine allergies

Penicillin

Additional info relevant to medication

Diabetes education

Status

BERTIE
DESMOND
Diabetes X-pert Programme
DAFNE


[Medication and Drug Allergies from GP Systems](#)

Other allergies

Special diet

Lifestyle and risks

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Medication and Drug Allergies from GP Systems

Other allergies

Reminders:

- The patients has type 2 diabetes. Metformin is the primary choice for better glycemc control. Check renal function and start metformin? ([scr00016](#))
- The patient has type 2 diabetes and no indication of ASA allergy. Based on current knowledge, ASA treatment is encouraged using a dose 100 mg 1x1. As the patient has asthma check first, whether the patient is intolerant to ASA or other NSAIDs. ([scr00108](#))
- The patient has diabetes. More than 13 months have passed since blood glucose or cholesterol were determined. Time for follow-up? ([scr00492](#))
- The patient has type 2 diabetes and the HbA1c value is increased (7.2%). Intensify hyperglycaemic treatment? ([scr00564](#))

Guidelines:

- Metabolic syndrome
- Newly diagnosed type 2 diabetes
- Diabetes: definition, differential diagnosis and classification
- Treatment and follow-up in type 2 diabetes
- Lifestyle education in type 2 diabetes
- Oral antidiabetic drugs in the treatment of type 2 diabetes
- Insulin therapy in type 2 diabetes
- Migraine
- Headache
- Occupational asthma
- Long-term management of asthma
- Asthma: symptoms and diagnosis
- Treatment of acute exacerbation of asthma

Decision support Click to see
script description

05.06.2008

Target


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- The patient has type 2 diabetes. Metformin is the primary choice for better glycemic control. Check renal function and start metformin? (scr00016)
- The patient has type 2 diabetes and no indication of ASA allergy.

Decision support 

Click to see script description

Acute diagnoses

Medication

04.01.2009
 12.06.2008
 30.05.2008

Medicine a

Penicillin

Medication a

Other aller

The EBMeDS Script Description Viewer - Microsoft Internet Explorer

Metformin as a primary choice for an oral hypoglycemic agent

Script description

The script is launched if the diagnosis is type 2 diabetes. First, the script checks whether the drug list contains metformin. If it does not, the script checks for the plasma/serum creatinine value. If the GFR is in the normal range, reminder (1) is shown. If GFR < 60 ml/min, reminder (2) is shown.

Evidence and Guidelines

EBMG source(s)

- Metformin is a well tolerated oral hypoglycemic agent, which reduces hepatic glucose production and provides proved evidence against cardiovascular events in type 2 diabetic subjects. It belongs to insulin sparing antihyperglycemic agents which do not introduce a risk for hypoglycemia. Metformin has been shown to be especially useful in insulin-resistant states and the primary drug-of-choice in type diabetes, if the body mass index exceeds 23-25 kg/m².
- The available oral antidiabetic agents are equally effective at lowering glucose levels. Only the sulfonylureas and metformin are proven to reduce long-term complications and only metformin

Click to see evidence summary

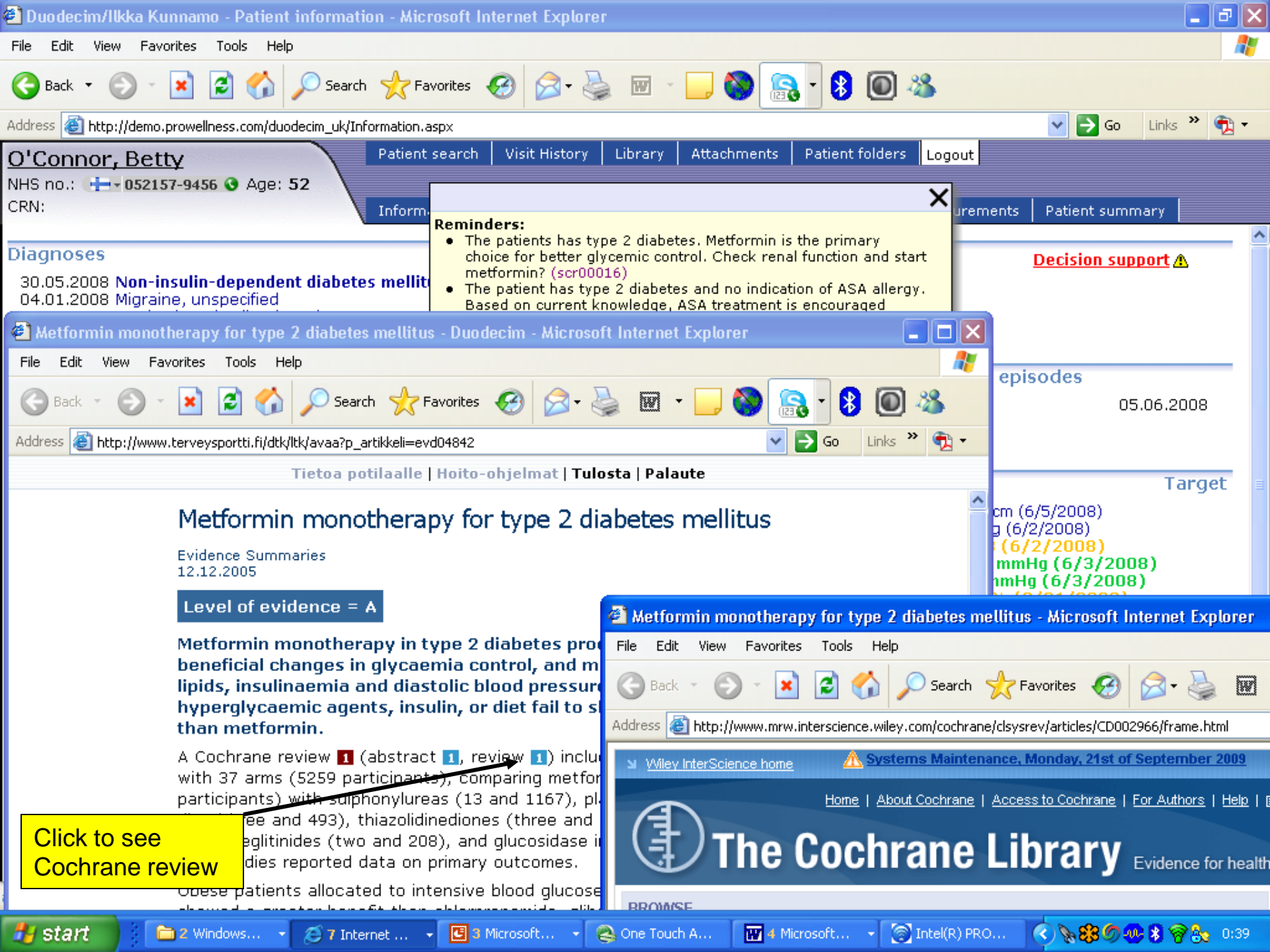
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
Status

programme

d risks



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Inform

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[Measurements](#) [Patient summary](#)Decision support 

Metformin monotherapy for type 2 diabetes mellitus - Duodecim - Microsoft Internet Explorer




[Tietoa potilaalle](#) | [Hoito-ohjelmat](#) | [Tulosta](#) | [Palaute](#)

Metformin monotherapy for type 2 diabetes mellitus

Evidence Summaries
12.12.2005

Level of evidence = A

Metformin monotherapy in type 2 diabetes produces beneficial changes in glycaemia control, and in lipids, insulinaemia and diastolic blood pressure. Hyperglycaemic agents, insulin, or diet fail to sustain these benefits better than metformin.

A Cochrane review  (abstract , review ) included 37 arms (5259 participants), comparing metformin with sulphonylureas (13 and 1167), placebo (three and 493), thiazolidinediones (three and 208), and glucosidase inhibitors (two and 208), and glucosidase inhibitors reported data on primary outcomes.

These patients allocated to intensive blood glucose control showed a greater benefit than placebo.

Click to see
Cochrane review

Metformin monotherapy for type 2 diabetes mellitus - Microsoft Internet Explorer

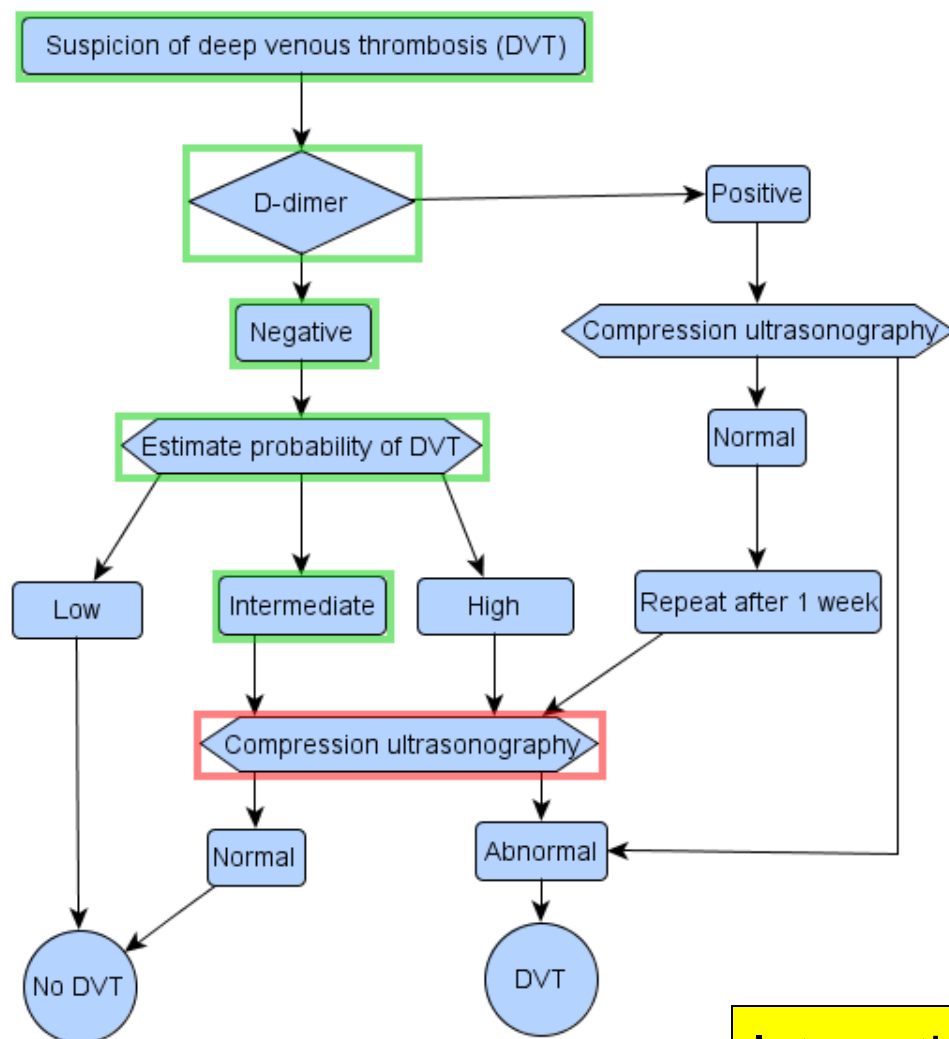
[Wiley InterScience home](#) Systems Maintenance, Monday, 21st of September 2009[Home](#) | [About Cochrane](#) | [Access to Cochrane](#) | [For Authors](#) | [Help](#) | [Feedback](#)

The Cochrane Library

Evidence for health

BROWSE

Parameters: D-dimer: mg/l • DVT score: • [dvt](#) • [treatment](#)



Deep venous thrombosis in femoral vein (compression ultrasonography)

Video database
10.9.2009
Ilkka Kunnamo











An old woman had swelling of the whole right leg. Compression ultrasonography on the level of the inguinal ligament shows an incompressible femoral vein, when gentle pressure is repeatedly applied to the probe (first a transverse view, then a longitudinal view of the vein). The thrombus in the vein is slightly echogenic. The slightly smaller artery is visible above the vein. In the longitudinal view the tail of the thrombus is visible inside the vein on the left. On the right the vein is normally compressible. The second transverse and longitudinal views show a normal left femoral vein.



Interactive algorithms

EBMeDS as a tool for
continuous professional
development
and quality measurement

Choose executed health check Doctor in charge: Ilkka Kunnamo
Care unit: Duodecim

SSN	Name	Care recommendation
 040432-0404	 Lisa Jones	Reminders: <ul style="list-style-type: none">The creatinine level is increased (190 $\mu\text{mol/l}$). Furosemide is recommended instead of a thiazide diuretic at least when the creatinine level exceeds 200 $\mu\text{mol/l}$. (scr00005)
 060629-0606	 Martha Kinsley	Reminders: <ul style="list-style-type: none">The patient has a diagnosis of congestive heart failure, but no information on left ventricular ejection fraction. (scr00272)The patient's weight has increased more than 2 kg (79 kg) . The dose of furosemide should be increased. (scr00274)
 050548-0505	 Robert Lawson	Reminders: <ul style="list-style-type: none">The patient is overweight (BMI 33.1) and no blood glucose test has been performed during the last two years. Consider ordering the test. (scr00490)The patient is overweight (BMI 33.1), and no lipid tests have been performed during the last 2 years. Consider ordering the test (scr00490)
 030459-0405	 Sam Meady	Reminders: <ul style="list-style-type: none">Selective beta-blockers are better tolerated non-selective beta-blockers in patients with asthma or COPD. (scr00422)
 030369-0303	 Homer	Reminders:

In a virtual health check all rules are executed in a **population** of patients, and resulting reminders are listed.



Questions to EHR or PHR vendors interested in implementing EBMeDS

- Do you have clinical data such as test results, diagnoses, medications, physiological measurements (weight, height, blood pressure) in electronic format?
- Are any of the data in structured format (coded)?
- Can you produce the XML-query message from the data?

If the answer is yes to all questions, EBMeDS can be implemented

Expected benefits from using EBMeDS

- Improves quality of care by decreasing errors
- Provides active guidance triggered by data in the EHR/PHR supports also "passive" users
- Targets also patients that have dropped out from follow-up prevents complications of disease or treatment
- Provides automated transfer of patient data to forms and calculators -> saves time
- Improves and speeds up the access of the professional and citizen to reliable and up-to-date medical information
- Offers an opportunity to quality measurement and reporting improving quality of care and outcomes
- Guides the patients (using a PHR) to healthy living and contacting health care professionals at the right time

Reminders for doctors, nurses, and patients

Example: Inhaled corticosteroids with or instead of long-acting beta-agonists for asthma

- **Doctor:** The patient is using a long-acting beta-agonist (<Trade name>) but no inhaled corticosteroid. For efficacy and safety reasons, add or replace with the latter.
- **Nurse:** as above + Consult a doctor. Not urgent
- **Patient:** You seem to be using an asthma medicine (<Trade name>) which is usually recommended only in conjunction with an inhaled corticosteroid. Inhaled corticosteroids should usually constitute the backbone of asthma treatment when long-term medication (lasting more than a few weeks) is needed. Long-acting beta-agonists, such as (<Trade name>), are usually used for additional effect if inhaled corticosteroids alone are not adequate. Discuss adjusting your medication with your doctor.

Patient's user interface to EHR

- Coded data is translated into lay language by means of a metathesaurus
- The terms are linked to definitions and explanations, "The Patient's Handbook", and local sources of patient information

Diagnoses

Lactose intolerance (poor absorption of)

[What is lactose intolerance](#)

[Diet advice](#)

Your cholesterol is above the agreed limit. Contact your doctor

Laboratory results

Haemoglobin

124

[Normal range](#)

[What does Hb tell](#)

Cholesterol

5.9

[Normal range](#)

LDL cholesterol

3.8

[Normal range](#)

[Lipid measurements](#)

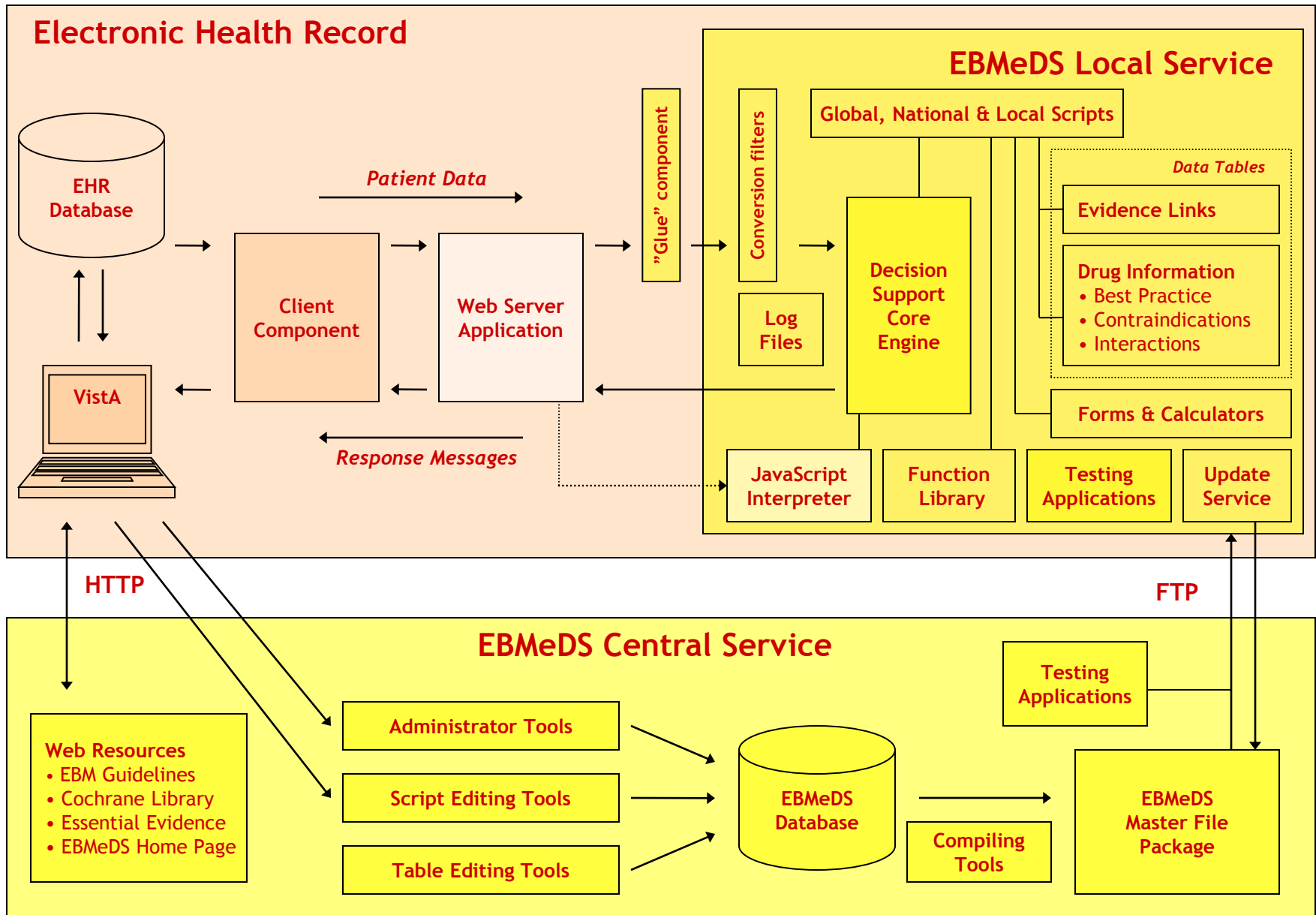
("evil cholesterol")

Cardiovascular risk (10 yrs) 6.2 % [How can I reduce my risk?](#)

[Treatment plan](#)

EBMeDS

Evidence-Based Medicine electronic Decision Support



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**

•Goldstein MK et al Proc AMIA 2000

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.**

What the Clinician Sees...

TESTPATIENT.GOLF

000-00-4422

Jun 10,1961 (41)

Visit Not Selected

Provider: GOLDSTEIN,MARY K

Primary Care Team Unassigned

Remote Data

Postings AD

Active Problem

Congestive Diabetes Hypertension Cerebral Hypertension Contact de Hail Loss Health Care

Active Medication

Genfibrozil 600 Lisinopril 20mg Ibuprofen 600

Recent Lab Results

Retrieving in background

ATHENA Hypertension Advisory

Patient SSN

Name

Patient Summary

Most Recent BP in Database

155/82

Date

10-25-2006

ENTER Today's Decision BP

Date

12-12-2006

Update Advisory

Guideline Goal: SBP < 130 and DBP < 85 [presence of diabetes, heart failure or renal insufficiency]

BP apparently NOT UNDER CONTROL, based on most recent available BP.

(Enter "Today's Decision Blood Pressure" and press "Update Advisory" for new recommendations.)

Recommendations

Precautions

Assumptions

Lifestyle

Adherence

Glossary

BP-Prescription Graphs

Prescription(s) for insulin has(have) NOT BEEN FILLED RECENTLY.

Consider INTENSIFYING drug treatment: BP ELEVATED based on most recent available BP.

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 ACE Inhibitors(lisinopril)	Info	<div>Diabetes & Renal Manifestation</div> <div>Heart Failure</div> <div>Renal Insufficiency</div>	Feedback
Add Thiazide Diuretic (HCTZ)	Info	<div>Isolated Systolic Hypertension</div> <div>Heart Failure</div>	Feedback

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

Do not display Advisory for this clinic visit again.

Recommendations considered

Not 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.

Cover Sheet

Problems

Meds

Orders

Notes

Consults

D/C Summ

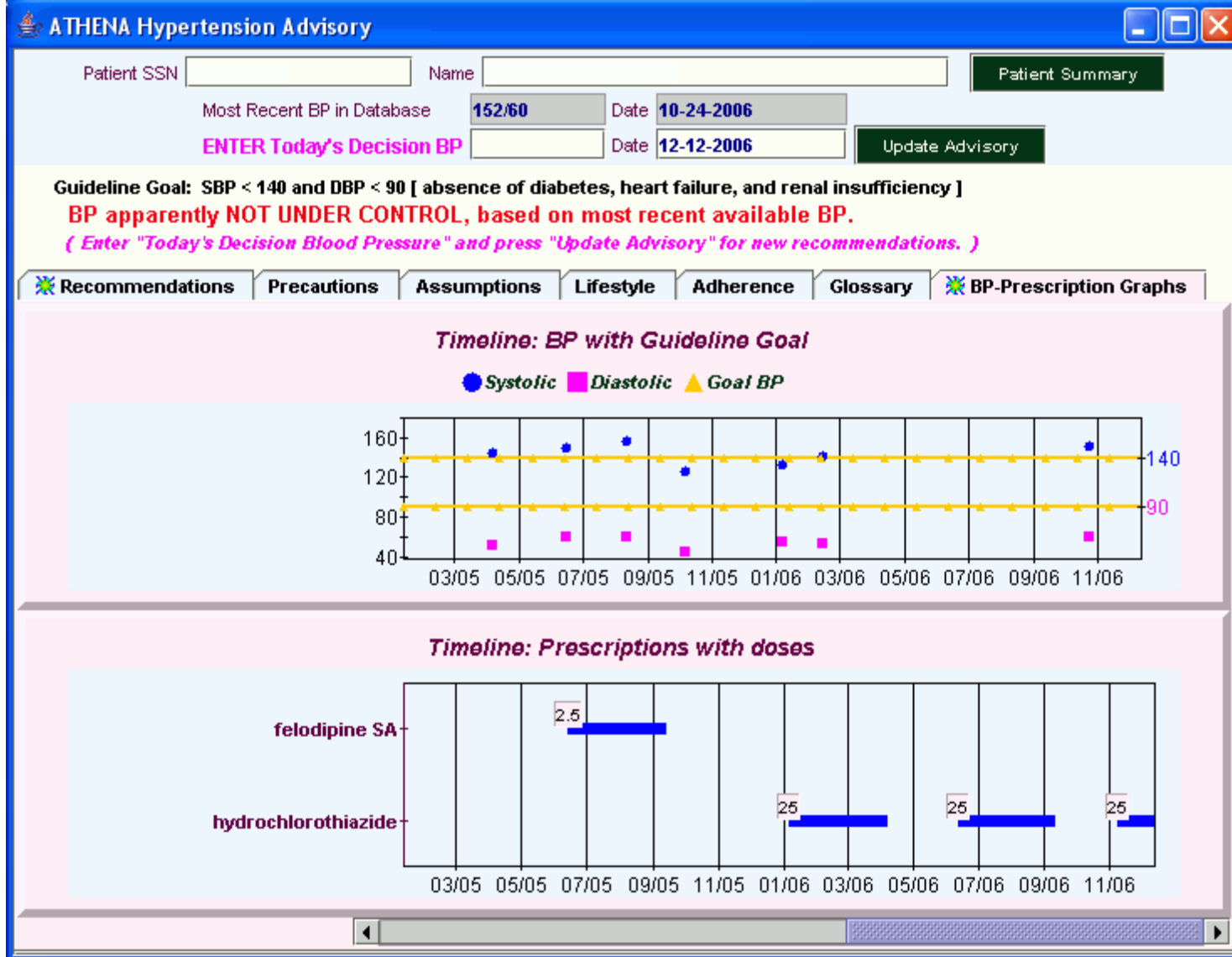
Labs

Reports

Sep 11,02 09:00

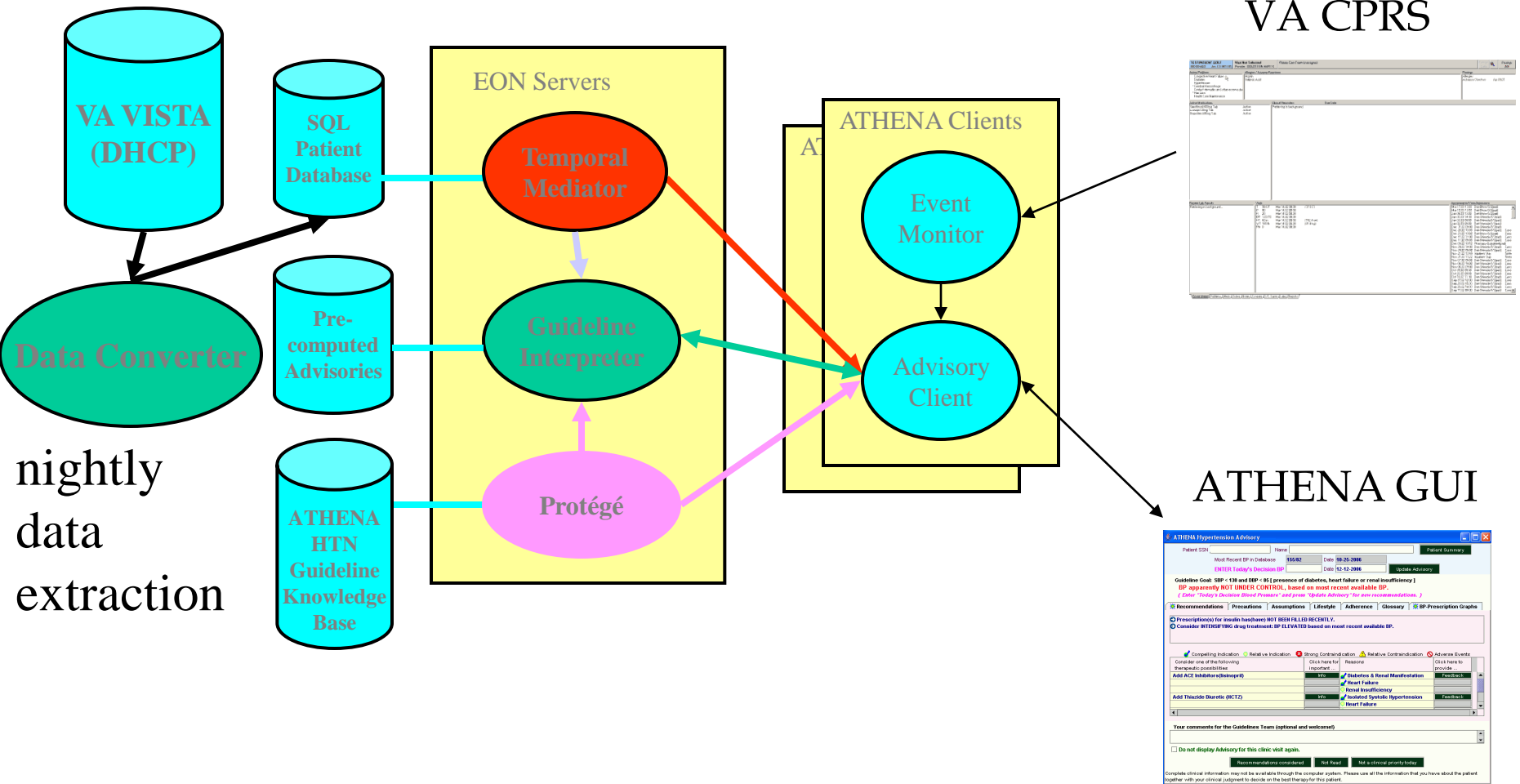
Diets:shinde

5/3(pad)



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 &

Building ATHENA System From EON Components



Demos

Email: worldmed@gmail.com