Clinical Decision Support in Use in UW Medicine Electronic Medical Record Systems

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October 5, 2010

Topic for today

Computerized clinical decision support sytems

- Definitions
- What we have learned
- National initiatives
- Diagnostic errors
- Computerized clinical decision support in UW Medicine
- Barriers, and what to do about them
- Opportunities

Consensus CDS Definition

"Providing clinicians, patients or individuals with knowledge and person-specific or population information, intelligently filtered or presented at appropriate times, to foster better health processes, better individual patient care, and better population health."

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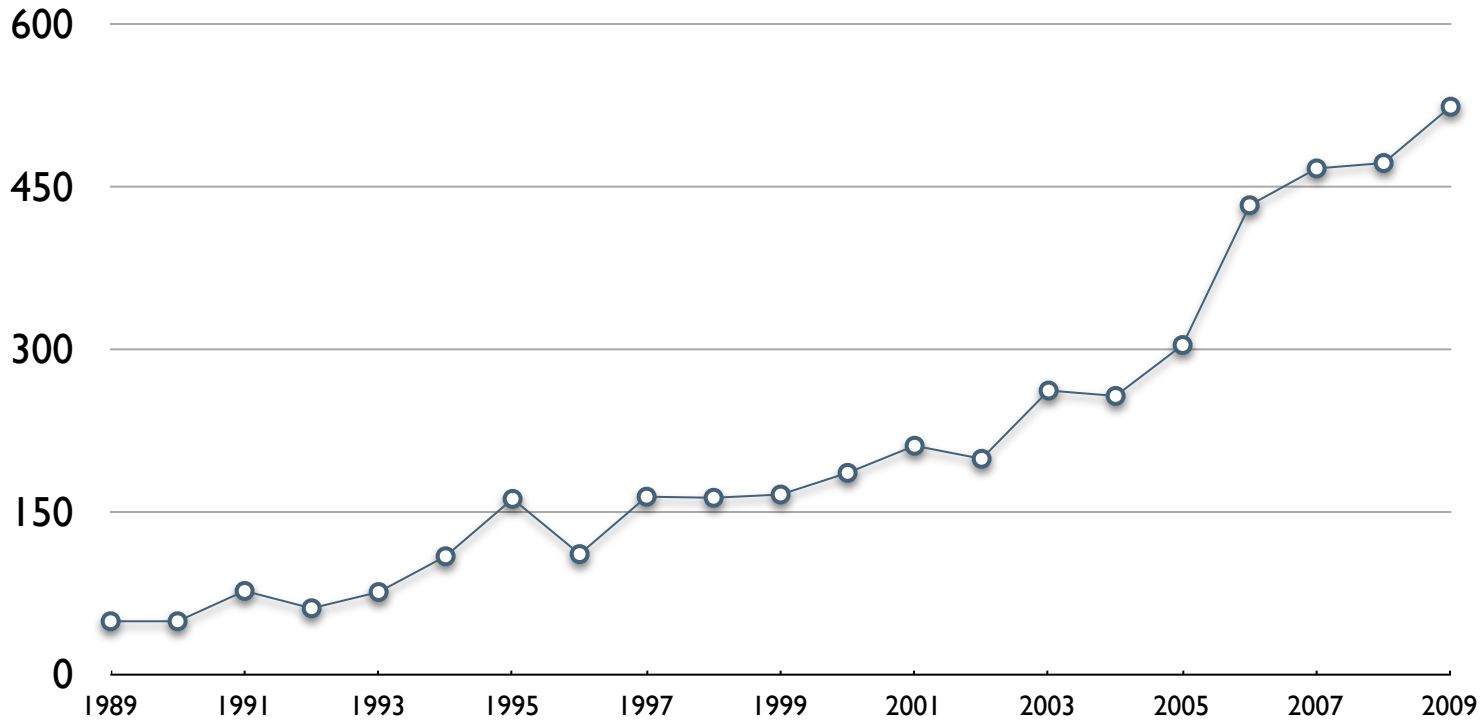
History of computerized clinical decision support

- Early promise
  - Algorithmic approaches to acid-base disorders
  - Diagnostic expert systems (Iliad, QMR, DXplain)
  - Free-standing expert systems (MYCIN, ONCOCIN)
- Later years
  - Embedded, limited, decision support
  - Clinical event monitors: Arden syntax
  - Attempts to automate clinical guidelines and exchange algorithms
  - Concerns about over-alerting
- Gap translating what has been learned from research into production patient care systems.

Medline articles with "decision support" in title or abstract



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Viewpoint paper

Clinical decision support: progress and opportunities

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ABSTRACT
In 2005, the American Medical Informatics Association undertook a set of activities relating to clinical decision support (CDS), with support from the office of the national coordinator and the Agency for Healthcare Research and Quality. They culminated in the release of the roadmap for national action on CDS in 2006. This article assesses progress toward the short-term goals within the roadmap, and recommends activities to continue to improve CDS adoption throughout the United States. The report finds that considerable progress has been made in the past four years, although significant work remains. Healthcare quality organizations are increasingly recognizing the role of health information technology in improving care, multi-site CDS demonstration projects are under way, and there are growing incentives for adoption. Specific recommendations include: (1) designating a national entity to coordinate CDS work and collaboration; (2) developing approaches to monitor and track CDS adoption and use; (3) defining and funding a CDS research agenda; and (4) updating the CDS 'critical path'.

The quality and safety of medical care in the United States have drawn increased attention in the past decade. Studies suggest many errors could be avoided with the use of health information and communications technology (HIT).[i] [1–4] Such improvements have been facilitated by the adoption of computerized provider order entry systems, electronic medical records that improve accessibility to clinical data, and a variety of approaches loosely grouped together and referred to as clinical decision support (CDS) systems. To foster better health processes, better individual patient care, and better population health, CDS systems intelligently provide, at appropriate times, knowledge or information (person-specific or population-specific). Clinicians, patients and individuals thus benefit from CDS.[5] Clinical decision support interventions may include alerting and reminder systems, dosing calculators, and order sets and tools that provide access to medical knowledge at the point of care. Evidence suggests that computerization of medical record systems and even implementation of provider order entry systems may not be sufficient to ensure

Research and Quality (AHRQ) asked the American Medical Informatics Association (AMIA) to develop a plan to guide federal and private sector activities to advance CDS. In response, AMIA established the CDS roadmap development steering committee to lead this effort. A set of meetings and consensus panels led to the production of the roadmap for national action on CDS (the 'CDS roadmap') in 2006.[5] This report recommended activities to facilitate CDS development, implementation and use throughout the United States to improve the quality, safety and efficiency of healthcare. The roadmap included a critical path that recommended activities in the three-year timeframe following the report's publication.

Since then, significant effort by numerous stakeholders, including federal agencies, quality organizations, informatics groups, healthcare systems and individual researchers have devoted effort to CDS. To assess national progress in CDS, we conducted an environmental scan, reviewing published literature, white papers, reports by multiple stakeholders and recent legislation. Using the critical path activities as a framework, our report presents a synthesis of progress to date. We discuss future directions and recommend specific next steps, taking into consideration trends in clinical computing and increased availability of funds to support HIT as part of the recent US federal stimulus package.

THE CDS ROADMAP AND THE CRITICAL PATH

The CDS roadmap organizes its recommendations into three pillars ('best knowledge available when needed', 'high adoption and effective use' and 'continuous improvement of knowledge and CDS methods'), with each pillar subdivided into two strategic objectives (table 1).[5] A comprehensive work plan in the roadmap suggests a detailed list of actions across a broad timeline.

The roadmap also lays out a set of short-term critical path activities, focused on the three-year time horizon from 2006 to 2009. Suggestions include an executive steering group to coordinate and facilitate progress, and efforts to share knowl-

A Roadmap for National Action on Clinical Decision Support

- Best knowledge available when needed
- High adoption and effective use
- Continuous improvement of knowledge and CDS methods

Adam Wright, Oregon Health & Sciences University
Don E. Detmer, American Medical Informatics Association

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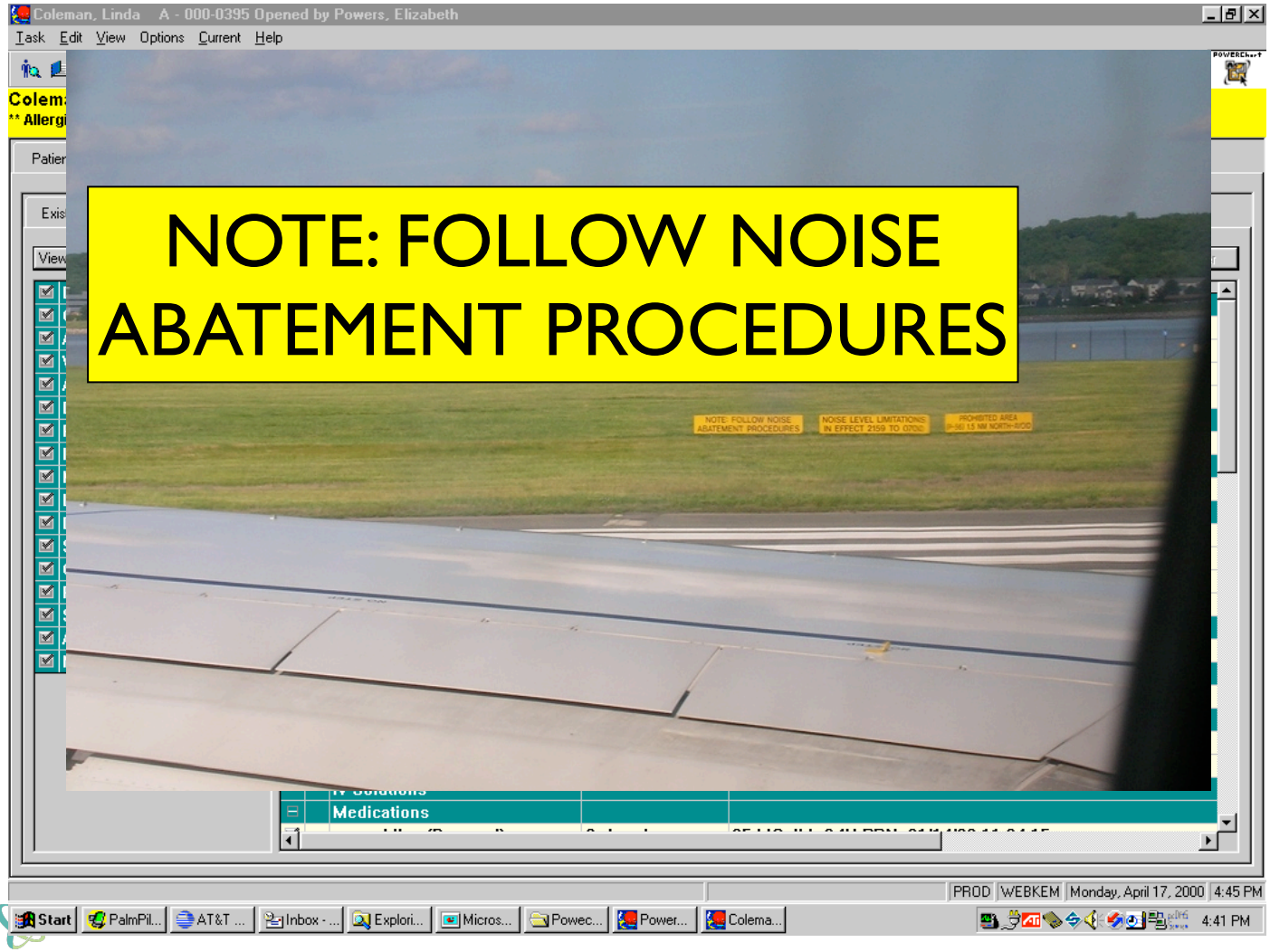
McDonald, C. J. Protocol-based computer reminders, the quality of care and the non-perfectability of man. N Engl J Med 1976;295:1351-5.



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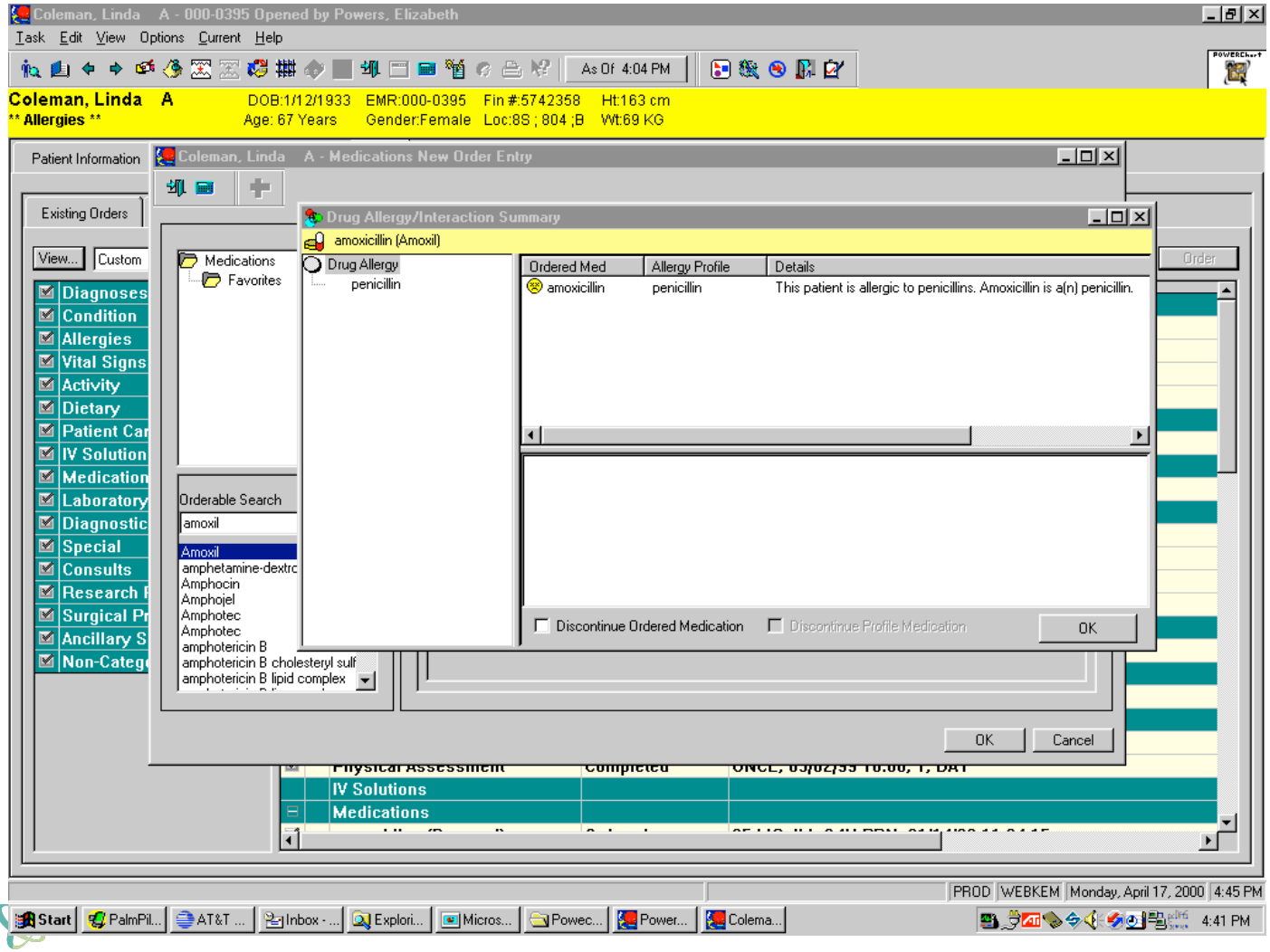
McDonald, C. J. Protocol-based computer reminders, the quality of care and the non-perfectability of man. N Engl J Med 1976;295:1351-5.



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Ten Rules for Effective Clinical Decision Support

1. Speed is everything
2. Anticipate needs and deliver in real time
3. Fit into the user's workflow
4. Little things can make a big difference.
5. Physicians resist stopping
6. Changing direction is fine
7. Simple interventions work best
8. Asking for information is OK--but be sure you really need it
9. Monitor impact, get feedback, and respond
10. Knowledge-based systems must be managed and maintained

Bates DW Kuperman GJ et al J Am Med Inform Assoc 2003; 10:523

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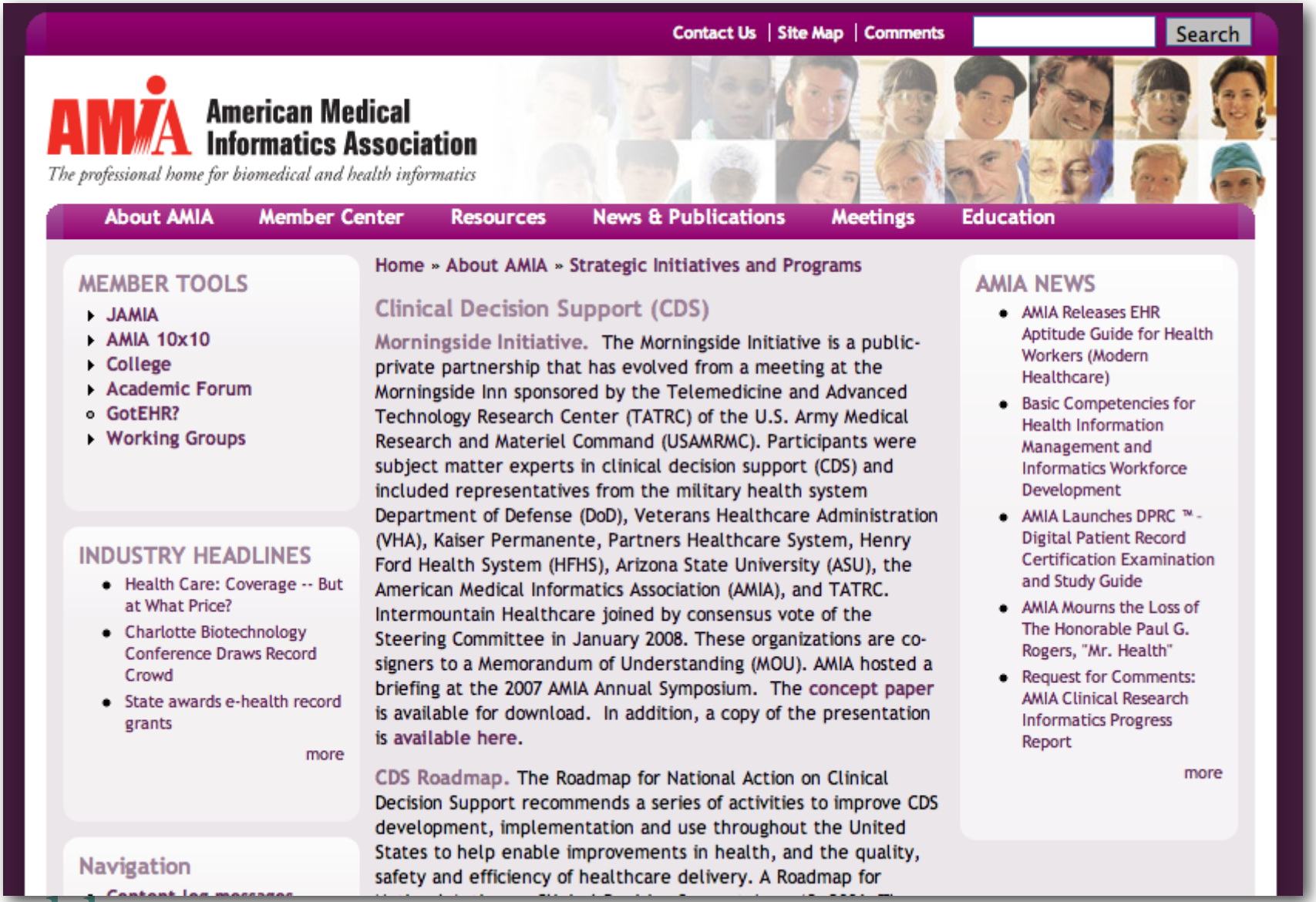

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Clinical Decision Support (CDS)

Morningside Initiative. The Morningside Initiative is a public-private partnership that has evolved from a meeting at the Morningside Inn sponsored by the Telemedicine and Advanced Technology Research Center (TATRC) of the U.S. Army Medical Research and Materiel Command (USAMRMC). Participants were subject matter experts in clinical decision support (CDS) and included representatives from the military health system Department of Defense (DoD), Veterans Healthcare Administration (VHA), Kaiser Permanente, Partners Healthcare System, Henry Ford Health System (HFHS), Arizona State University (ASU), the American Medical Informatics Association (AMIA), and TATRC. Intermountain Healthcare joined by consensus vote of the Steering Committee in January 2008. These organizations are co-signers to a Memorandum of Understanding (MOU). AMIA hosted a briefing at the 2007 AMIA Annual Symposium. The concept paper is available for download. In addition, a copy of the presentation is available here.

CDS Roadmap. The Roadmap for National Action on Clinical Decision Support recommends a series of activities to improve CDS development, implementation and use throughout the United States to help enable improvements in health, and the quality, safety and efficiency of healthcare delivery. A Roadmap for

AMIA NEWS

- AMIA Releases EHR Aptitude Guide for Health Workers (Modern Healthcare)
- Basic Competencies for Health Information Management and Informatics Workforce Development
- AMIA Launches DPRC ™ - Digital Patient Record Certification Examination and Study Guide
- AMIA Mourns the Loss of The Honorable Paul G. Rogers, "Mr. Health"
- Request for Comments: AMIA Clinical Research Informatics Progress Report

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Clinical Decision Support Workshop Meeting

August 25 – 26, 2009

Office of the National Coordinator for Health Information Technology

55 Helpful People

Summary document:

http://healthit.hhs.gov.

Search for: ONC CDS Workshop

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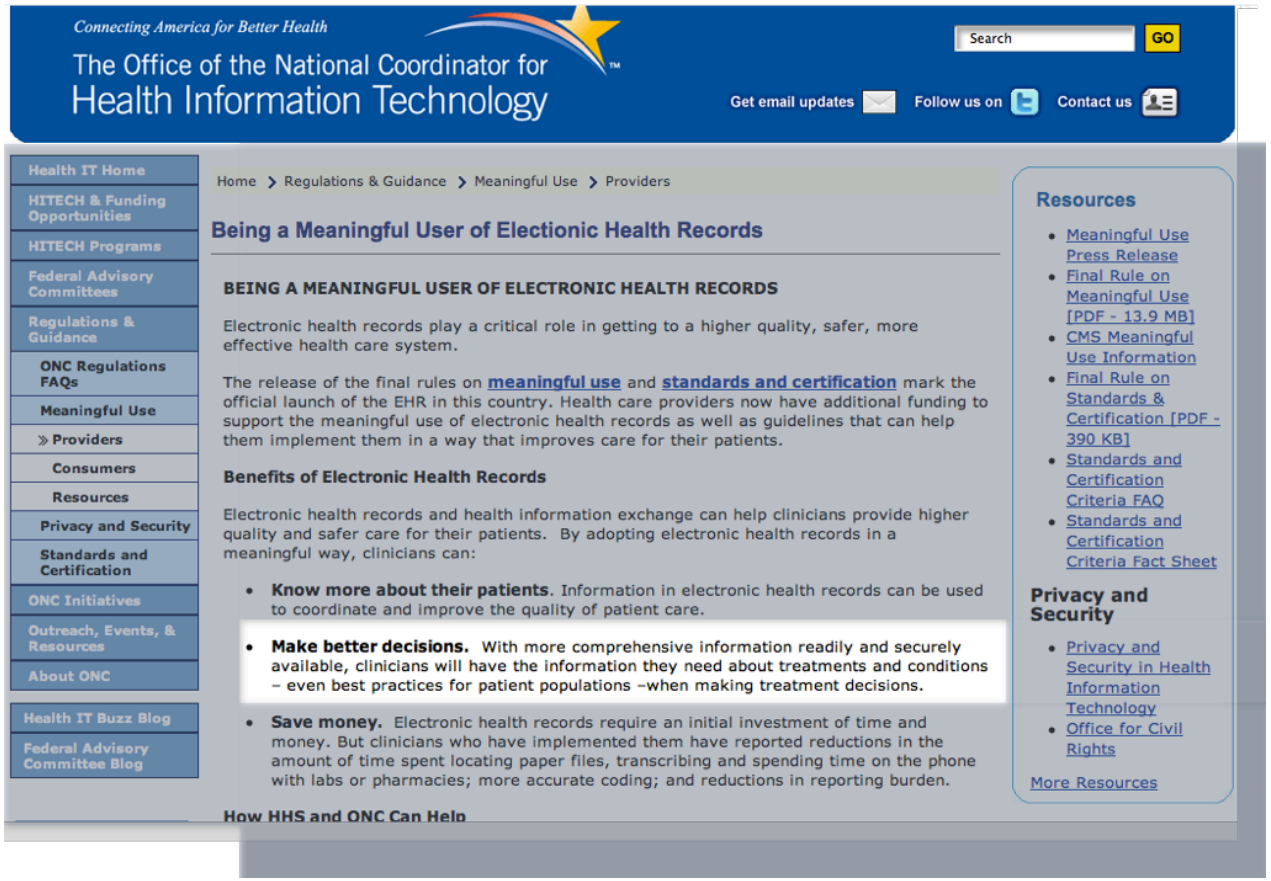
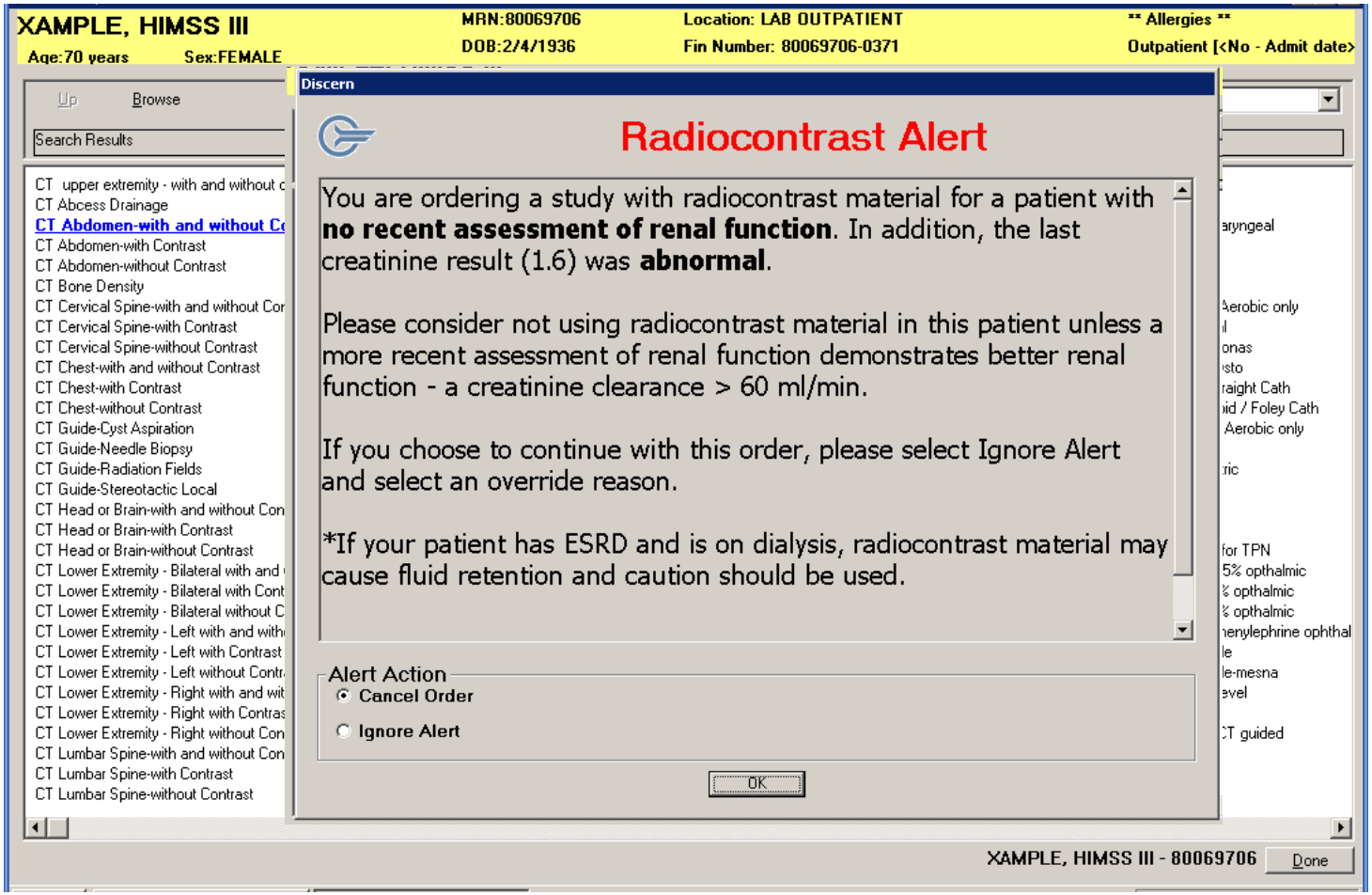
Improving clinical decision making with healthcare IT is a national goal



Alerts



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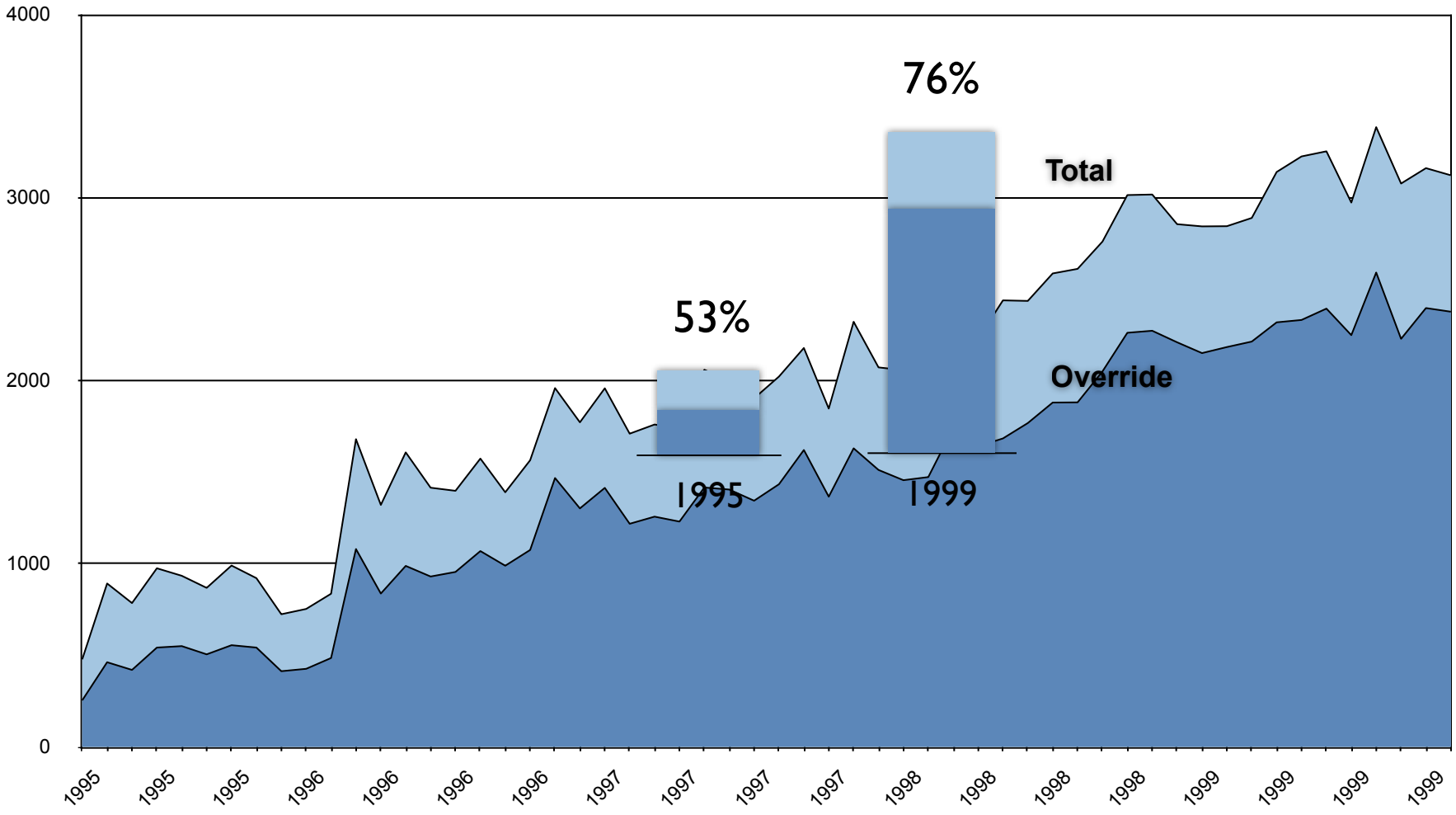
Slide courtesy of Bill Galanter, MD

Total and overridden allergy alerts

[Abookire et al Proc AMIA 2000]



The New England Journal of Medicine

Special Article

A COMPUTER-ASSISTED MANAGEMENT PROGRAM FOR ANTIBIOTICS AND OTHER ANTIINFECTIVE AGENTS

R. Scott Evans, Ph.D., Stanley L. Pestotnik, M.S., R.Ph., David C. Classen, M.D., M.S., Terry P. Clemmer, M.D., Lindell K. Weaver, M.D., James F. Orme, Jr., M.D., James F. Lloyd, B.S., and John P. Burke, M.D.

Abstract

Background and Methods Optimal decisions about the use of antibiotics and other antiinfective agents in critically ill patients require access to a large amount of complex information. We have developed a computerized decision-support program linked to computer-based patient records that can assist physicians in the use of antiinfective agents and improve the quality of care. This program presents epidemiologic information, along with detailed recommendations and warnings. The program recommends antiinfective regimens and courses of therapy for particular patients and provides immediate feedback

FACED with an increasing loss of autonomy in the managed care marketplace, physicians often view the debate about the quality of care as simply about finding ways to reward them for doing less for patients and to control costs by the use of arbitrary rules for clinical care.[1] Skeptics view quality-of-care projects as a disguised form of marketing; this skepticism will not disappear until physicians can see quality-of-care efforts that make difficult decisions easier and more accurate.[2,3] Establishing systems for improving care is difficult, at best, for groups of specialist physicians, but it is next

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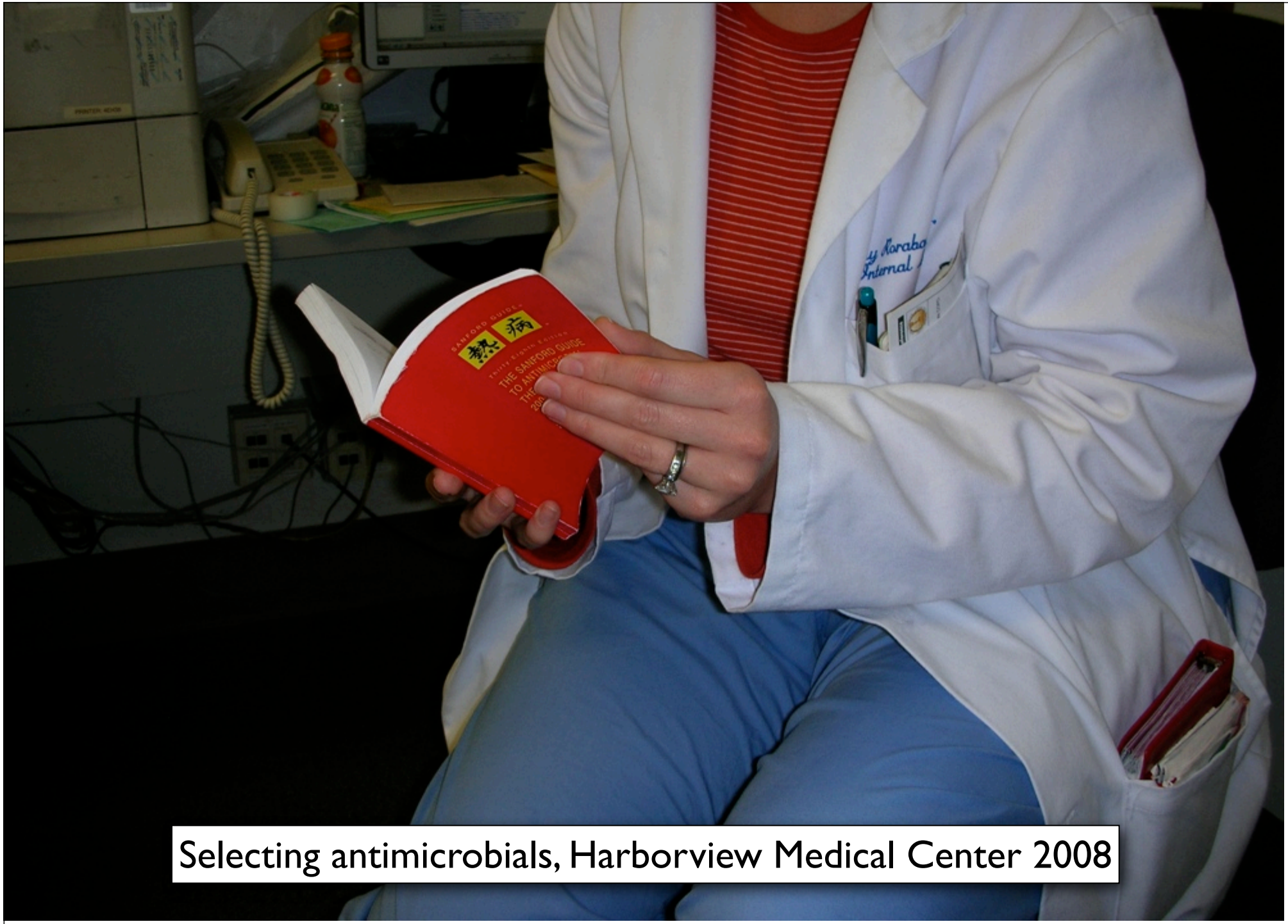
NEJM 1998; 338:232-238



Selecting antimicrobials, Harborview Medical Center 2008

Effect of point-of-care computer reminders on physician behaviour: a systematic review

[Shojania et al CMAJ 2010;182]

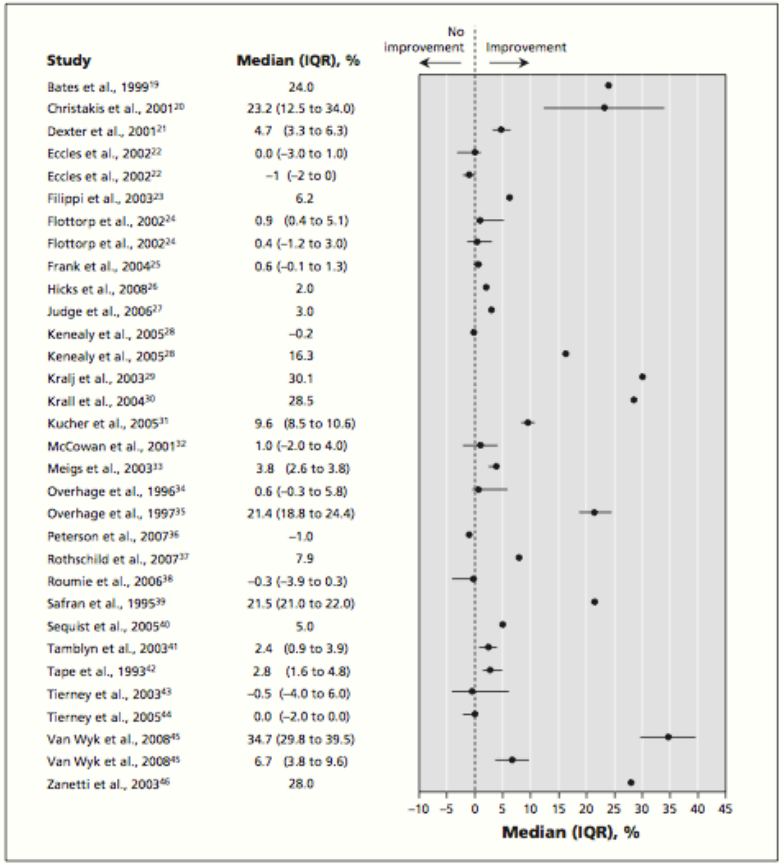


Figure 2: Median absolute improvements in adherence to processes of care between intervention and control groups in each study. Each study is represented by the median and interquartile range for its reported outcomes; studies with single data points reported only one eligible outcome.

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- Opportunities

Diagnostic errors

[Schiff and Bates N Engl J Med 362 2010]

"A fundamental part of delivering good medical care is getting the diagnosis right ... Diagnostic errors are common, outnumbering medication and surgical errors as causes of outpatient malpractice claims and settlements.

The problem of having too much information is now surpassing that of having too little..."

Diagnostic errors

[Schiff Arch Intern Med169 2009]

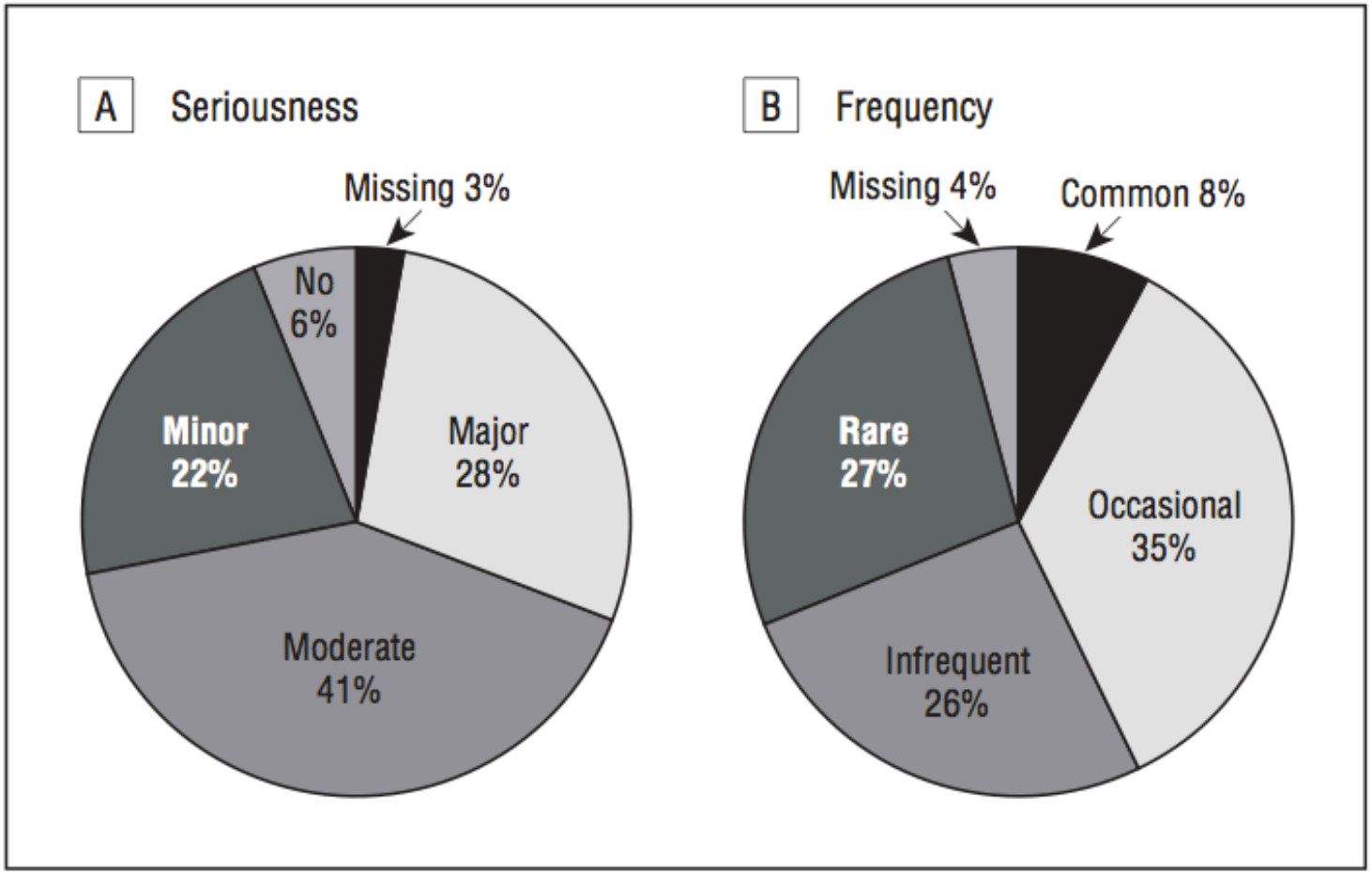

Figure 2. Perceived seriousness (A) and frequency (B) of the reported diagnosis error as rated by the physician reporting the error.

How can we avoid diagnostic errors?
Ideas

- "Grand" problem list created from corpus of notes in individual patient's record. Diagnostic impressions, theories, from multiple authors. NLP makes this now possible.
- Re-examine diagnostic expert systems? Data on which they rely is increasingly in discrete, encoded form.
- "Question list." What unanswered questions have been posed by others who have written notes in this patient's record?
- Can pedigree be determined from notes? Does it suggest increased risk for heritable disease?

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UW Medicine, Seattle

- Hospitals

  Harborview Medical Center
  UW Medical Center
  Seattle Cancer Care Alliance
  949 beds, 51,000 admissions
  Northwest Hospital
  281 beds, 11,246 admissions

- Clinics

  1.4 million outpatient and ER visits
  Northwest Hospital
  463,804 outpatient and ER visits

- Staff

  1,200 attending physicians
  Northwest Hospital 624 medical staff
  1,100 residents
  800 medical students
  1,200 nurses

http://www.nwhospital.org/aboutus/

EMRs in use in UW Medicine

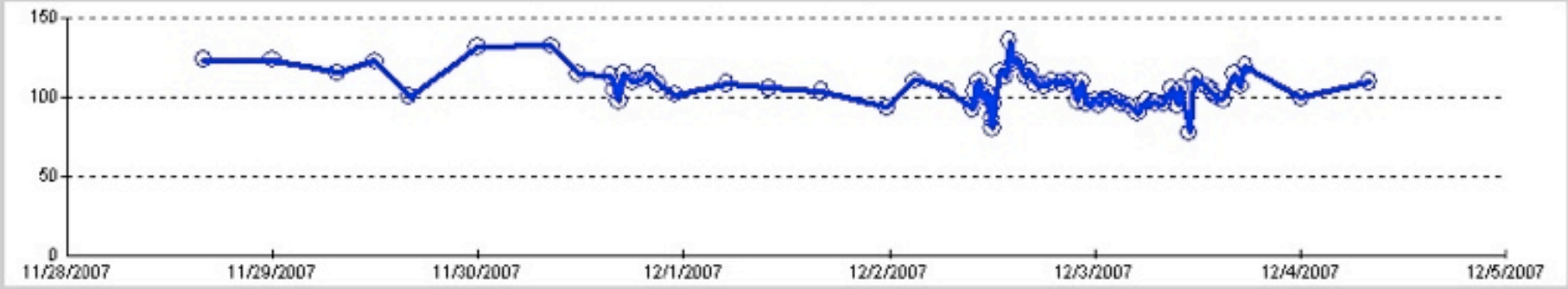
Most commonly used systems

- Cerner **Millennium**. Powerchart, electronic notes, inpatient bedside documentation, MAR, results review
- Epic Systems **EpicCare**. CPOE, electronic notes, clinical workflow, reminders, health maintenance
- Isoprime **Neodata**. NICUs.
- Siemens **Soarian**. Northwest Hospital inpatient.
- Merge **Docusys**. UWMC, HMC OR suites.

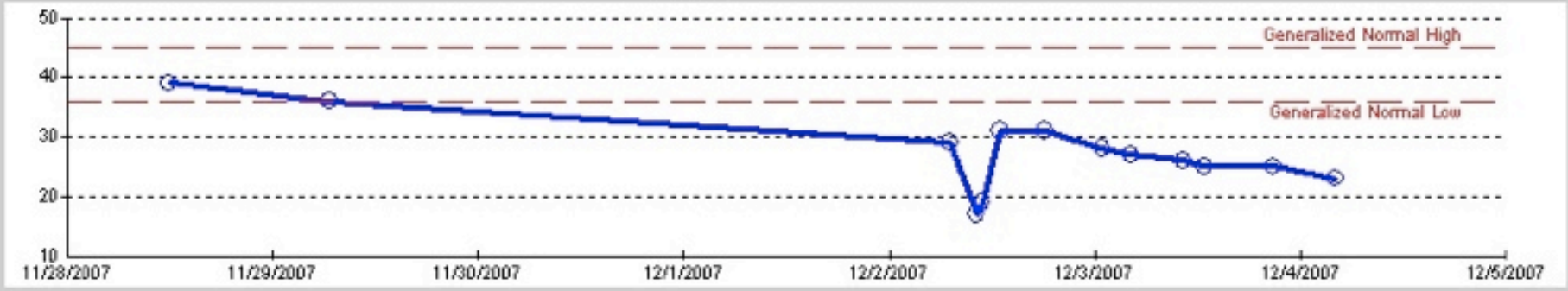
Also: MINDscape, Roosevelt Pediatrics, radiation oncology, others

Heart Rate

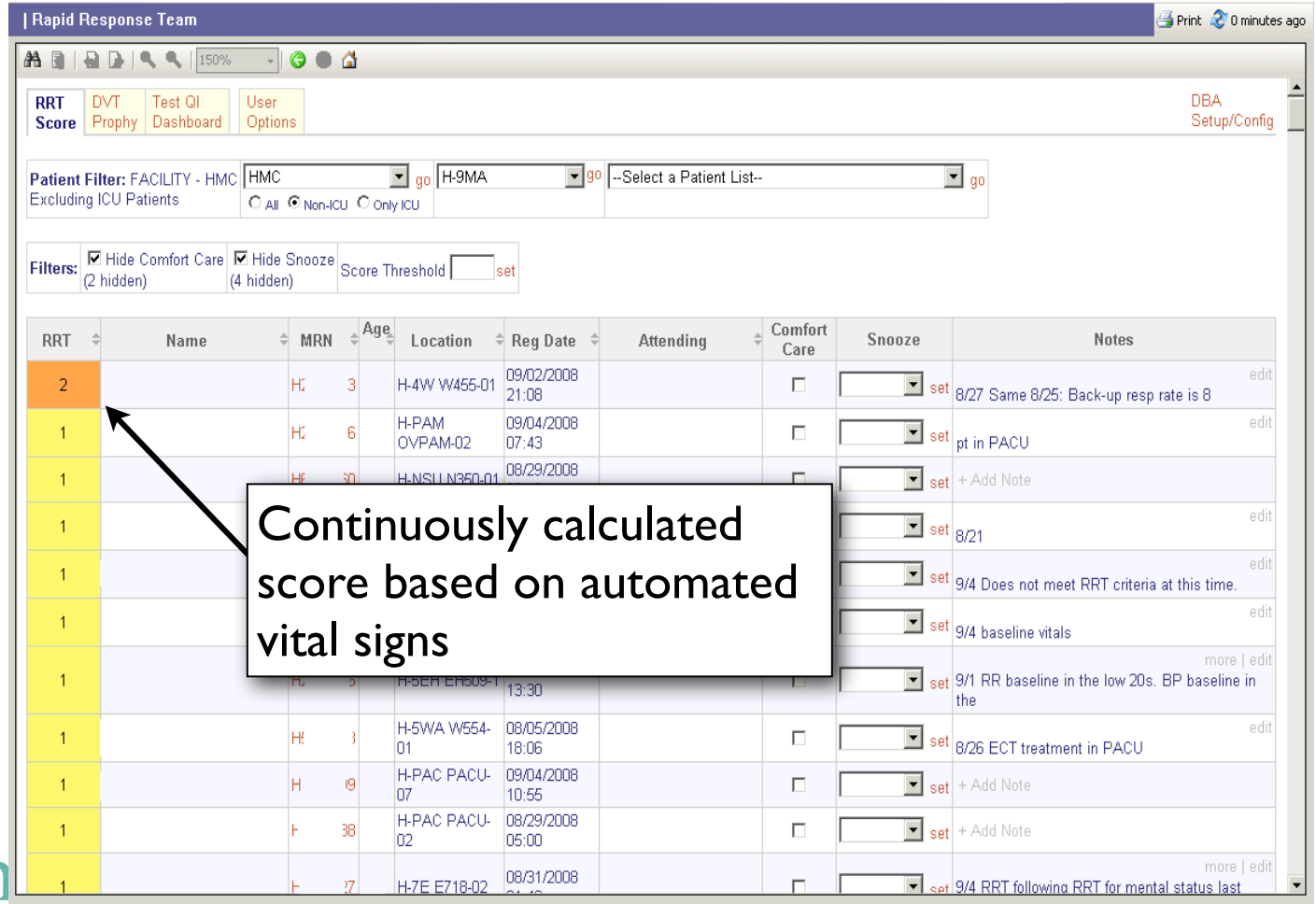
SBP - Noninvasive



HCT



Faster identification of hospitalized patients with worsening vital signs



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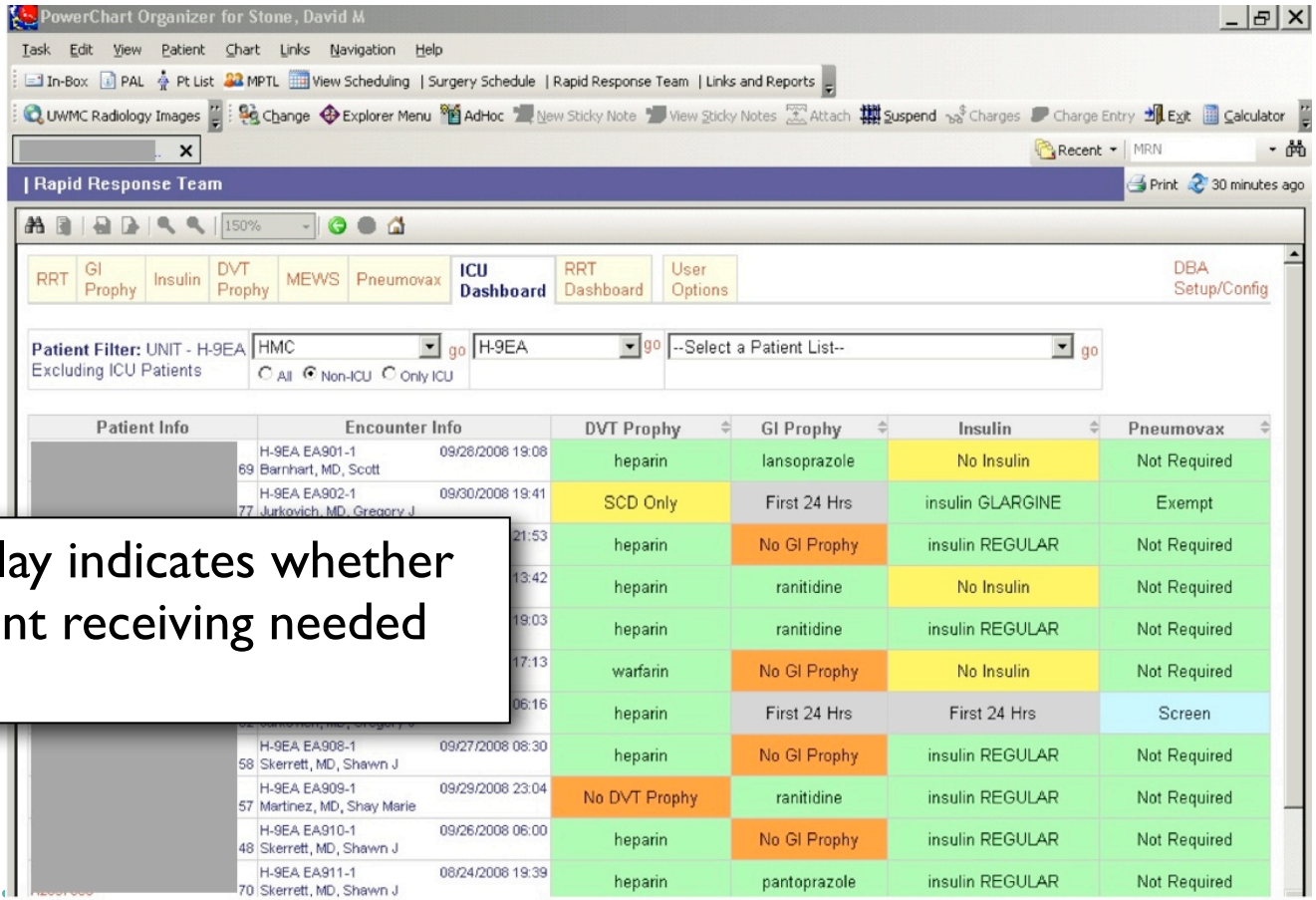
Display of quality indicators



Display indicates whether patient receiving needed care

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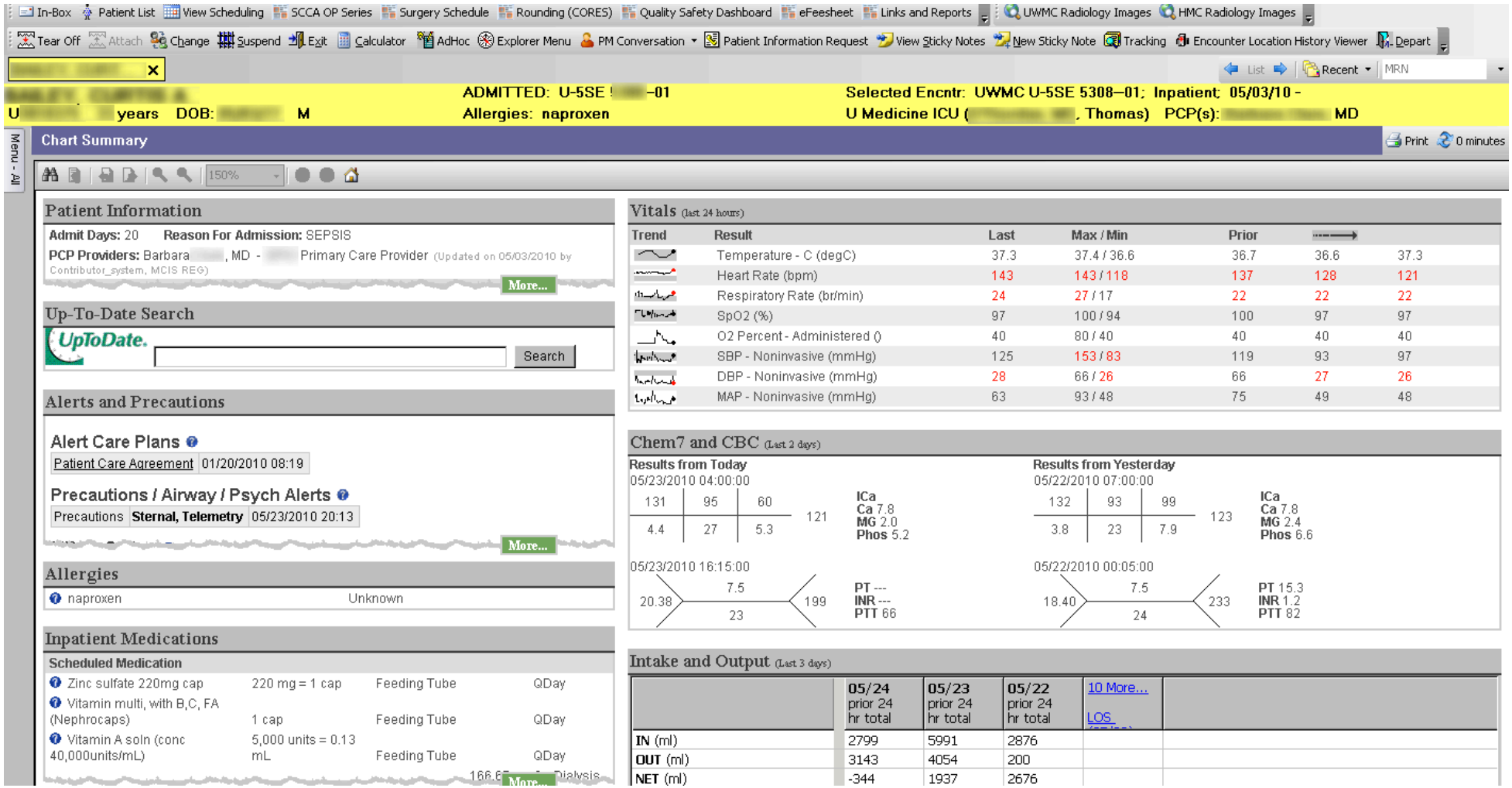
Summary views



How can computing systems aid clinical decision making?

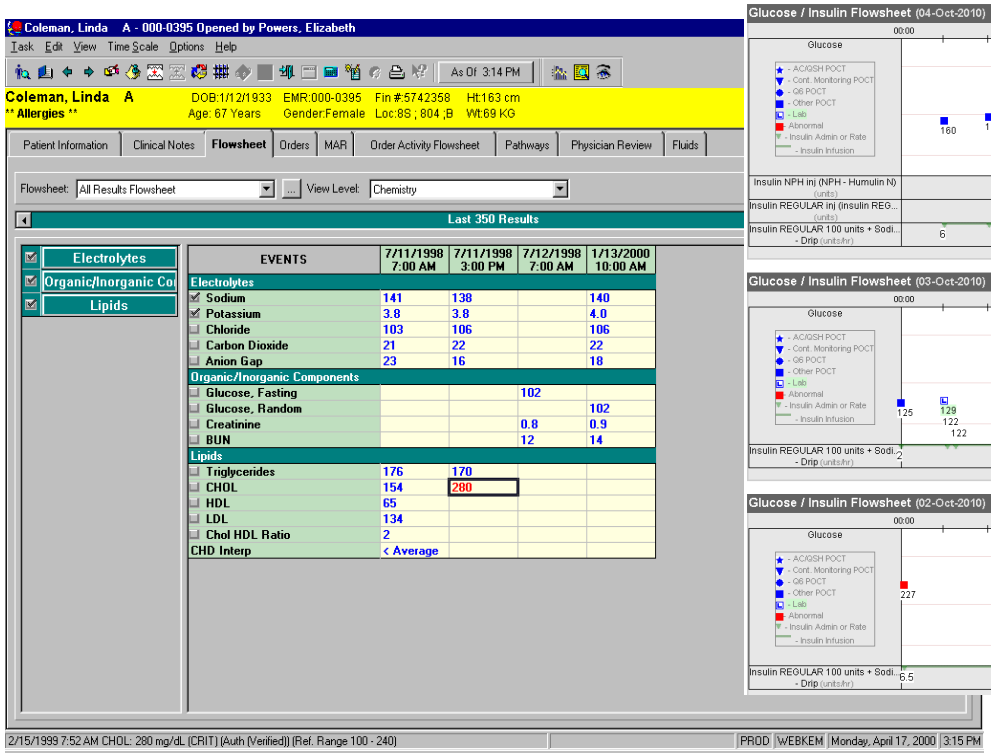
Simplify access to data to make decisions
Alerts and reminders
CPOE order checks
Guide orders
Review new clinical data; alert when important patterns recognized
Monitoring of treatment
Embedded links to external resources
Aid in documentation
Aid in diagnosis

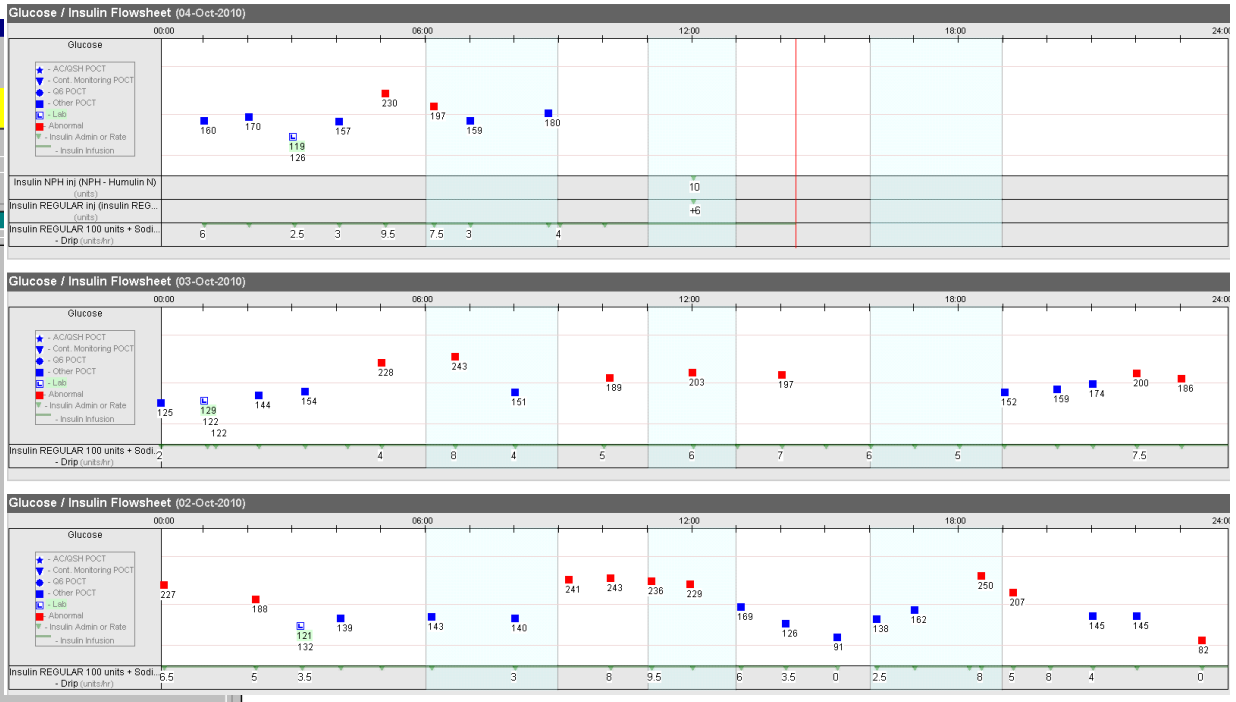
Simplify access to data to make decisions	
	Results review
	Specialized displays
Alerts and reminders	
	Health maintenance
	Condition specific
	Warnings for transfusion, deceased, worker risk, falls
CPOE order checks	
	Drug allergy
	Drug drug
	Duplicate drug or service
	Dose range checking
	Weight-based ordering
	Dose adjustment for renal/hepatic function
	Age-specific VS checks
Guide orders	
	Pre-configured orders
	Order sets
	Rules
	Corollary orders
	Templates, calculations
	Relevant labs
Review new clinical data; alert when important patterns recog	
	Critical values for lab
	Critical values for radiology
	Critical values for anatomic pathology
	Page for new result when requested
Monitoring of treatment	
	Warfarin, digoxin, other
	Recalls for needed subsequent testing
Embedded links to external resources	
	UpToDate
	Micromedex
	Other resources
Aid in documentation	
	Templates
Aid in diagnosis	
	DXplain, QMR

		ORCA	UW Medicine Epic sites	Virginia Mason (C)	Univ Illinois (Chicago) (C)	Seattle Childrens (C)	Evergreen (C)	Swedish (E)	Everett Clinic (E)	Northwest (S)
Simplify access to data to make decisions										
	Results review	✔	✔	✔	✔	✔	✔	✔	✔	✔
	Specialized displays	✔	✔	✔	✔	✔	✔	✔	✔	✔
Alerts and reminders										
	Health maintenance		✔	✔	✔		✔	✔	✔	
	Condition specific			✔	✔	✔	✔	✔		
	Warnings for transfusion, deceased, worker risk, falls	✔		✔	✔	✔	✔	✔		✔
CPOE order checks										
	Drug allergy	✔	✔	✔	✔	✔	✔	✔	✔	✔
	Drug drug	✔	✔	✔	✔	✔	✔	✔	✔	✔
	Duplicate drug or service			✔	✔	✔	✔		✔	✔
	Dose range checking	✔				✔	✔	✔		✔
	Weight-based ordering	✔		✔		✔	✔	✔		✔
	Dose adjustment for renal/hepatic function	✔		✔	✔ (renal)	✔		✔		
	Age-specific VS checks				✔	✔	✔	✔		
Guide orders										
	Pre-configured orders	✔	✔	✔	✔	✔	✔	✔	✔	✔
	Order sets	✔	✔	✔	✔	✔	✔	✔	✔	✔
	Rules	✔		✔	✔	✔	✔	✔		✔
	Corollary orders	✔		✔	✔		✔	✔		
	Templates, calculations	✔	✔	✔	✔	✔	✔	✔	✔	✔
	Relevant labs	✔	✔	✔	✔	✔	✔	✔	✔	✔
Review new clinical data; alert when important patterns recognized										
	Critical values for lab	✔	✔	✔	✔	✔	✔	✔	✔	
	Critical values for radiology	✔				✔	✔		✔	
	Critical values for anatomic pathology						✔			
	Page for new result when requested		✔							
Monitoring of treatment										
	Warfarin, digoxin, other		✔		✔	✔	✔	✔	✔	
	Recalls for needed subsequent testing		✔					✔	✔	
Embedded links to external resources										
	UpToDate	✔	✔	✔			✔	✔	✔	✔
	Micromedex	✔	✔				✔		✔	✔
	Other resources	✔			✔	✔		✔		
Aid in documentation										
	Templates	✔	✔	✔	✔	✔	✔	✔	✔	✔
Aid in diagnosis										
	DXplain, QMR									

C=Cerner, E=Epic, S=Siemens. ✔=available, ✔ =planned or in development

Simplify access to datra





The Glucose/Insulin Flowsheet shows a graphical daily comparison of Glucose Levels, insulin injections and drips. It differentiates between Lab draw, POC, AC/QSH, continuous monitoring, etc. Daily comparison helps align with meals from day to day. There is also a future link to a IV to subq calculator web site that helps compare Glucose Levels and Drip rates to suggest a transition to subq.

Clinical decision support that does not require CPOE, or an EMR

[AHRQ, Lambert PI. (Devine, Payne @UW)]

Pharmacy system

Laboratory system

TABLE I. High Priority Lab↔Med Pairs Identified Through Delphi Process

	MED	LAB	Synch Rule	Asynch Rule	Critical Value	Group
1	aminoglycoside	[aminoglycoside]	none	none	none	IV
2	heparin	+HIT	10/5/2004	5/14/2007	none	IX
3	dihidroergotamine & ergotamine	+Pregnancy test	7/25/2006	none	none	VIII
4	warfarin	+Pregnancy test	7/25/2006	none	none	VIII
5	digoxin	↑[digoxin]	9/6/2001	9/6/2001	2.4 mg/mL	IV
6	statin	↑ALT/AST	none	none	none	VII
7	statin	↑CK	none	none	none	VII
8	warfarin	↑INR	6/12/2006	7/14/09	none	III
9	ACE	↑K+	6/2/2003	6/2/2003	6.2 mEq/L	II
10	ARB	↑K+	6/2/2003	6/2/2003	6.2 mEq/L	II
11	K Sparing Diuretic	↑K+	6/2/2003	6/2/2003	6.2 mEq/L	II
12	potassium	↑K+	6/2/2003	6/2/2003	6.2 mEq/L	II
13	heparin	↑PTT	5/13/2003	5/13/2003	150 sec	VIII
14	aminoglycoside	↓eGFR/↓CrCl/↑Cr	5/4/2002	11/25/2002	none	VI
15	digoxin	↓eGFR/↓CrCl/↑Cr	5/4/2002	11/25/2002	none	VI
16	Ganciclovir	↓eGFR/↓CrCl/↑Cr	5/4/2002	11/25/2002	none	VI
17	LMWH	↓eGFR/↓CrCl/↑Cr	5/4/2002	11/25/2002	none	VI
18	methotrexate	↓eGFR/↓CrCl/↑Cr	5/4/2002	11/25/2002	none	VI
19	NSAIDS	↓eGFR/↓CrCl/↑Cr	5/4/2002	11/25/2002	none	VI
20	quinolones	↓eGFR/↓CrCl/↑Cr	5/4/2002	11/25/2002	none	VI
21	vancomycin	↓eGFR/↓CrCl/↑Cr	5/4/2002	11/25/2002	none	VI
22	Loop diuretics	↓K+	none	none	2.8 mEq/L	I
23	clopidogral	↓Platelet	4/28/2009	planned	20 k/μL	V
24	heparin	↓Platelet	4/28/2009	planned	20 k/μL	V
25	LMWH	↓Platelet	4/28/2009	planned	20 k/μL	V
26	clozapine	ANC	none	none	1 k/μL	X

Observations on current practice in use of clinical decision support in our community

- Clinical decision support is used at a level far lower than its potential to help
- Key information can be missed in massive patient records leading to diagnostic errors
- Despite decades of research, simple effective decision support features may not be available from EMR vendors
- Focus on alerts for prescribing may divert attention from other important decision support areas

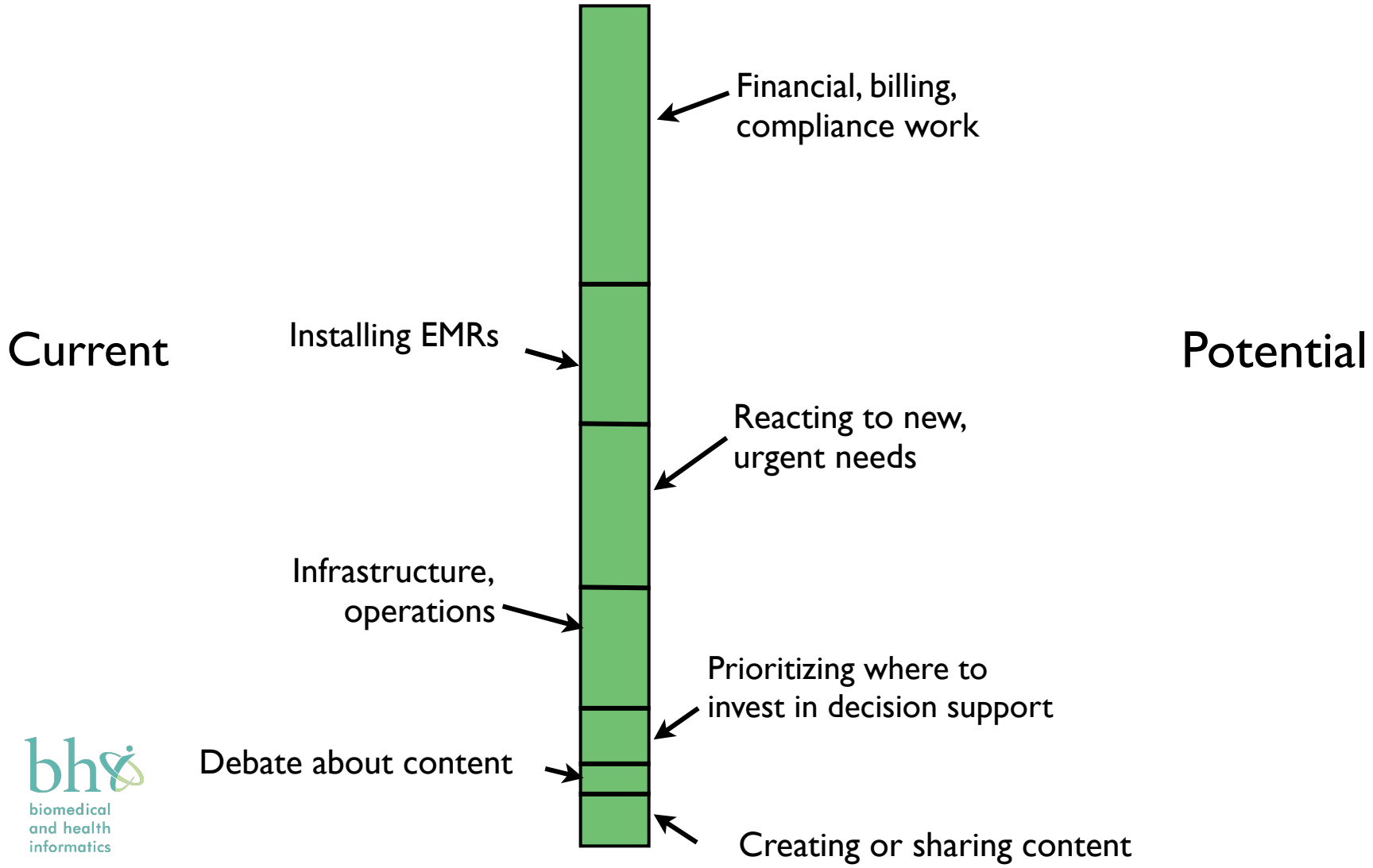
Topic for today

Computerized clinical decision support sytems

- Definitions
- What we have learned
- National initiatives
- Diagnostic errors
- Computerized clinical decision support in UW Medicine
- Barriers, and what to do about them
- Opportunities

Between current practice and potential for CDS

Dissecting the barrier



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Summary

Computerized clinical decision support in UW Medicine EMRs

- By national standards, we are average.
- Some tools provided by vendors are not (fully) used.
- Opportunities for collaboration and research:
  - Focus on areas known to work (e.g. rules, CPOE)
  - Measurement use and impact of CDSS in production systems
  - Diagnostic errors largely unaddressed, with great potential for advance.

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