

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

Thomas H. Payne, MD, FACP, FACMI

Medical Director, IT Services
UW Medicine

Clinical Associate Professor
Departments of Medicine, Health Services, and Biomedical & Health
Informatics
University of Washington



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and health
informatics

Biomedical Health Informatics Lecture Series (MEBI 590)
October 5, 2010

Topic for today

Computerized clinical decision support systems

- 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

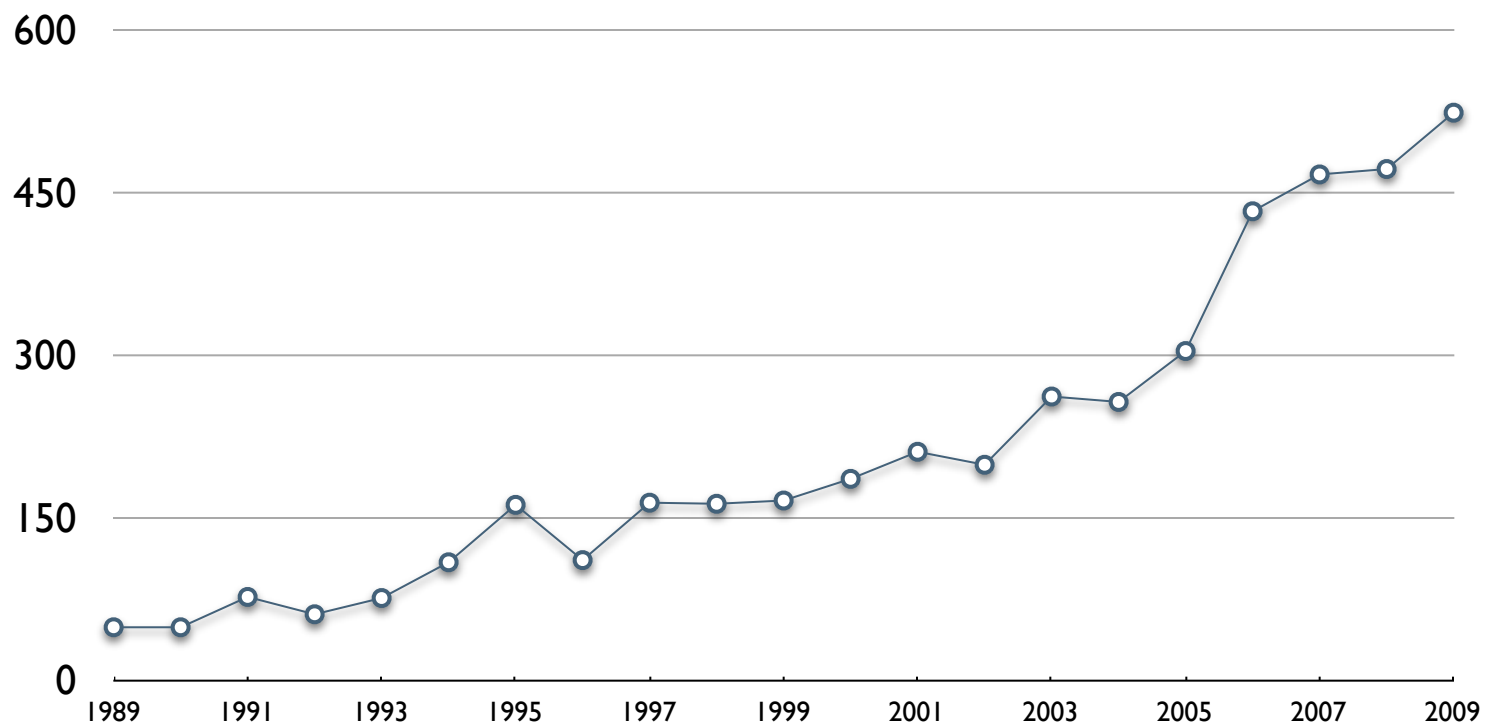
“Providing clinicians, patients or individuals with knowledge and person-specific or population information, intelligently filtered or presented at appropriate times, to foster better health processes, better individual patient care, and better population health.”



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



Clinical decision support: progress and opportunities

Jason A Lyman,¹ Wendy F Cohn,¹ Meryl Bloomrosen,² Don E Detmer^{1,2}

¹Department of Public Health Sciences, University of Virginia Health System, Charlottesville, Virginia, USA

²American Medical Informatics Association, Bethesda, Maryland, USA

Correspondence to

Dr Jason Lyman, Department of Public Health Sciences, University of Virginia Health System, Charlottesville, VA 22908, USA; lyman@virginia.edu

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Received 29 April 2009
Accepted 25 June 2010

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).^{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-



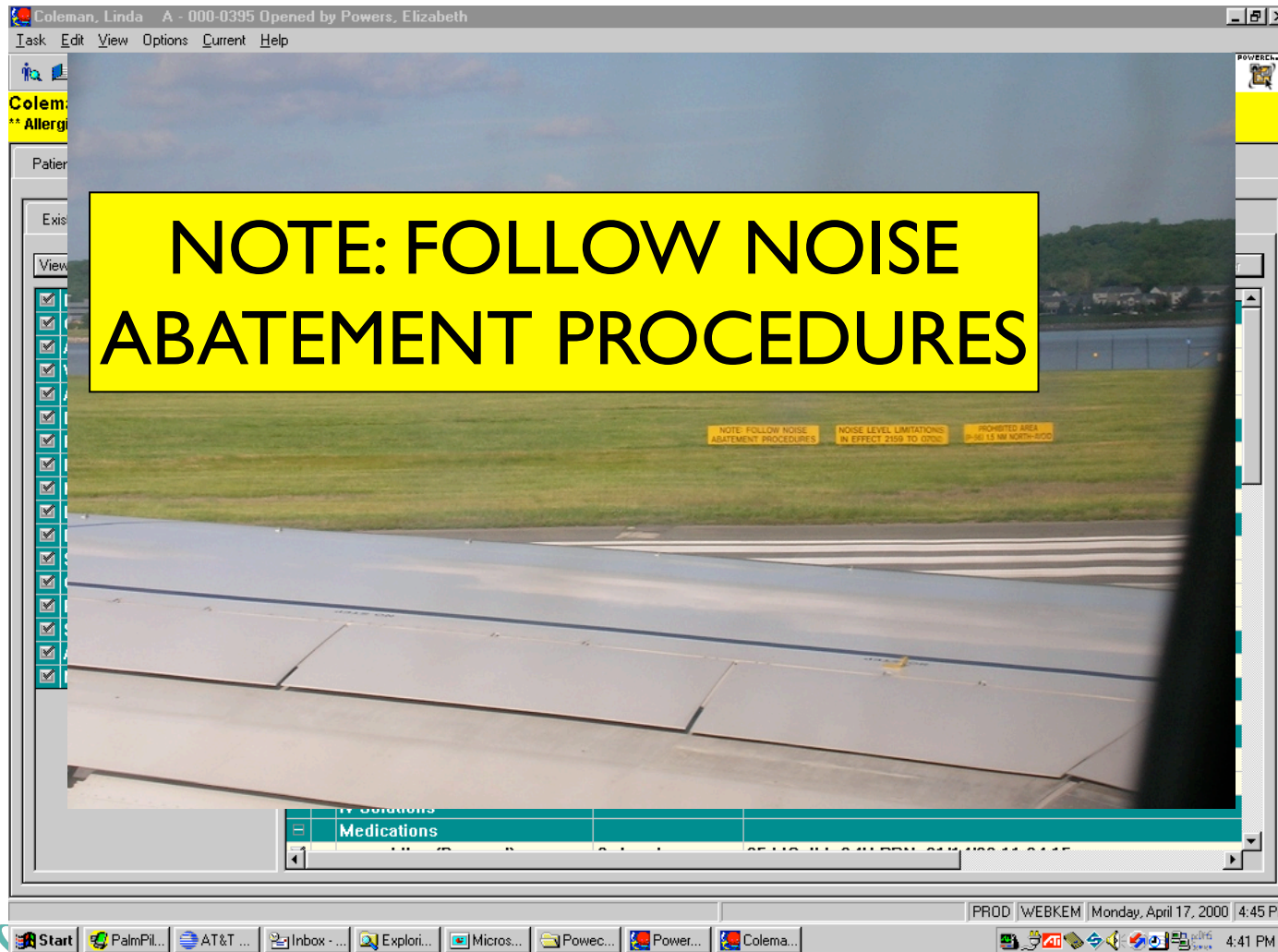
A Roadmap for National Action on Clinical Decision Support

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

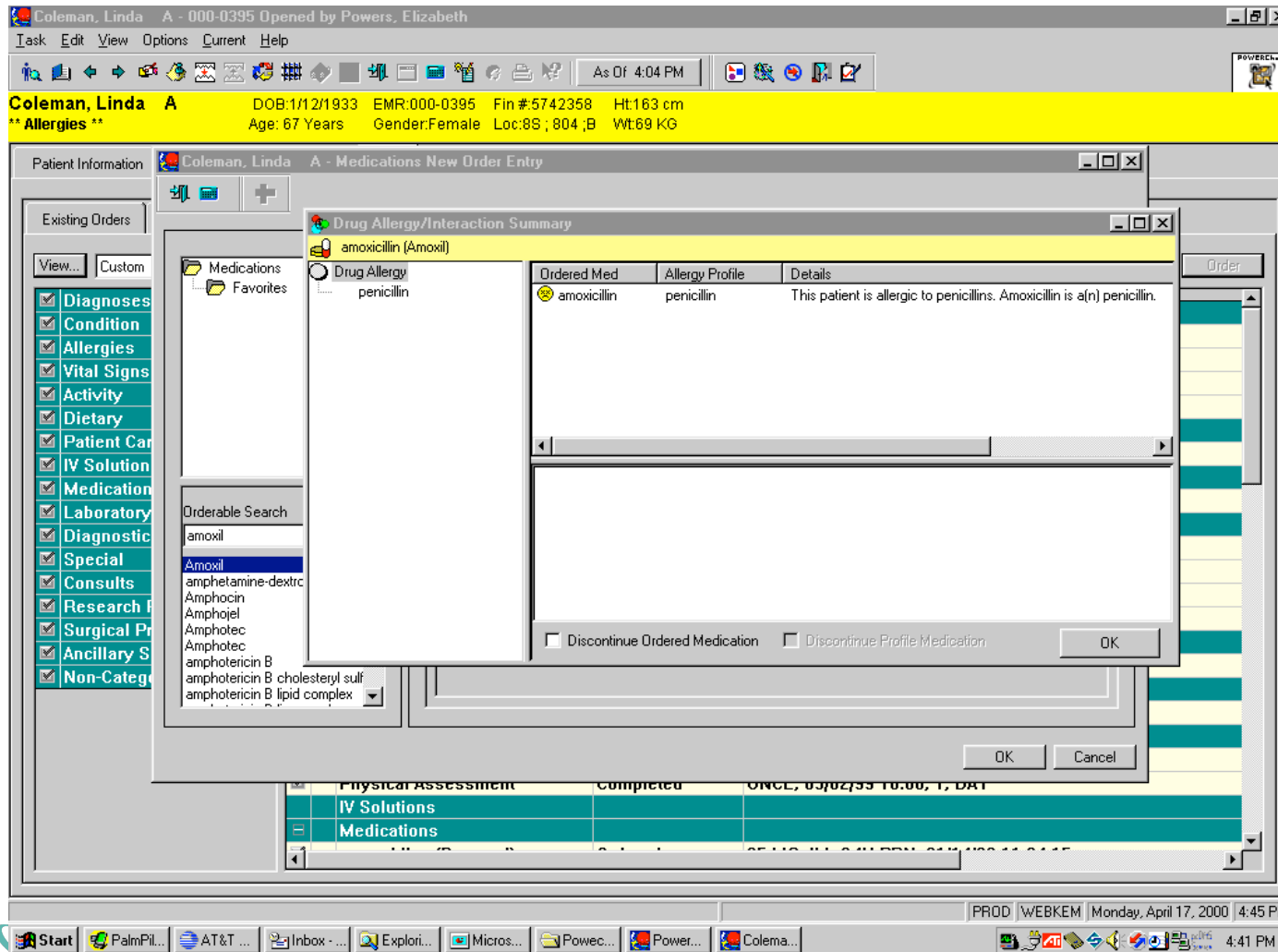
Adam Wright, Oregon Health & Sciences University
Don E. Detmer, American Medical Informatics Association



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.



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.



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

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MEMBER TOOLS

- ▶ JAMIA
- ▶ AMIA 10x10
- ▶ College
- ▶ Academic Forum
- GotEHR?
- ▶ Working Groups

INDUSTRY HEADLINES

- Health Care: Coverage -- But at What Price?
- Charlotte Biotechnology Conference Draws Record Crowd
- State awards e-health record grants

[more](#)

Navigation

[Content Log messages](#)

Home » About AMIA » Strategic Initiatives and Programs

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

[more](#)



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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and health
informatics

Improving clinical decision making with healthcare IT is a national goal

The screenshot shows the website for the Office of the National Coordinator for Health Information Technology. The header features the organization's name, a search bar, and social media links. The main content area is titled "Being a Meaningful User of Electronic Health Records" and includes a sub-header "BEING A MEANINGFUL USER OF ELECTRONIC HEALTH RECORDS". The text explains the importance of electronic health records and lists benefits such as knowing more about patients, making better decisions, and saving money. A sidebar on the right contains a "Resources" section with links to various documents and a "Privacy and Security" section with links to related information.

Connecting America for Better Health

The Office of the National Coordinator for Health Information Technology

Search GO

Get email updates Follow us on [Twitter](#) [Facebook](#) [LinkedIn](#) Contact us [User](#)

Home > Regulations & Guidance > Meaningful Use > Providers

Being a Meaningful User of Electronic Health Records

BEING A MEANINGFUL USER OF ELECTRONIC HEALTH RECORDS

Electronic health records play a critical role in getting to a higher quality, safer, more effective health care system.

The release of the final rules on [meaningful use](#) and [standards and certification](#) mark the official launch of the EHR in this country. Health care providers now have additional funding to support the meaningful use of electronic health records as well as guidelines that can help them implement them in a way that improves care for their patients.

Benefits of Electronic Health Records

Electronic health records and health information exchange can help clinicians provide higher quality and safer care for their patients. By adopting electronic health records in a meaningful way, clinicians can:

- **Know more about their patients.** Information in electronic health records can be used to coordinate and improve the quality of patient care.
- **Make better decisions.** With more comprehensive information readily and securely available, clinicians will have the information they need about treatments and conditions – even best practices for patient populations –when making treatment decisions.
- **Save money.** Electronic health records require an initial investment of time and money. But clinicians who have implemented them have reported reductions in the amount of time spent locating paper files, transcribing and spending time on the phone with labs or pharmacies; more accurate coding; and reductions in reporting burden.

Resources

- [Meaningful Use Press Release](#)
- [Final Rule on Meaningful Use \[PDF - 13.9 MB\]](#)
- [CMS Meaningful Use Information](#)
- [Final Rule on Standards & Certification \[PDF - 390 KB\]](#)
- [Standards and Certification Criteria FAQ](#)
- [Standards and Certification Criteria Fact Sheet](#)

Privacy and Security

- [Privacy and Security in Health Information Technology](#)
- [Office for Civil Rights](#)

[More Resources](#)

How HHS and ONC Can Help

Health IT Home

HITECH & Funding Opportunities

HITECH Programs

Federal Advisory Committees

Regulations & Guidance

ONC Regulations FAQs

Meaningful Use

> Providers

Consumers

Resources

Privacy and Security

Standards and Certification

ONC Initiatives

Outreach, Events, & Resources

About ONC

Health IT Buzz Blog

Federal Advisory Committee Blog

Alerts

XAMPLE, HIMSS III MRN:80069706 Location: LAB OUTPATIENT **** Allergies ****
Age: 70 years Sex: FEMALE DOB: 2/4/1936 Fin Number: 80069706-0371 Outpatient [<No - Admit date>

Up Browse

Search Results

- CT upper extremity - with and without c
- CT Abcess Drainage
- CT Abdomen-with and without Co**
- CT Abdomen-with Contrast
- CT Abdomen-without Contrast
- CT Bone Density
- CT Cervical Spine-with and without Con
- CT Cervical Spine-with Contrast
- CT Cervical Spine-without Contrast
- CT Chest-with and without Contrast
- CT Chest-with Contrast
- CT Chest-without Contrast
- CT Guide-Cyst Aspiration
- CT Guide-Needle Biopsy
- CT Guide-Radiation Fields
- CT Guide-Stereotactic Local
- CT Head or Brain-with and without Con
- CT Head or Brain-with Contrast
- CT Head or Brain-without Contrast
- CT Lower Extremity - Bilateral with and
- CT Lower Extremity - Bilateral with Cont
- CT Lower Extremity - Bilateral without C
- CT Lower Extremity - Left with and with
- CT Lower Extremity - Left with Contrast
- CT Lower Extremity - Left without Contr
- CT Lower Extremity - Right with and wit
- CT Lower Extremity - Right with Contras
- CT Lower Extremity - Right without Con
- CT Lumbar Spine-with and without Con
- CT Lumbar Spine-with Contrast
- CT Lumbar Spine-without Contrast

Discern

Radiocontrast Alert

You are ordering a study with radiocontrast material for a patient with **no recent assessment of renal function**. In addition, the last creatinine result (1.6) was **abnormal**.

Please consider not using radiocontrast material in this patient unless a more recent assessment of renal function demonstrates better renal function - a creatinine clearance > 60 ml/min.

If you choose to continue with this order, please select Ignore Alert and select an override reason.

*If your patient has ESRD and is on dialysis, radiocontrast material may cause fluid retention and caution should be used.

Alert Action

- Cancel Order
- Ignore Alert

OK

aryngeal

Aerobic only

il

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raight Cath

id / Foley Cath

Aerobic only

ric

for TPN

5% ophthalmic

½ ophthalmic

½ ophthalmic

renylephrine ophthal

le

le-mesna

avel

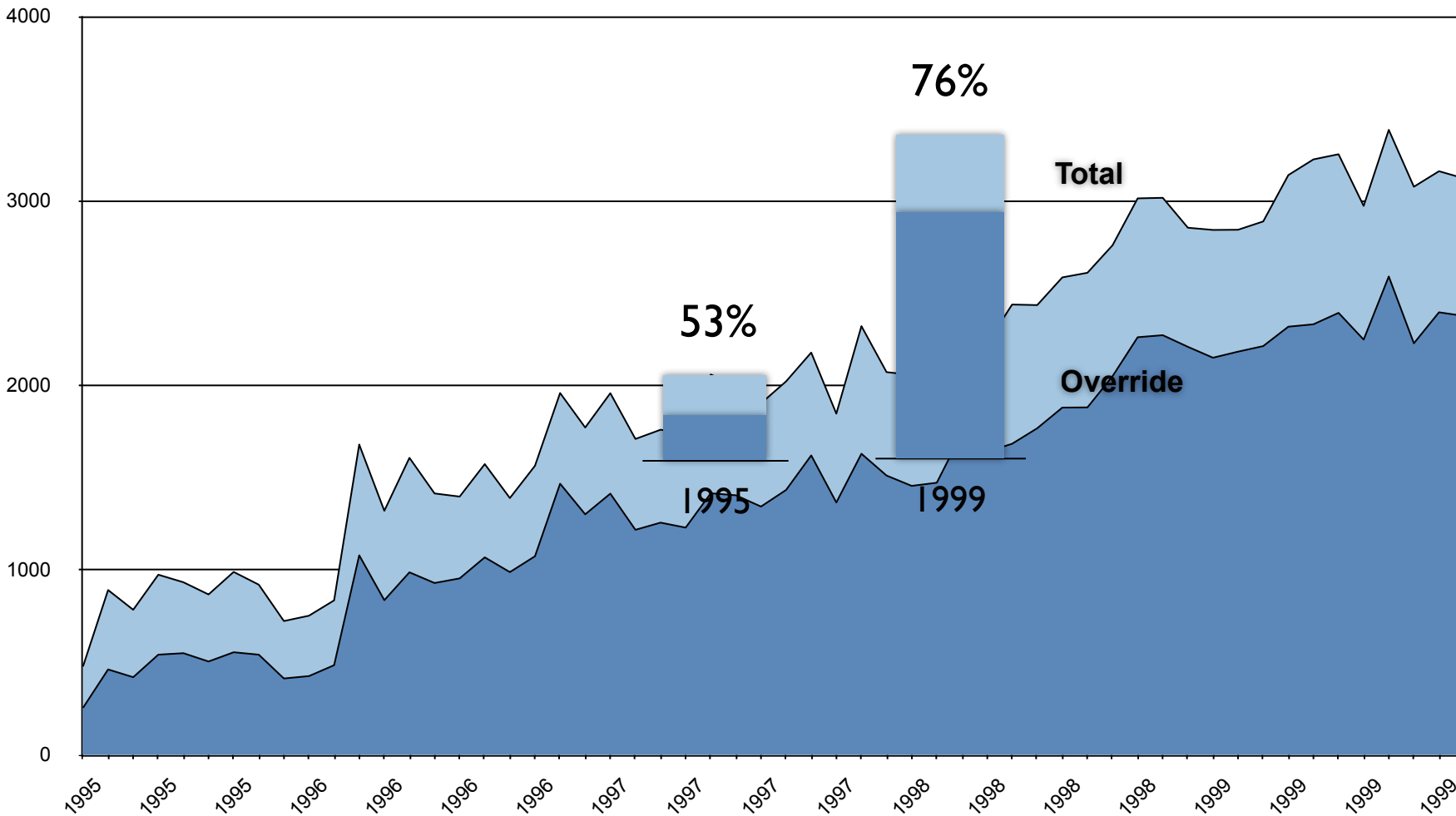
CT guided

XAMPLE, HIMSS III - 80069706 Done



Total and overridden allergy alerts

[Abookire et al Proc AMIA 2000]



Special Article

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

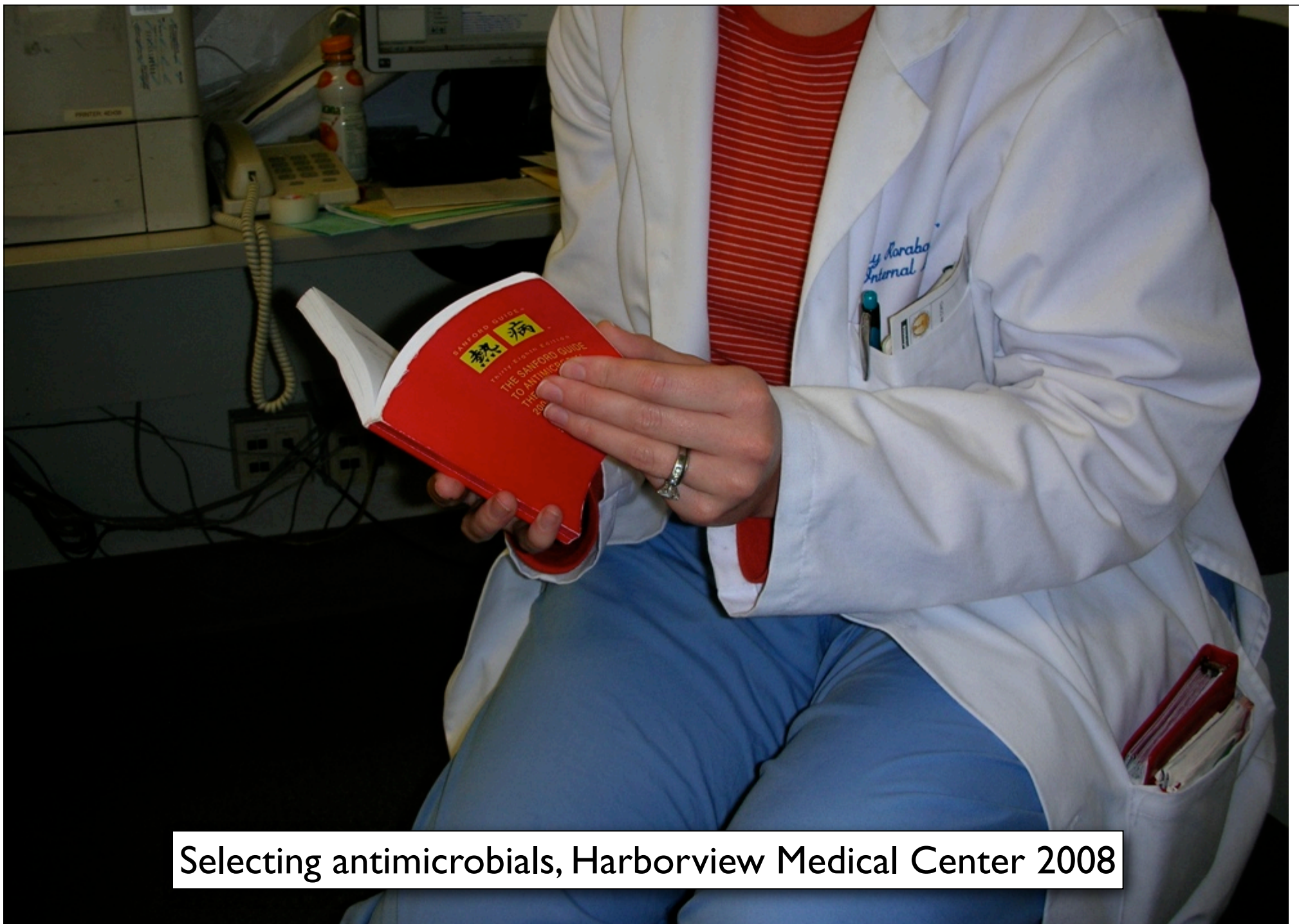
R. SCOTT EVANS, PH.D., STANLEY L. PESTOTNIK, M.S., R.PH., DAVID C. CLASSEN, M.D., M.S., TERRY P. CLEMMER, M.D.,
LINDELL K. WEAVER, M.D., JAMES F. ORME, JR., M.D., JAMES F. LLOYD, B.S., AND JOHN P. BURKE, M.D.

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





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]

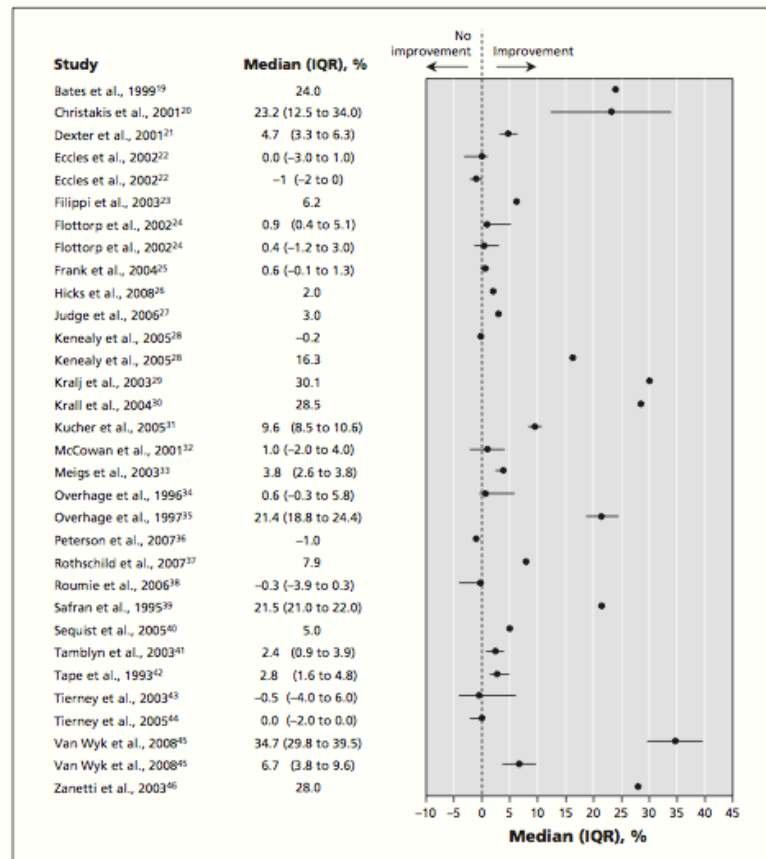


Figure 2: Median absolute improvements in adherence to processes of care between intervention and control groups in each study. Each study is represented by the median and interquartile range for its reported outcomes; studies with single data points reported only one eligible outcome.



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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 Med 169 2009] |

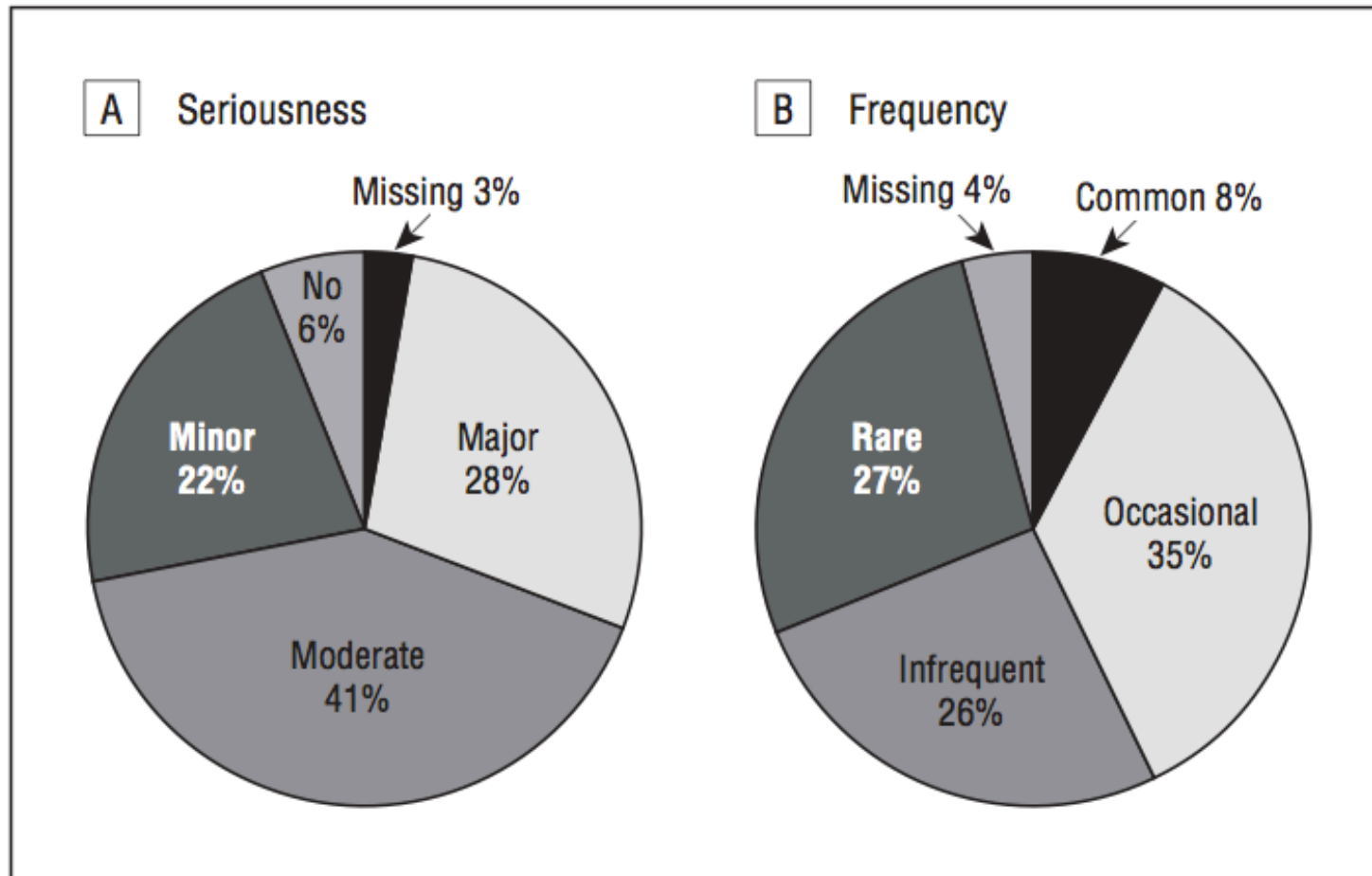


Figure 2. Perceived seriousness (A) and frequency (B) of the reported diagnosis error as rated by the physician reporting the error.

al
ig

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



EMRs in use in UW Medicine

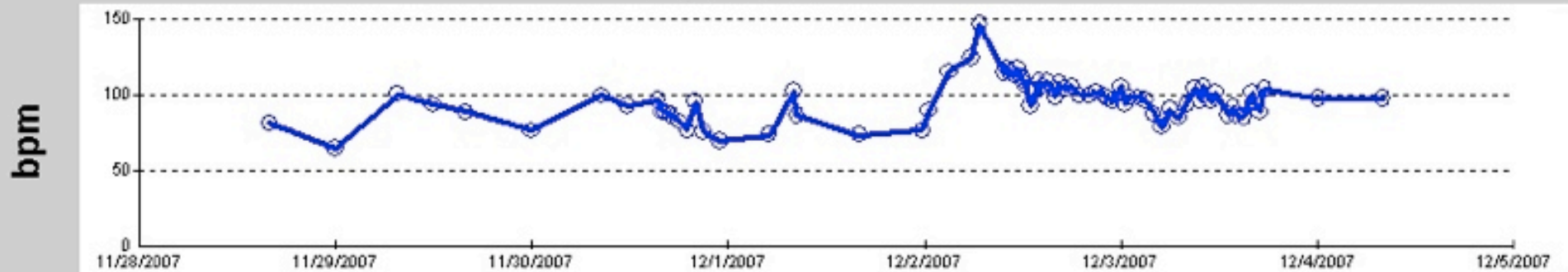
Most commonly used systems

- 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



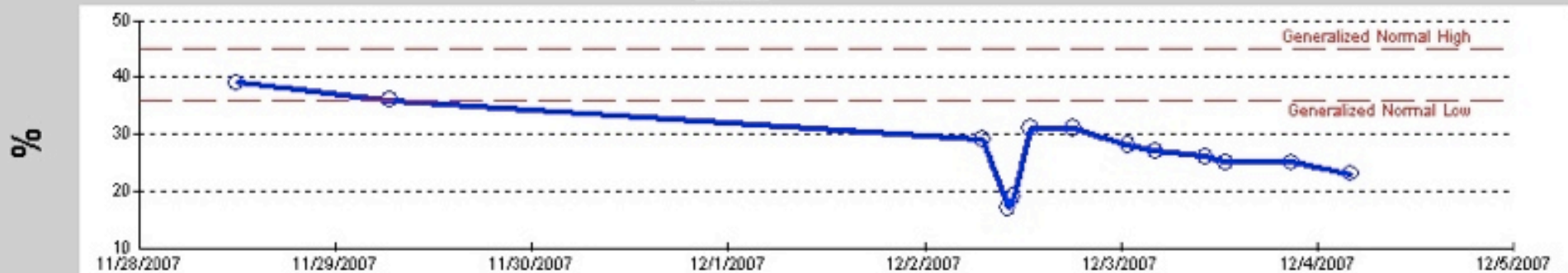
Heart Rate



SBP - Noninvasive



HCT



Faster identification of hospitalized patients with worsening vital signs

Rapid Response Team

Print 0 minutes ago

RRT Score DVT Prophylaxis Test QI Dashboard User Options DBA Setup/Config

Patient Filter: FACILITY - HMC HMC go H-9MA go --Select a Patient List-- go
Excluding ICU Patients All Non-ICU Only ICU

Filters: Hide Comfort Care (2 hidden) Hide Snooze (4 hidden) Score Threshold set

RRT	Name	MRN	Age	Location	Reg Date	Attending	Comfort Care	Snooze	Notes
2		H-...	3	H-4W W455-01	09/02/2008 21:08		<input type="checkbox"/>	<input type="text"/> set	8/27 Same 8/25: Back-up resp rate is 8
1		H-...	6	H-PAM OVPAM-02	09/04/2008 07:43		<input type="checkbox"/>	<input type="text"/> set	pt in PACU
1		H-...	30	H-NSU N350-01	08/29/2008		<input type="checkbox"/>	<input type="text"/> set	+ Add Note
1							<input type="checkbox"/>	<input type="text"/> set	8/21
1							<input type="checkbox"/>	<input type="text"/> set	9/4 Does not meet RRT criteria at this time.
1							<input type="checkbox"/>	<input type="text"/> set	9/4 baseline vitals
1							<input type="checkbox"/>	<input type="text"/> set	9/1 RR baseline in the low 20s. BP baseline in the
1		H-...	3	H-5WA W554-01	08/05/2008 18:06		<input type="checkbox"/>	<input type="text"/> set	8/26 ECT treatment in PACU
1		H-...	19	H-PAC PACU-07	09/04/2008 10:55		<input type="checkbox"/>	<input type="text"/> set	+ Add Note
1		H-...	38	H-PAC PACU-02	08/29/2008 05:00		<input type="checkbox"/>	<input type="text"/> set	+ Add Note
1		H-...	7	H-7E E718-02	08/31/2008		<input type="checkbox"/>	<input type="text"/> set	9/4 RRT following RRT for mental status last

Continuously calculated score based on automated vital signs



Display of quality indicators

PowerChart Organizer for Stone, David M

Task Edit View Patient Chart Links Navigation Help

In-Box PAL Pt List MPTL View Scheduling Surgery Schedule Rapid Response Team Links and Reports

UWMC Radiology Images Change Explorer Menu AdHoc New Sticky Note View Sticky Notes Attach Suspend Charges Charge Entry Exit Calculator

Recent MRN

Rapid Response Team

Print 30 minutes ago

RRT GI Prophylaxis Insulin DVT Prophylaxis MEWS Pneumovax ICU Dashboard RRT Dashboard User Options DBA Setup/Config

Patient Filter: UNIT - H-9EA HMC go H-9EA go --Select a Patient List-- go

Excluding ICU Patients All Non-ICU Only ICU

Patient Info	Encounter Info	DVT Prophylaxis	GI Prophylaxis	Insulin	Pneumovax
	H-9EA EA901-1 09/28/2008 19:08 69 Barnhart, MD, Scott	heparin	lansoprazole	No Insulin	Not Required
	H-9EA EA902-1 09/30/2008 19:41 77 Jurkovich, MD, Gregory J	SCD Only	First 24 Hrs	insulin GLARGINE	Exempt
	21:53	heparin	No GI Prophylaxis	insulin REGULAR	Not Required
	13:42	heparin	ranitidine	No Insulin	Not Required
	19:03	heparin	ranitidine	insulin REGULAR	Not Required
	17:13	warfarin	No GI Prophylaxis	No Insulin	Not Required
	06:16	heparin	First 24 Hrs	First 24 Hrs	Screen
	H-9EA EA908-1 09/27/2008 08:30 58 Skerrett, MD, Shawn J	heparin	No GI Prophylaxis	insulin REGULAR	Not Required
	H-9EA EA909-1 09/29/2008 23:04 57 Martinez, MD, Shay Marie	No DVT Prophylaxis	ranitidine	insulin REGULAR	Not Required
	H-9EA EA910-1 09/26/2008 06:00 48 Skerrett, MD, Shawn J	heparin	No GI Prophylaxis	insulin REGULAR	Not Required
	H-9EA EA911-1 08/24/2008 19:39 70 Skerrett, MD, Shawn J	heparin	pantoprazole	insulin REGULAR	Not Required

Display indicates whether patient receiving needed care



Summary views

In-Box Patient List View Scheduling SCCA OP Series Surgery Schedule Rounding (CORES) Quality Safety Dashboard eFeesheet Links and Reports UWMC Radiology Images HMC Radiology Images

Tear Off Attach Change Suspend Exit Calculator AdHoc Explorer Menu PM Conversation Patient Information Request View Sticky Notes New Sticky Note Tracking Encounter Location History Viewer Depart

ADMITTED: U-5SE 5308-01 Selected Encntr: UWMC U-5SE 5308-01; Inpatient: 05/03/10 - U Medicine ICU (Thomas) PCP(s): MD

U years DOB: M Allergies: naproxen

Chart Summary

Print 0 minutes

Patient Information

Admit Days: 20 Reason For Admission: SEPSIS
 PCP Providers: Barbara, MD - Primary Care Provider (Updated on 05/03/2010 by Contributor_system, MCIS REG)

[More...](#)

Up-To-Date Search

Alerts and Precautions

Alert Care Plans
 Patient Care Agreement 01/20/2010 08:19

Precautions / Airway / Psych Alerts
 Precautions: Sternal, Telemetry 05/23/2010 20:13

[More...](#)

Allergies

naproxen Unknown

Inpatient Medications

Scheduled Medication

Zinc sulfate 220mg cap	220 mg = 1 cap	Feeding Tube	QDay
Vitamin multi, with B,C, FA (Nephrocaps)	1 cap	Feeding Tube	QDay
Vitamin A soln (conc 40,000units/mL)	5,000 units = 0.13 mL	Feeding Tube	QDay

166.6 [More...](#) Dialysis

Vitals (last 24 hours)

Trend	Result	Last	Max / Min	Prior	Target
	Temperature - C (degC)	37.3	37.4 / 36.6	36.7	36.6
	Heart Rate (bpm)	143	143 / 118	137	128
	Respiratory Rate (br/min)	24	27 / 17	22	22
	SpO2 (%)	97	100 / 94	100	97
	O2 Percent - Administered ()	40	80 / 40	40	40
	SBP - Noninvasive (mmHg)	125	153 / 83	119	93
	DBP - Noninvasive (mmHg)	28	66 / 26	66	27
	MAP - Noninvasive (mmHg)	63	93 / 48	75	49

Chem7 and CBC (Last 2 days)

Results from Today	Results from Yesterday																
05/23/2010 04:00:00	05/22/2010 07:00:00																
<table border="1"> <tr><td>131</td><td>95</td><td>60</td><td>121</td></tr> <tr><td>4.4</td><td>27</td><td>5.3</td><td></td></tr> </table> ICa 7.8 Ca 2.0 MG 5.2 Phos 5.2	131	95	60	121	4.4	27	5.3		<table border="1"> <tr><td>132</td><td>93</td><td>99</td><td>123</td></tr> <tr><td>3.8</td><td>23</td><td>7.9</td><td></td></tr> </table> ICa 7.8 Ca 2.4 MG 6.6 Phos 6.6	132	93	99	123	3.8	23	7.9	
131	95	60	121														
4.4	27	5.3															
132	93	99	123														
3.8	23	7.9															
05/23/2010 16:15:00	05/22/2010 00:05:00																
<table border="1"> <tr><td>20.38</td><td>7.5</td><td>199</td></tr> <tr><td></td><td>23</td><td></td></tr> </table> PT --- INR --- PTT 66	20.38	7.5	199		23		<table border="1"> <tr><td>18.40</td><td>7.5</td><td>233</td></tr> <tr><td></td><td>24</td><td></td></tr> </table> PT 15.3 INR 1.2 PTT 82	18.40	7.5	233		24					
20.38	7.5	199															
	23																
18.40	7.5	233															
	24																

Intake and Output (Last 3 days)

	05/24 prior 24 hr total	05/23 prior 24 hr total	05/22 prior 24 hr total	10 More...
IN (ml)	2799	5991	2876	LOS
OUT (ml)	3143	4054	200	
NET (ml)	-344	1937	2676	

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	✓		✓	✓	✓	✓	✓		✓
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 data

Coleman, Linda A - 000-0395 Opened by Powers, Elizabeth

Task Edit View Time Scale Options Help

As Of 3:14 PM

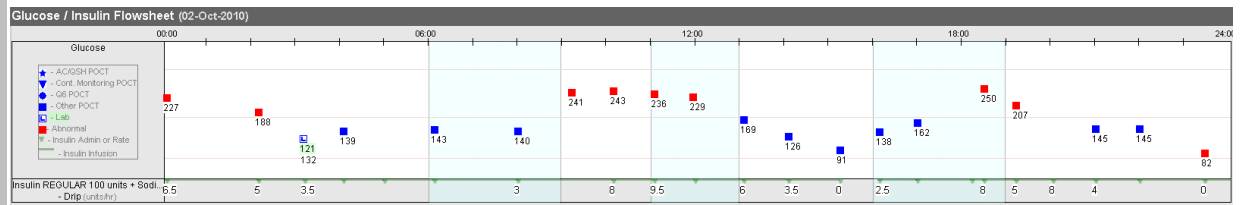
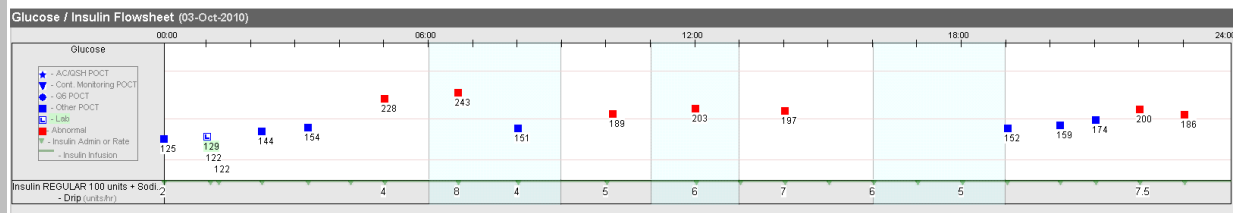
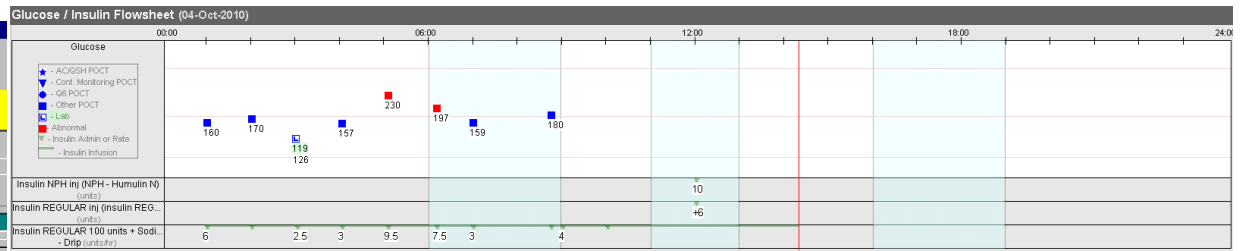
Coleman, Linda A DOB: 1/12/1933 EMR: 000-0395 Fin #: 5742358 Ht: 163 cm
 Age: 67 Years Gender: Female Loc: 8S ; 604 ; B Wt: 69 KG

Patent Information Clinical Notes **Flowsheet** Orders MAR Order Activity Flowsheet Pathways Physician Review Fluids

Flowsheet: All Results Flowsheet View Level: Chemistry

Last 350 Results

EVENTS	7/11/1998 7:00 AM	7/11/1998 3:00 PM	7/12/1998 7:00 AM	1/13/2000 10:00 AM
Electrolytes				
✓ Sodium	141	138		140
✓ Potassium	3.8	3.8		4.0
Chloride	103	106		106
Carbon Dioxide	21	22		22
Anion Gap	23	16		18
Organic/Inorganic Components				
Glucose, Fasting			102	
Glucose, Random				102
Creatinine			0.8	0.9
BUN			12	14
Lipids				
Triglycerides	176	170		
CHOL	154	280		
HDL	65			
LDL	134			
Chol HDL Ratio	2			
CHD Interp	< Average			



2/15/1999 7:52 AM CHOL: 280 mg/dL (CRIT) (Auth (Verified)) (Ref. Range 100 - 240)

PRDD | WEBKEM | Monday, April 17, 2000 | 3:15 PM

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 Pl. (Devine, Payne @UW)]

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	dihydroergotamine & 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

Pharmacy system

Laboratory system

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

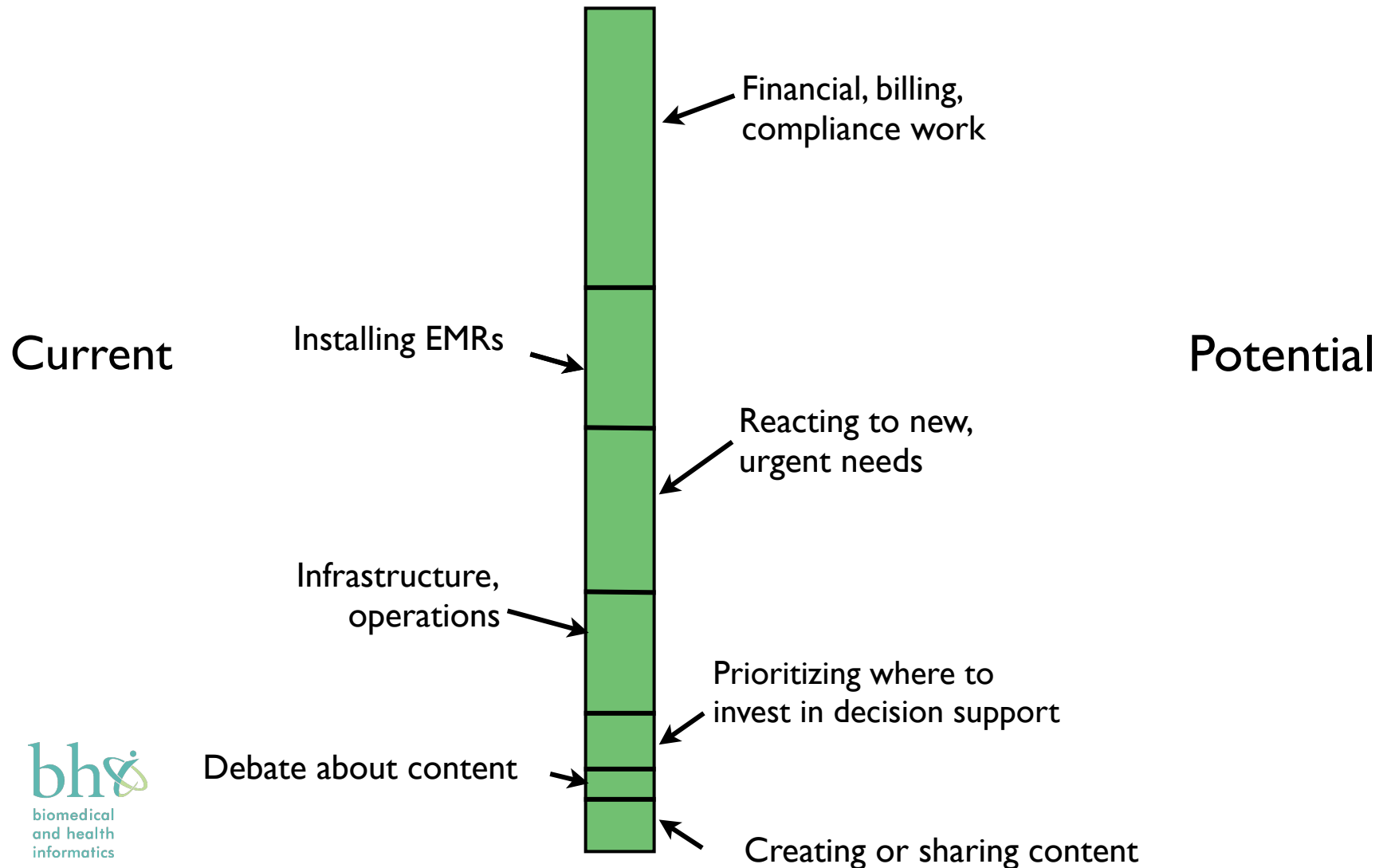
Topic for today

Computerized clinical decision support systems

- 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



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.

Selected references

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tpayne@u.washington.edu