

The Roles of Librarians in Electronic Health Records Systems

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Librarians and the EHR: Envisioning the Future
October 3, 2008

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Today's topics

- An overview of electronic health records
- The importance of access to point of care tools
- How librarians can contribute to their institutions' EHR systems
- Summary and questions



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What is the definition of electronic health record?

“EHR means a repository of patient data in digital form, stored and exchanged securely, and accessible by multiple authorized users. It contains retrospective, concurrent, and prospective information and its primary purpose is to support continuing, efficient and quality integrated health care.”

International Organization for Standardization (ISO) definition, cited in Häyrinen K, Sarantola K and Nykanen P. International Journal of Medical Informatics 2008; 77:291-304.

“Although there is no universally accepted definition of *EHR*, consensus is emerging that electronic documentation of providers' notes, electronic viewing of laboratory and radiology results, and electronic prescribing (known as computerized provider order entry, or CPOE) are key components of an *EHR*.”

Jha A, Ferris TG, Donelan K, DesRoches C, Shields A, Rosenbaum S, Blumenthal D. How Common Are Electronic Health Records In The United States? A Summary Of The Evidence. Health Affairs 2006; 25:w496-w507 (Published online 11 October 2006)



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What is the difference between EHRs and EMRs?

- It depends on who you ask.
- Some say EHRs contain a subset of EMR data, are by the patient, and contain data from many organizations
- In this talk I'll use the IOM functional definition



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Electronic health record functionality

Box 2. Core Functionalities for an Electronic Health Record System

- Health information and data
- Results management
- Order entry/management
- Decision support
- Electronic communication and connectivity
- Patient support
- Administrative processes
- Reporting & population health management

IOM Committee on Data Standards for Patient Safety, 2003 <http://www.nap.edu/books/NI000427/html/>



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DATE AND HOUR	PROB. NO.	NOTES
5/11/03 1330		Progress note by PA student This is a 67 yo ♂ admitted for cellulitis of the RUC. On admission he c/o fever & chills. Today he reports feeling quite well. He slept well, ate chicken & had a BM last night. Today he had another BM, breakfast

DATE AND HOUR	PROB. NO.	NOTES
9/12/03		R2 PN 67 yo vasculopathic ♀ w/ CVA, HON now E brief vision loss of macular etiology No c/o. Denies any vision changes. Reports feeling tired past few wks. PHTA now. P/LC PNVU. T _{ax} = 36 ♂ 56 115/76 18 Awake, alert Reg unchanged.



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The screenshot displays a complex medical information system interface. At the top, there are browser tabs and navigation menus. The main area is divided into several sections:

- Patient Information:** Shows patient name (DOE, JOHN), age (54), sex (Male), and other demographic data.
- Full Panel Test Listing:** A table listing various lab tests and their results. For example, Hemoglobin is 9.2 g/dL, Hematocrit is 27%, and Hemoglobin A1c is 5.7%.
- Lab Results:** A detailed view of lab results for 'Blood Gas' and 'Chemistry', showing values for pH, pCO2, pO2, and various electrolytes and metabolites.
- Clinical Notes:** A section for entering and reviewing patient notes, including a note from 'PAYNE, THOMAS H' dated 9/25/08.
- Imaging:** A 'Radiology Viewer' window showing a chest X-ray image.
- Monitoring:** A 'Vista CPRS' window displaying vital signs and trends over time.

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Thursday, September 25, 2008

What's new in EMRs

- Implementations more common and faster
- Greater understanding that EMRs have disadvantages and risks
- Adoption still low in US
- Aids to documentation and compliance improving
- Software somewhat more mature
- More commercial EMRs, fewer locally-developed
- Very little data sharing within US
- Free market process--vendors compete; little cooperation
- New certification (CCHIT). Unclear what impact this will have.
- Some companies sold, others declining in market share

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Making Health Care More Affordable: President Bush believes all Americans should have access to affordable, high-quality health care. Rising health-care costs impose a burden on families and small businesses and put coverage out of the reach of many Americans. Many businesses - particularly small firms - are struggling with these rising costs.

- The President has proposed a comprehensive, consumer-driven plan to address the problems of rising health-care costs and uninsurance. His plan includes Health Savings Accounts (HSAs), Association Health Plans (AHPs) for small businesses, civic groups, and community organizations, tax credits for low-income families, medical liability reform, and a goal of electronic health records for most Americans within 10 years.

and a goal of electronic health records for most Americans within 10 years.

Providing Affordable, Environmentally Responsible Energy: The President's comprehensive energy strategy will help America meet the energy needs of a growing economy in environmentally responsible ways. His plan encourages conservation; passage of Clear Skies legislation to cut power-plant pollution; alternative sources of energy, including hydrogen-fuel, clean coal, and ethanol; a modernized electricity grid; and more production here at home, including safe, clean, nuclear energy.

<http://www.whitehouse.gov/stateoftheunion/2005/index.html>
Accessed 5/6/05



tpayne@u.washington.edu Sept 10, 2008

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SPECIAL ARTICLE

**Electronic Health Records in Ambulatory Care
— A National Survey of Physicians**

Catherine M. DesRoches, Dr.P.H., Eric G. Campbell, Ph.D., Sowmya R. Rao, Ph.D., Karen Donelan, Sc.D., Timothy G. Ferris, M.D., M.P.H., Ashish Jha, M.D., M.P.H., Rainu Kaushal, M.D., M.P.H., Douglas E. Levy, Ph.D., Sara Rosenbaum, J.D., Alexandra E. Shields, Ph.D., and David Blumenthal, M.D., M.P.P.

ABSTRACT

BACKGROUND

From the Institute for Health Policy (C.M.D., E.G.C., S.R.R., K.D., D.E.L., A.E.S., D.B.) and the Massachusetts General Physicians Organization (T.G.F.), Massachusetts General Hospital; and Harvard Medical School (A.J.) — both in Boston; Weill Cornell Medical College, New York (R.K.); and the Department of Health Policy, George Washington University, Washington, DC (S.R.). Address reprint requests to Dr. DesRoches at the Institute for Health Policy, Massachusetts General Hospital, Suite 800, 50 State Street, Boston, MA 02114, or at cdesroches@partners.org.

This article (10.1056/NEJMoa0802005) was published at www.nejm.org on June 18, 2008.

N Engl J Med 2008;359:730-40.
Copyright © 2008 Massachusetts Medical Society.

Electronic health records have the potential to improve the delivery of health care services. However, in the United States, physicians have been slow to adopt such systems. This study assessed physicians' adoption of outpatient electronic health records, their satisfaction with such systems, the perceived effect of the systems on the quality of care, and the perceived barriers to adoption.

METHODS

In late 2007 and early 2008, we conducted a national survey of 2758 physicians, which represented a response rate of 62%. Using a definition for electronic health records that was based on expert consensus, we determined the proportion of physicians who were using such records in an office setting and the relationship between adoption and the characteristics of individual physicians and their practices.

RESULTS

Four percent of physicians reported having an extensive, fully functional electronic-records system, and 13% reported having a basic system. In multivariate analyses, primary care physicians and those practicing in large groups, in hospitals or medical centers, and in the western region of the United States were more likely to use electronic health records. Physicians reported positive effects of these systems on several dimensions of quality of care and high levels of satisfaction. Financial barriers were viewed as having the greatest effect on decisions about the adoption of electronic health records.

CONCLUSIONS

Physicians who use electronic health records believe such systems improve the quality of care and are generally satisfied with the systems. However, as of early 2008, electronic systems had been adopted by only a small minority of U.S. physicians, who may differ from later adopters of these systems.



EMR status at selected Seattle area medical centers, September 2008

April 2002

Sept 2008

	April 2002	Sept 2008
Children's Hospital and Medical Center	Signed contract, implementing	Inpatient and outpatient CPOE, results review
Evergreen Medical Center	Signed contract, implementing	ER, results review, inpatient documentation, outpatient EMR
Group Health Cooperative of Puget Sound	Signed contract	Outpatient CPOE and documentation, shared health record
UW Medicine	Signed contract	Physician documentation, pharmacy, medical records, RN/inpatient documentation
Virginia Mason Medical Center	Signed contract, implementing	CPOE, clinic, working on MD documentation, inpatient RN documentation, outpatient med mgmt
VA Puget Sound Health Care System	CPOE and EMR in production	Full inpatient, outpatient EMR with CPOE and documentation. Data shared VA-wide and with DoD
Swedish Medical Center	-	Implementing CPOE and documentation



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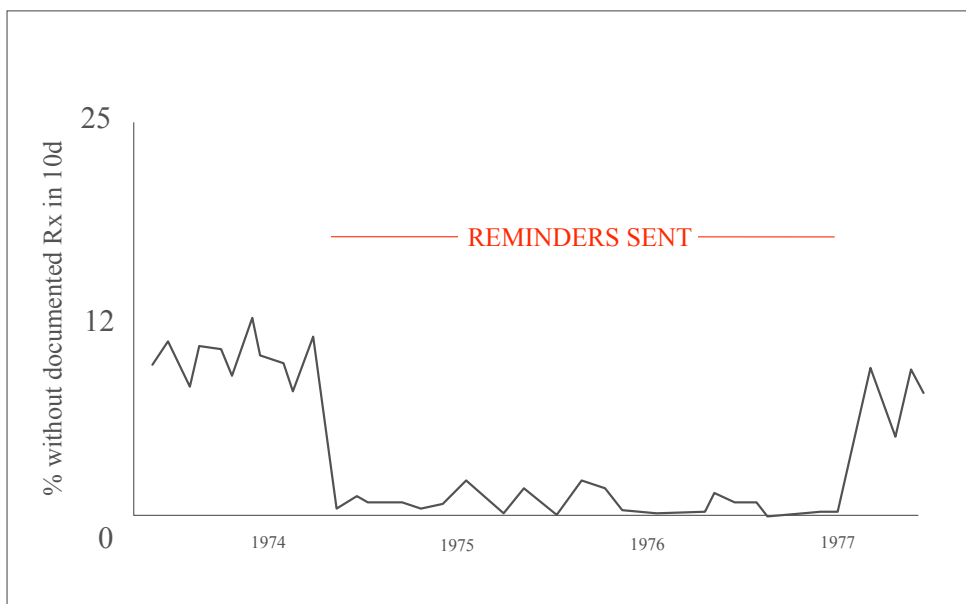


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Treatment of positive Strep cultures [Barnett et al, Medical Care, 1978]



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The healthcare setting is very busy

For example, Harborview Medical Center environment:

- ED – 300 patients a day. 50-70 ill enough to warrant immediate admission.
- 80 ICU patients
- Highest occupancy rate of any hospital in the region—98% in 2004.
- Enormous volumes of information



Slide courtesy of Scott Barnhart, MD

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Clinical computing can aid busy workflow



Admitting patients from an emergency room



John is:

- Checking Mr. Smith's hematocrit
- Writing Mr. Jones' progress note
- Answering a page about Ms. Thompson's CT scan

Slide courtesy of Jon McDonagh, MD

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How can computers aid decision making?

- Simplify access to data needed to make decisions
- Provide reminders and prompts
- Assist in order entry
- Assist in diagnosis
- Review new clinical data; alert when important patterns recognized



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What is Clinical Decision Support?

Computer decision support systems are computer applications designed to aid clinicians in making diagnostic and therapeutic decisions in patient care.



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Ten Commandments 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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Convenience, workflow increase use

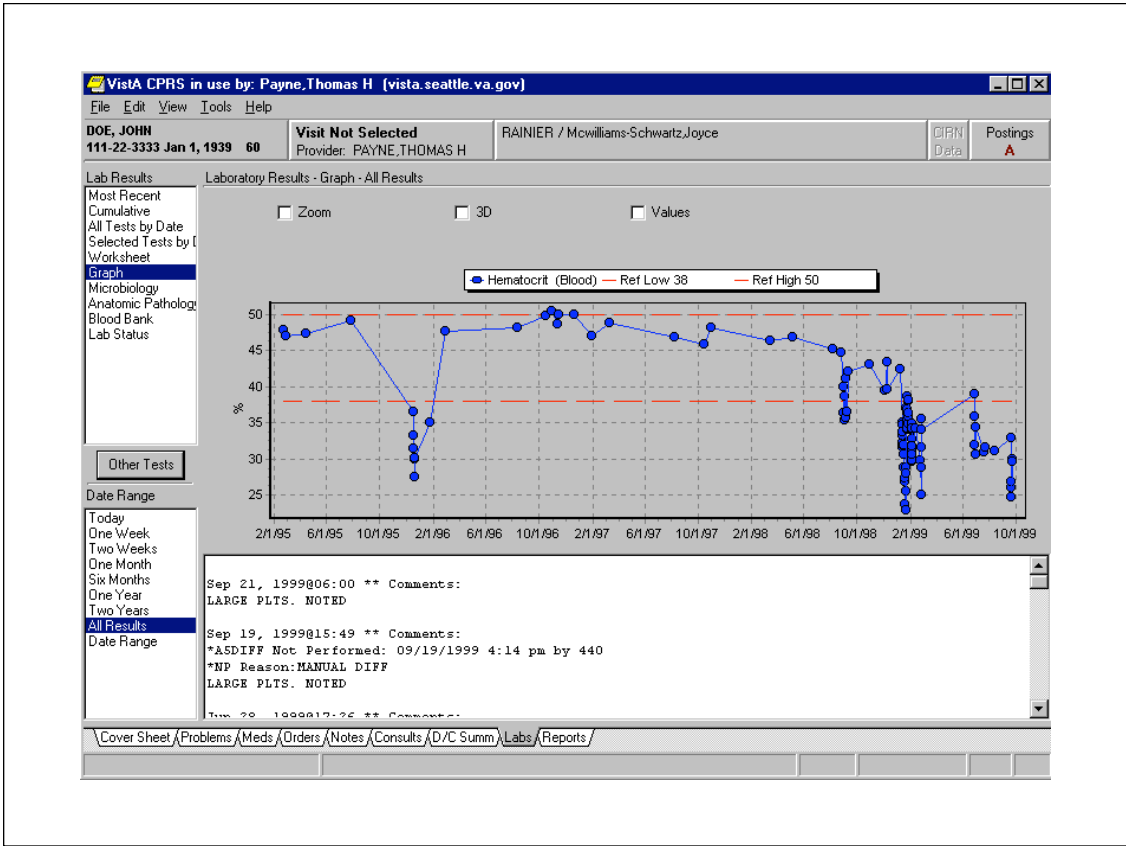
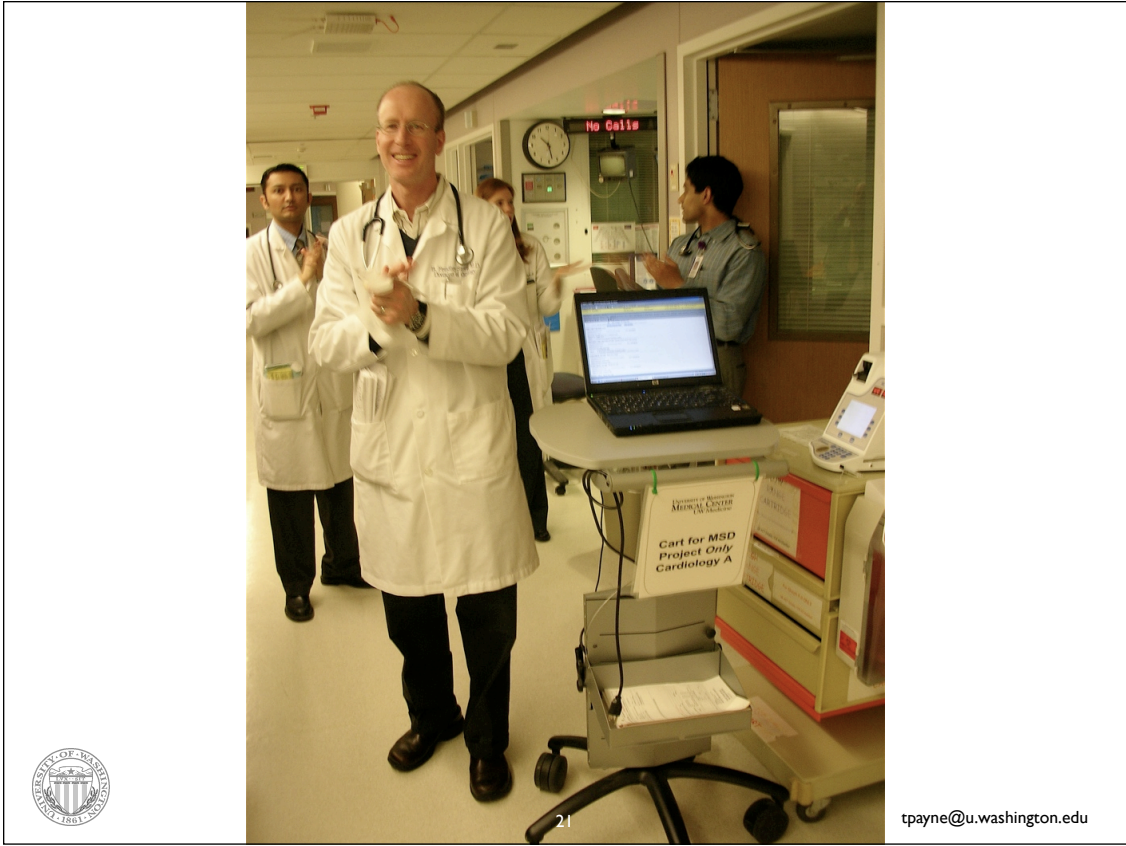
- Palm
- Now iPhone, iPod Touch
- Tablets
- Mobile devices
- Paper



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VistA CPRS in use by: Nichol,Paul (test.puget-sound.med.va.gov)

TEST PATIENT EIGHT 39011 Oct 09,02 14:56 UW SHORELINE CBOC /

000-00-1929 May 03,1929 (73) Provider: NICHOL,PAUL

Outpatient Medications

- SERTRALINE HCL 100MG TAB Qty: 30 for 30 days
Sig: TAKE ONE TABLET BY MOUTH EVERY NIGHT AT BEDTIME
- ASPIRIN 325MG EC TAB Qty: 300
Sig: TAKE ONE TABLET BY MOUTH EVERY DAY TO REDUCE RISK OF HEART ATTACK OR STROKE
- TRAMADOL HCL 50MG TAB Qty: 90 for 30 days
Sig: TAKE ONE TABLET BY MOUTH THREE TIMES A DAY TESTING ORIGINAL ALG
- PSEUDOEPHEDRINE HCL 60MG TAB Qty: 30 for 30 days
Sig: TAKE ONE-HALF TABLET BY MOUTH EVERY DAY TO RELIEVE NASAL CONGESTION
- AMOXICILLIN 250MG CAP Qty: 30 for 10 days
Sig: TAKE ONE CAPSULE BY MOUTH THREE TIMES A DAY TO TREAT/PREVENT BACTERIAL INFECTION-TESTING ALG 09/25
- ASPIRIN 325MG EC TAB Qty: 300 for 30 days
Sig: TAKE ONE TABLET BY MOUTH EVERY HEART ATTACK OR STROKE
- SODIUM CHLORIDE INJ 0.9% 50ML Qty: 20 for
Sig: INJECT 50 MLS INTRAVENOUSLY EVERY AMPICILLIN 1 GRAM EVERY SIX HOURS CO
- A & D OINT Qty: 120 for 90 days
Sig: APPLY SMALL AMOUNT TO AFFECTED.

Medication Order

WARFARIN TAB

Dosage	Complex	Route	Schedule
5MG		ORAL	Q5PM
2MG	0.126	ORAL	Q3MONTH
2.5MG	0.129		Q3WEEK
3MG	0.36		Q4H
3.75MG	0.099		Q4H WA
4MG	0.252		Q4WEEK
5MG	0.131		Q5D
6MG	0.378		Q5PM

Order Checking

Previous adverse reaction to: ANTICOAGULANTS

SIGNIFICANT drug-drug interaction: ASPIRIN & WARFARIN (Change ASPIRIN TAB,EC 325MG (PENDING))

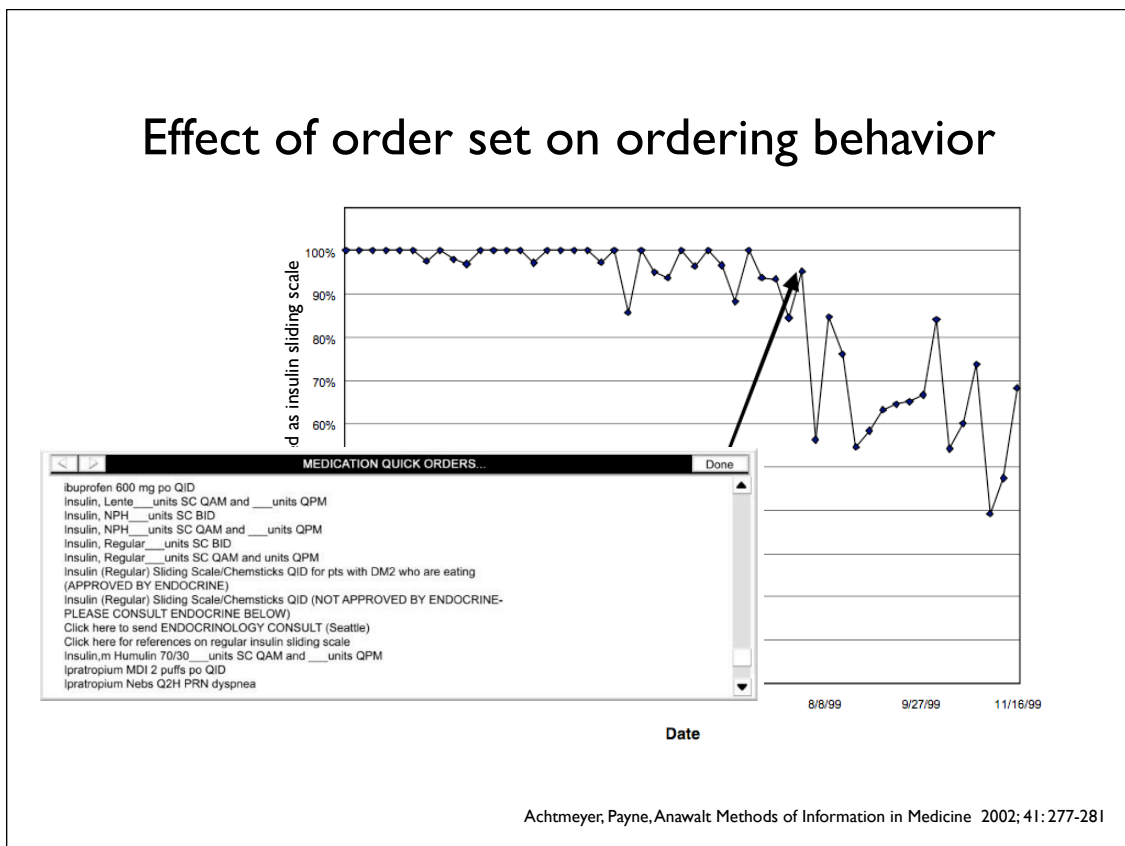
Accept Order Cancel Order

Priority: ROUTINE

Accept Order Quit

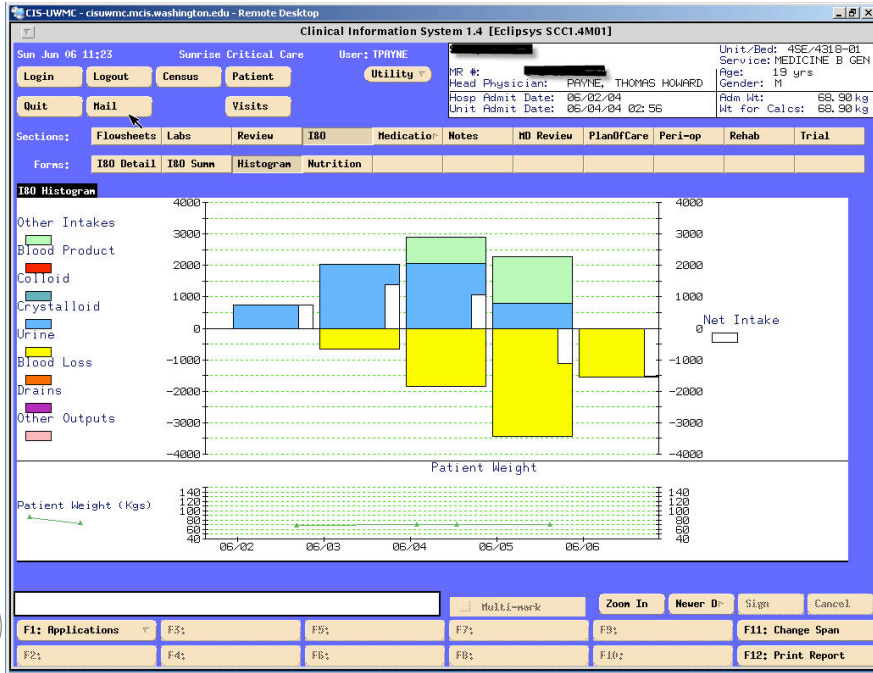
Lock

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Recovery from renal failure



2008

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

DOB: 1/12/1933 EMR: 000-0395 Fin #: 5742358 HT: 163 cm
 Age: 67 Years Gender: Female Loc: 8S, 804_B Wt: 69 KG

Drug Allergy/Interaction Summary

Medication	Allergy Profile	Details
amoxicillin (Amoxil)	penicillin	This patient is allergic to penicillins. Amoxicillin is a(n) penicillin.

Orderable Search: amoxil, amphetamine-dextro, Amphocin, Amphojel, Amphotec, amphotericin B, amphotericin B cholesteryl sulf, amphotericin B lipid complex

PROD | WEBKEM | Monday, April 17, 2000 | 4:45 PM



tpayne@u.washington.edu June 11, 2003

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CPOE and diagnostic errors

- CPOE can reduce serious adverse medication events by as much as 55%
- Prescribing the right dose of a drug, without drug-drug or drug-allergy interactions, but for the wrong condition does not help the patient
- Clinicians need help avoiding both types of errors



Table 2 Strategies to Reduce Diagnostic Errors

Strategy	Purpose	Timing	Focus	Underlying Assumptions	Tradeoffs
Education and training					
Training in reflective practice and avoidance of biases	Provide metacognitive skills	Not tied to specific patient cases	Individual, prevention	Transfer from educational to practice setting will occur; clinician will recognize when thinking is incorrect	Not tied to action; expensive and time consuming except in defined educational settings
Increase expertise	Provide knowledge and experience	Not tied to specific patient cases	Individual, prevention	Transfer across cases will occur; errors are a result of lack of knowledge or experience	Expensive and time consuming except in defined educational settings
Consultation					
Computer-based general knowledge resources	Validate or correct initial diagnosis; suggest alternatives	At the point-of-care while considering diagnosis	Individual, prevention	Users will recognize the need for information and will use the feedback provided	Delay in action; most sources still need better indexing to improve speed of accessing information
Consult with experts	Validate or correct initial diagnosis	At point-of-care for specific patient	System, prevention/mitigation	Expertise and agreement would mean diagnosis is correct	Delay in action; expensive; may need 3rd opinion if there is disagreement; if not mandatory would be only used for cases where physician is puzzled
DDSS	Validate or correct initial diagnosis	Before definitive diagnosis of specific patient	System, prevention	DDSS suggestions would include correct diagnosis; physician will recognize correct diagnosis when DDSS suggests it	Delay in action, cost of system; if not mandatory for all cases would be only used for cases where physician is puzzled
Feedback					
Increase number of autopsies/M&M	Prevent future errors	After an adverse event or death has occurred	System, prevention in future	Clinician will learn from errors and will not make them again; feedback will improve calibration	Cannot change action, too late for specific patient, expensive
Audit and feedback	Prevent future errors	At regular intervals covering multiple patients seen over a given period	System, prevention in future	Clinician will learn from errors and will not make them again; feedback will improve calibration	Cannot change action, too late for specific patient, expensive
Rapid follow-up	Prevent future errors and mitigate harm from errors for specific patient	At specified intervals unique to specific patients shortly after diagnosis or treatment	System, mitigation	Error may not be preventable, but harm in selected cases may be mitigated; feedback will improve calibration	Expense, change in workflow, MD time in considering problem areas

DDSS = diagnostic decision-support system; MD = medical doctor; M&M = morbidity and mortality.

Berner ES, Graber ML. Overconfidence as a Cause of Diagnostic Error in Medicine. Am J Med. 2008; 121 (5A), S2-S23.



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How do librarians fit into this?

- Managing information embedded in EMRs
 - Order configuration entities
 - Templates
 - Maintenance
 - Infobuttons
- Maintenance
- New ideas
- Collaboration with thought leaders



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CPOE

- Large library of order configuration entities
 - Preconfigured orders
 - Order screens
 - Order sets
- Successful businesses have developed to help with creation and maintenance



Order configuration entities

Terms used in EMR products

Order screen

Order dialog, order composer

Preconfigured order

Quick order, order template

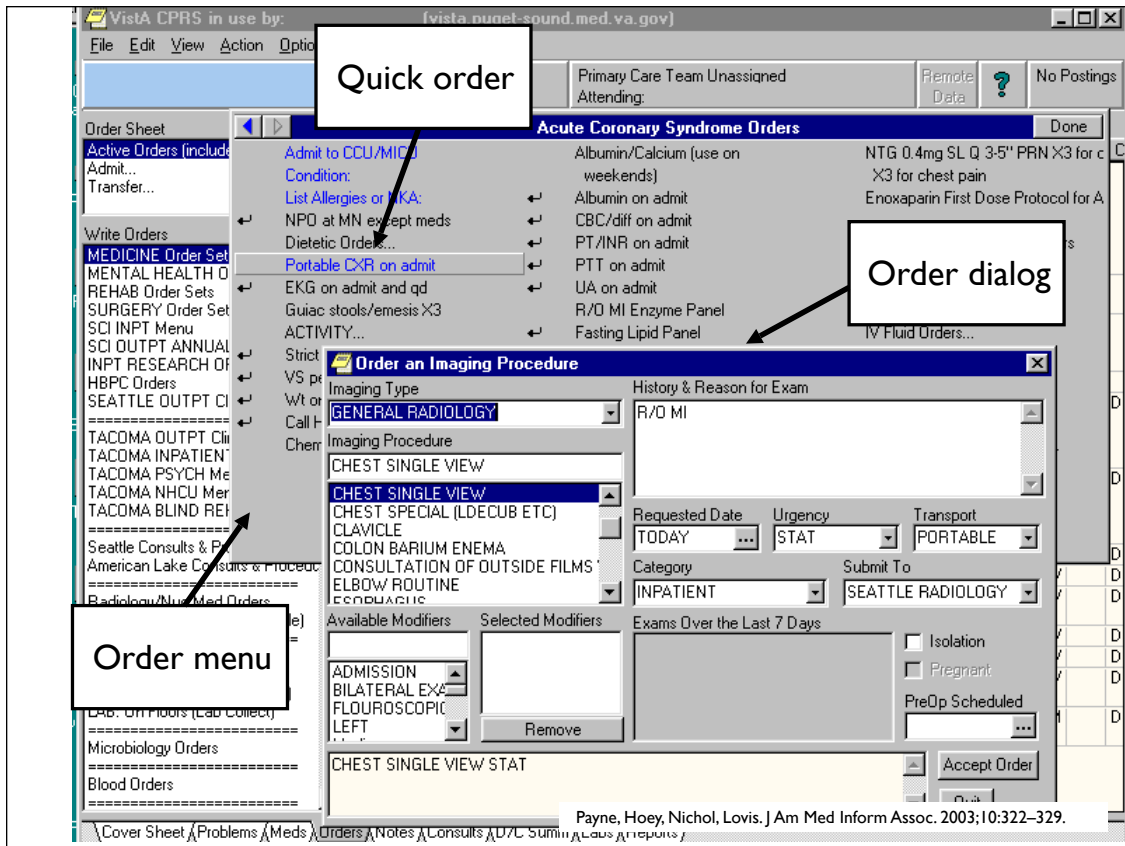
Order set

Order set, order menu, SmartSet

Protocols

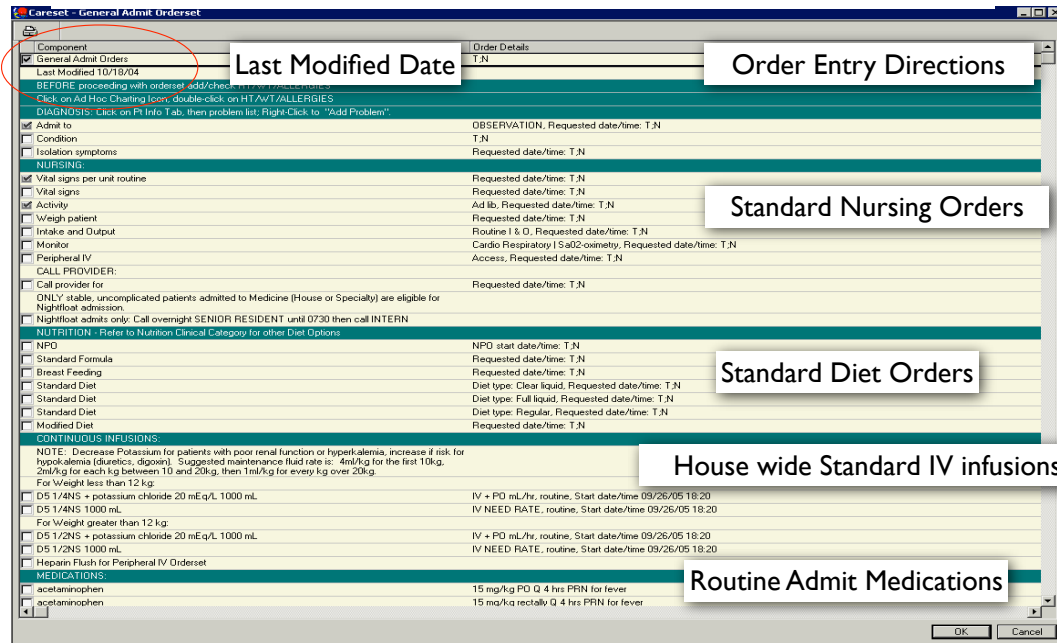
Higher level grouping of orders





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Example Order Set: General Admit Orders



Slide courtesy of Matt Eisenberg, MD

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ZTEST, ORDERSONLINE8 - 11620297 Opened by Eisenberg, Matthew A, MD

ZTEST, ORDERSONLINE8 - Add Order

ZTEST, ORDERSONLINE8 11620297 7197 Inpatient 2 years Male DCW: 13.00 kg (04-18-2006) z911 - 200150
 PCP: **Allergies** (11-13-2005)

Search Results

- ACE OrderSet
- Acute Seizure Management OrderSet
- Adenitis Admit OrderSet
- Admit to Extended Recovery OrderSet
- After Hours Recovery OrderSet
- ALTE Admit OrderSet
- Amikacin and Drug Levels OrderSet
- Amikacin Pulm and Drug Levels OrderSet
- Anesthesia NPO OrderSet
- Anesthesia Post Op OrderSet
- Anesthesia Pre Op OrderSet
- Antegrade Continence Enema OrderSet
- Apnea OrderSet, Infant
- Asthma Admit OrderSet
- Autonomic Dysreflexia OrderSet
- Baclofen Test Admit OrderSet
- Bacterial Endocarditis Prophylaxis OrderSet
- Blood Cultures OrderSet
- Bone and Joint Infection Admit OrderSet
- Bronchitis Admit OrderSet
- Bronchoscopy Post Op OrderSet
- Bronchoscopy Specimen OrderSet
- Carbamazepine Initiation OrderSet
- Cardiac Surgery Anesthesia Pre Op OrderSet
- Cardiac Surgery ASD, VSD, Ross & Conduit Post Op OrderSet
- Cardiac Surgery Cardiovascular Drip OrderSet
- Cardiac Surgery General Transfer OrderSet
- Cardiac Surgery Heart Transplant Immunosuppression OrderSet
- Cardiac Surgery Heart Transplant Post Op OrderSet
- Cardiac Surgery Heart Transplant Pre Op Admit OrderSet
- Cardiac Surgery Heart Transplant Thymoglobulin (ATG) OrderSet
- Cardiac Surgery Heart Transplant Transfer OrderSet
- Cardiac Surgery Mediastinal Irrigation OrderSet
- Cardiac Surgery Post Op ICU OrderSet
- Cardiac Surgery Post Op Ward OrderSet
- Cardiac Surgery Pre Op OrderSet
- Cardiology Pacemaker/ICD Post Op OrderSet
- Cardiology Post Cath Admit OrderSet
- Cardiology Post Cath Outpatient OrderSet
- Cefallitis and Aderitis Admit OrderSet
- Central Line Inpatient OrderSet
- Central Line Outpatient OrderSet
- CF Admit OrderSet
- CF Lab OrderSet
- Citrate Regional Anticoagulation OrderSet
- Coagulation and Hematology Lab OrderSet
- Coagulation Screen OrderSet
- Continuous Renal Replacement Therapy OrderSet
- Croup Admit OrderSet
- CRRT OrderSet
- CSF Immunology Workup OrderSet
- CSF Studies OrderSet
- Cyclophosphamide Infusion OrderSet
- Cystic Fibrosis Admit OrderSet
- Cystic Fibrosis Lab OrderSet
- Cytosol Infusion
- Day Surgery OrderSet
- Dehydration Admit OrderSet
- Dental Day Surgery OrderSet
- Dental Post Op Admit OrderSet
- Dermatology Day Surgery OrderSet
- Desensitization OrderSet, PICU
- Diabetic Ketoacidosis Admit OrderSet
- Discharge OrderSet
- DKA Admit OrderSet
- Caline Disorder Med Admit OrderSet
- Caline Disorder Psych Admit OrderSet
- ECLS Initiation OrderSet
- ECLS Management OrderSet
- ECDM Initiation OrderSet
- ECDM Management OrderSet
- ED A Quick Lab/Rad OrderSet
- ED Abdominal Pain OrderSet
- ED Acute Scrotum OrderSet
- ED Allergic Reaction OrderSet
- ED An Unstable Patient OrderSet
- ED Asthma High Score (5-12) Pathway OrderSet
- ED Asthma Low Score (1-4) Pathway OrderSet
- ED Bronchitis OrderSet
- ED Chest Pain OrderSet
- ED Constipation OrderSet
- ED Croup OrderSet
- ED Dehydration OrderSet
- ED DKA Diabetes OrderSet
- ED Fever 0-30 Days OrderSet
- ED Fever 31-60 Days OrderSet
- ED Fever 61 Days or greater OrderSet
- ED Fever HemDnc Patient OrderSet
- ED Fracture OrderSet
- ED Interim Admit OrderSet
- ED Intubation OrderSet
- ED Intussusception OrderSet
- ED Ketamine Sedation OrderSet
- ED Laceration OrderSet
- ED Leukemia New Diagnosis OrderSet
- ED Migraine OrderSet
- ED Newborn Jaundice OrderSet
- ED Observation Admit OrderSet
- ED Restraint Psychiatric OrderSet
- ED Seizure OrderSet

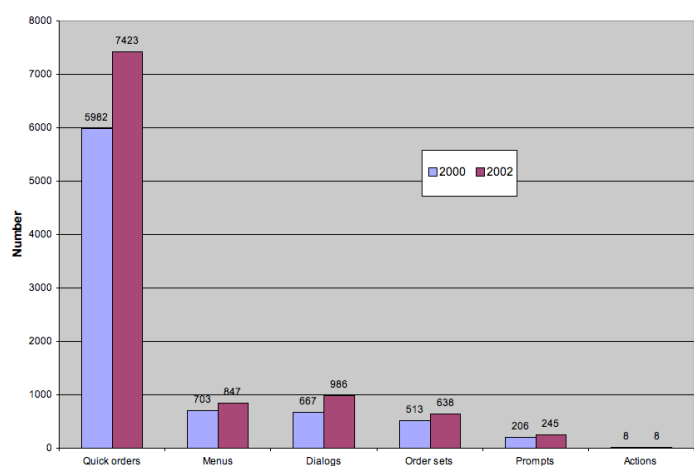
ZTEST, ORDERSONLINE8 - 11620297 Done



Slide courtesy of Matt Eisenberg, MD

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Order configuration entities at a CPOE site



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Which knowledge sources are used by commercial EMRs for CPOE?*

Example of guide to commercial offerings.

	FDB	Multum	Micro-medex	Medispan
Cerner		●	●	
Epic	●			●
Siemens	●			
Physician Microsystems				●
GE	●			

*Verify with vendors before relying on this table.

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The screenshot shows a Netscape browser window with two overlapping windows. The background window displays a list of review forms under the heading "Quick order and order set review". The foreground window shows the details for "ReviewForm 52 RegularInsulinSliding".

Quick order and order set review

This is a list of supporting documentation for To find out who to contact if you have ques or order set, look up the form in the list belc can improve the care we deliver.

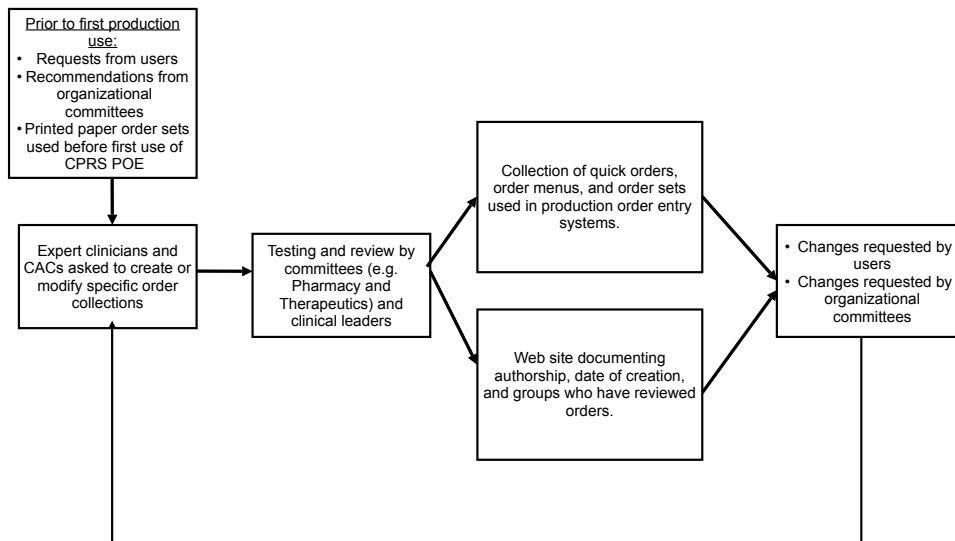
- [ReviewForm 1 IronLabTests.htm](#)
- [ReviewForm 2 Blood product ordering.cu](#)
- [ReviewForm 5 PrePTCA.htm](#)
- [ReviewForm 6 PostPTCA.htm](#)
- [ReviewForm 7 OpiateDetoxProtocol.htm](#)
- [ReviewForm 8 ValproateInAlcoholWithdr](#)
- [ReviewForm 9 AlcoholWithdrawalStandr](#)
- [ReviewForm 12 7EastAdmtOrders.htm](#)
- [ReviewForm 13 AdmtToMedicine.htm](#)

Order set number: 052
Title: Regular Insulin Sliding Scale
Version: 2
Institution: VA Puget Sound
Author: Brad Anzwalt, Linda Haas
Author's Service Line/Specialty: Primary and Specialty Medical Care
Date reviewed: 7/27/99
Test or production, and install date: Production, 8/16/99
Purpose: Sliding scale coverage for hospitalized patients with diabetes mellitus who are eating
Description: Quick order to generate nursing text order to print on the Medication Administration Record to govern regular insulin coverage for blood

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Managing order set content. One model.



Payne, Hoey, Nichol, Lovis. J Am Med Inform Assoc. 2003;10:322-329.

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Infobuttons

“Infobuttons” are information retrieval tools that use the context of this interaction to predict the most likely information needs and to offer a list of links to resources and content topics that may fulfill them.



Effectiveness of topic specific infobuttons: A randomized controlled trial

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Peter J. Haug, MD^{1,2}

James J. Cimino, MD³

Scott P. Narus, PhD¹

Chuck Norlin, MD⁴

Joyce A. Mitchell, PhD¹

¹Department of Biomedical Informatics, University of Utah, Salt Lake City, UT;

²Intermountain Healthcare, Salt Lake City, UT;

Conclusion The results support the hypothesis that topic links are more efficient than nonspecific links regarding the time seeking for information. It is unclear whether the statistical difference demonstrated will result in a clinically significant impact. However, the overall results confirm previous evidence that infobuttons are effective at helping clinicians to answer questions at the point of care and demonstrate a modest incremental change in the efficiency of information delivery for routine users of this tool.



Time	Medication	Dose	Frequency	Quantity	Status
06/20/2008 15:06	prazosin 2 mg oral capsule	2 mg, PO		0	Unavailable
06/20/2008 15:05	prazosin 2 mg oral capsule	2 mg, PO		0	Unavailable
06/20/2008 14:33	pancrelipase	PO		0	Paul, ...
06/20/2008 14:30	pancrelipase	PO, Before Meals		0	Paul, ...
06/20/2008 14:44	naproxen sodium	220 mg, PO, BID		0	Unavailable
06/20/2008 14:37	multivitamin, prenatal	1 cap, PO, QDay		0	Unavailable
06/20/2008 15:26	insulin lispro-insulin lispro protamine 25 units-75 units/mL subcutaneous suspension	1unit daily, Subcutaneous		0	Unavailable
06/20/2008 15:01	insulin lispro 100 units/mL subcutaneous injection	5 units, 10 mL, Subcutaneous, TID Before Meals		0	Unavailable
06/20/2008 14:58	insulin lispro 100 units/mL subcutaneous injection	See Instructions		0	Unavailable
06/20/2008 15:04	insulin glargine 100 units/mL subcutaneous solution	Subcutaneous		0	Unavailable
06/20/2008 15:03	insulin glargine 100 units/mL subcutaneous solution	Subcutaneous		0	Unavailable
06/20/2008 15:03	insulin glargine 100 units/mL subcutaneous solution	Subcutaneous		0	Unavailable
06/20/2008 14:46	hydrochlorothiazide 25 mg oral tablet	25 mg, 30 tab, PO, QDay		0	Unavailable
06/20/2008 14:46	hydrochlorothiazide 25 mg oral tablet	25 mg, PO		0	Unavailable
06/20/2008 15:29	Eucerin topical lotion	apply to legs, Topical		0	Unavailable
06/20/2008 14:47	atenolol 25 mg oral tablet	25 mg, 30 tab, PO, QDay		0	Unavailable



ZZTEST, PATIENT A - U9699999 Opened by Payne, MD, Thomas Howard

Task Edit View Patient Chart Links Navigation Help

In-Box Patient List View Scheduling Surgery Schedule Links and Reports UWMC Radiology Images HMC Radiology Images

New Sticky Note View Sticky Notes Tear Off Attach Change Suspend Charges Charge Entry Exit Calculator AdHoc PM Conv

ZZTEST, PATI... x

ZZTEST, PATIENT A Age: 78 years Sex: Female Location: U-4S; SS402;
 DOB: 05/05/1930 MRN: U9699999 Limited Stay [04/23/200

MINDscape

HealthLinks > Cgi-bin

HealthLinks University of Washington

Home Library MyHealth Toolkits UW Help Ask Us!

Micromedex Search

Searching Micromedex for "multivitamin,"... Please Wa

Note: you may see a small pop-up window open--this is an expected part of this automated search.

HealthLinks | Site Index | About HealthLinks | Contact Us | All Rights Reserved | Privacy Policy
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 https://healthlinks.washington.edu/cgi-bin/search/session.cgi

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Task Edit View Patient Chart Links Navigation Help

In-Box Patient List View Scheduling Surgery Schedule Links and Reports UWMC Radiology Images HMC Radiology Images

New Sticky Note View Sticky Notes Tear Off Attach Change Suspend Charges Charge Entry Exit Calculator AdHoc PM Conversation Explorer Menu

ZZTEST, PATI... x

ZZTEST, PATIENT A Age: 78 years Sex: Female Location: U-4S; SS402; -2 **Allergies**
 DOB: 05/05/1930 MRN: U9699999 Limited Stay [04/23/2005 22:51] Encl: <No - Financial number>

MINDscape

THOMSON MICROMEDEX

MICROMEDEX® Healthcare Series

Main Drugs Toxicology Disease IV Compatibility Patient Ed Handheld PDA

Need training to access clinical information at the point of care? Print Ready Calculators Subscription Details Page Help

Search Path: Main Keyword Search >

Initial Results

Your Search: pancrelipase

Modify your search: OR Did you mean:

pancrelipase Search PANCRELIPASE Search

Find all keywords that: Exactly Match Begin With

Go To: Summaries Drugs Toxicology Reproductive Risk

PROD: TPAYNE September 25, 2008 18:22

44

Embedded links to information sources

- Example of problem list
- Recent work in UW Medicine with a commercial electronic reference site
- Promise of increasing ease and relevance of information systems using encoded data and UMLS



45

tpayne@u.washington.edu, October 3, 2008

45

ZZTEST, PATIENT A - U969999 Opened by Payne, MD, Thomas Howard

Task Edit View Patient Chart Links Problem List Help

In-Box Patient List View Scheduling Surgery Schedule Links and Reports UMMC Radiology Images HMC Radiology Images

New Sticky Note View Sticky Notes Tear Off Attach Change Suspend Charges Charge Entry Exgt Calculator AdHoc PM Conversation Explorer Menu

ZZTEST, PATI... x

ZZTEST, PATIENT A Age: 78 years Sex: Female Location: U-4S: S5402: -2 ** Allergies **
DOB: 05/05/1930 MRN: U969999 Limited Stay [04/23/2005 22:51] Enc: <No - Financial number>

PT Info Print 4 minutes ago

Problem List Patient Demographics Insurance Encounters Relationships

Classification View All Problems Change View

Classification	Name of Problem	Life Cycle Date	Course	Onset Date	Responsible Provider	Recorder	Code	Ranking
Medical	ACUTE RESPIRATORY F...	5/28/2008	Stable			Payne, MD, Thomas Howard	518.81	
Medical	HEADACHE	5/20/2008		About 7/11/...		Stern, MD, MS, Jean M	704.0	
Medical	CONGESTIVE HEART FAI...	1/24/2008				Payne, MD, Thomas Howard	428.0	
Medical	Diabetes mellitus - adult on...	5/28/2008			Lonstreth Jr, MD, W T	Lonstreth Jr, MD, W T	433.75015	
Medical	Hemiplegia	5/28/2008			Lonstreth Jr, MD, W T	Lonstreth Jr, MD, W T	842.2011	

PROD | TPAYNE | September 25, 2008 | 17:50



46

Opened by Payne, MD, Thomas Howard

Task Edit View Patient Chart Links Problem List Help

In-Box Patient List View Scheduling Surgery Schedule UWMC Radiology Images HMC Radiology Images UWMC Mindscape HMC Mindscape UWMC Surgery Schedule

New Sticky Note View Sticky Note

ZZTEST, PATIENT A

PM Conversation

Recent MRN

D1 ** Allergies **

:25 - <No - Discharge date>

Print 2 minutes ago

Code Ranking

Problem: [Text Field] Freetext

Annotated display: [Text Field]

Qualifier: [Dropdown]

*Confirmation: Confirmed

*Classification: < none >

Onset date: Precision: Year: Month: Day: Set to today

Status date: Precision: Year: Month: Day: Set to today

2008 June 25

Status Details Caregiver Relationships

Life cycle:

Active

Inactive

Resolved

Canceled

Other

Severity class: [Dropdown]

Severity: [Text Field]

Course:


Stable

Improving

Worsening

Comment: Chronological Reverse chronological

Add Comment... View History >> OK Cancel Apply



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ZZTEST, PATIENT A - U9699999 Opened by Payne, MD, Thomas Howard

Task Edit View Patient Chart Links Problem List Help

In-Box Patient List View Scheduling Surgery Schedule Links and Reports UWMC Radiology Images HMC Radiology Images

New Sticky Note View Sticky Notes Tear Off Attach Change Suspend Charges Charge Entry Ekg Calculator AdHoc PM Conversation Explorer Menu

ZZTEST, PATIENT A

Age: 78 years Sex: Female Location: U 4S; 5S402; -2 ** Allergies **

DOB: 05/05/1930 MRN: U9699999 Limited Stay [04/23/2005 22:51] Encl#: <No - Financial number>


PM Conversation 9 minutes ago

Problem List Patient Demographics Insurance Encounters Relationships

Classification View All Problems Change View

Classification	Name of Problem	Life Cycle Date	Course	Onset Date	Responsible Provider	Recorder	Code	Ranking
Medical	ACUTE RESPIRATORY F...	5/28/2008	Stable	About 7/11/...	Payne, MD, Thomas Howard	Payne, MD, Thomas Howard	518.81	
Medical	HEADACHE	5/20/2000			Stem, RD, MD, Jean M	Stem, RD, MD, Jean M	704.9	
Medical	CONGESTIVE HEART FAIL...	1/24/2008			Payne, MD, Thomas Howard	Payne, MD, Thomas Howard	428.0	
Medical	Diabetes mellitus - adult on...	5/28/2008			Longstreth Jr, MD, w T	Longstreth Jr, MD, w T	433775015	
Medical	Hemiplegia				Longstreth Jr, MD, w T	Longstreth Jr, MD, w T	84272011	

PROD | TPAYNE | September 25, 2008 | 17:56



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ZZTEST, PATIENT A - U9699999 Opened by Payne, MD, Thomas Howard

Task Edit View Patient Chart Links Problem List Help

In-Box Patient List View Scheduling Surgery Schedule Links and Reports UWMC Radiology Images HMC Radiology Images

New Sticky Note View Sticky Notes Tear Off Attach Change Suspend Charges Charge Entry Exit Calculator Ad-hoc PM Conversation Explorer Menu

ZZTEST, PATIENT A Age: 78 years Sex: Female Location: U-4S; SS402; -2 **Allergies**
 DDB: 05/05/1930 MRN: 119699999 Limited Stat 004/23/2005 22:51; Enc#:(No - Financial number)

Pt Info

Problem List Patient Demographics Insurance

Classification View

Classification	Name of Problem
All Problems	
Medical	ACUTE RESPIRATORY F...
Medical	HEADACHE
Medical	CONGESTIVE HEART FAL...
Medical	Diabetes mellitus - adult...
Medical	Hemiplegia

Medline Clinical Search

Search String: Hemiplegia

All Categories
 Include Only Selected Categories

Categories

Therapy Prognosis Patient Care Preventive Health Services
 Etiology Diagnosis Nursing Care Health Education

All Publication Types
 Include Only Selected Publication Types

Publication Types

Twin Study Multicenter Study Meta Analysis Randomized Controlled Trial
 Review Clinical Trials Practice Guidelines Controlled Clinical Trial

Search G2 to Citation Matcher Cancel

Code	Ranking
518.81	
794.0	
428.0	
493775015	
84272011	

PROD | TPAYNE | September 25, 2008 | 17:53



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ZZTEST, PATIENT A - U9699999 Opened by Payne, MD, Thomas Howard

Task Edit View Patient Chart Links Problem List Help

In-Box Patient List View Scheduling Surgery Schedule Links and Reports UWMC Radiology Images HMC Radiology Images

New Sticky Note View Sticky Notes Tear Off Attach Change Suspend Charges Charge Entry Exit Calculator Ad-hoc PM Conversation Explorer Menu

ZZTEST, PATIENT A Age: 78 years Sex: Female Location: U-4S; SS402; -2 **Allergies**
 DDB: 05/05/1930 MRN: 119699999 Limited Stat 004/23/2005 22:51; Enc#:(No - Financial number)

NCBI PubMed
 A service of the U.S. National Library of Medicine and the National Institutes of Health

Search PubMed for Hemiplegia AND ((Therapeutics[MH] OR TU[SH] OR TH[SH])) AND (- Microsoft Internet Explo...
 Go Clear Advanced Search (beta) Save Search

Limits Preview/Index History Clipboard Details

Display Summary Show 20 Sort By Send to

All: 309 Review: 309

Items 1 - 20 of 309 Page 1 of 16

1: [Boehing S, Yates DA.](#) Related Articles, List
 Effects of a new orthosis and physical therapy on gait in a subject with longstanding hemiplegia. *J Geniatr Phys Ther.* 2008;31(1):38-46. Review. PMID: 18489807 [PubMed - indexed for MEDLINE]

2: [Ducros A.](#) Related Articles, List
 [Familial and sporadic hemiplegic migraine]. *Rev Neurol (Paris).* 2008 Mar;164(3):216-24. Epub 2008 Mar 11. Review. French. PMID: 18405771 [PubMed - indexed for MEDLINE]

3: [Sujith OK.](#) Related Articles, List
 Functional electrical stimulation in neurological disorders. *Eur J Neurol.* 2008 May;15(5):437-44. Review. PMID: 18394046 [PubMed - indexed for MEDLINE]

4: [Harvey EL, Nudo RJ.](#) Related Articles, List
 Cortical brain stimulation: a potential therapeutic agent for upper limb motor recovery following stroke.

Code	Ranking
518.81	
794.0	
428.0	
493775015	
84272011	

PROD | TPAYNE | September 25, 2008 | 17:54



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Problem Search

*Search: congestive heart failure

Find clinical terms which match the following criteria:

Terminology: <All terminologies>

Terminology Axis: <All terminology axes>

Search by name Search by code

Term	Terminology Axis	Code	Terminology
Acute congestive heart failure	Finding	18472010	SNOMED CT
Acute left-sided congestive heart failure	Finding	124437018	SNOMED CT
Acute right-sided congestive heart failure	Finding	133544010	SNOMED CT
Benign hypertensive heart disease with congestive cardiac failure	Finding	299853017	SNOMED CT
Benign hypertensive heart disease with congestive heart failure	Finding	129025010	SNOMED CT
Benign hypertensive heart disease with congestive cardiac failure	Finding	299852010	SNOMED CT
Biventricular congestive heart failure	Finding	129404019	SNOMED CT
CHF - Congestive heart failure	Finding	153058012	SNOMED CT
CHF - Congestive heart failure	Finding	483288014	SNOMED CT
Chronic congestive heart failure	Finding	147247018	SNOMED CT
Chronic left-sided congestive heart failure	Finding	9994016	SNOMED CT
Chronic right-sided congestive heart failure	Finding	111275015	SNOMED CT
Congestive heart failure	Finding	70653017	SNOMED CT
Congestive heart failure monitoring	Finding	216184014	SNOMED CT
CONGESTIVE HEART FAILURE, UNSPECIFIED	Finding	428 0	ICD-9-CM
Congestive rheumatic heart failure	Finding	136880013	SNOMED CT
Hypertensive heart and renal disease with congestive heart failure	Finding	299672017	SNOMED CT
Hypertensive heart and renal disease with congestive cardiac failure	Finding	299674016	SNOMED CT
Hypertensive heart disease with congestive cardiac failure	Finding	9634016	SNOMED CT
Hypertensive heart disease with congestive heart failure	Finding	101181010	SNOMED CT
Hypertensive heart disease without congestive cardiac failure	Finding	1236317010	SNOMED CT
Malignant hypertensive heart disease with congestive heart failure	Finding	137848017	SNOMED CT
Malignant hypertensive heart disease without congestive heart failure	Finding	60617018	SNOMED CT
Pleural effusion due to congestive heart failure	Finding	150352015	SNOMED CT
Red half-moon nail in congestive heart failure	Finding	1782351013	SNOMED CT
RHEUMATIC HEART FAILURE (CONGESTIVE)	Finding	368 91	ICD-9-CM

26 item(s)

OK Cancel



51

Problem Search

*Search: congestive heart failure

Find clinical terms which match the following criteria:

Terminology: <All terminologies>

Terminology Axis: <All terminology axes>

Search by name Search by code

Term	Terminology Axis	Code	Terminology
Acute congestive heart failure	Finding	18472010	SNOMED CT
Acute left-sided congestive heart failure	Finding	124437018	SNOMED CT
Acute right-sided congestive heart failure	Finding	133544010	SNOMED CT
Benign hypertensive heart disease with congestive cardiac failure	Finding	299853017	SNOMED CT
Benign hypertensive heart disease with congestive heart failure	Finding	129025010	SNOMED CT
Benign hypertensive heart disease with congestive cardiac failure	Finding	299852010	SNOMED CT
Biventricular congestive heart failure	Finding	129404019	SNOMED CT
CHF - Congestive heart failure	Finding	153058012	SNOMED CT
CHF - Congestive heart failure	Finding	483288014	SNOMED CT
Chronic congestive heart failure	Finding	147247018	SNOMED CT
Chronic left-sided congestive heart failure	Finding	9994016	SNOMED CT
Chronic right-sided congestive heart failure	Finding	111275015	SNOMED CT
Congestive heart failure	Finding	70653017	SNOMED CT
Congestive heart failure monitoring	Finding	216184014	SNOMED CT
CONGESTIVE HEART FAILURE, UNSPECIFIED	Finding	428 0	ICD-9-CM
Congestive rheumatic heart failure	Finding	136880013	SNOMED CT
Hypertensive heart and renal disease with congestive heart failure	Finding	299672017	SNOMED CT
Hypertensive heart and renal disease with congestive cardiac failure	Finding	299674016	SNOMED CT
Hypertensive heart disease with congestive cardiac failure	Finding	9634016	SNOMED CT
Hypertensive heart disease with congestive heart failure	Finding	101181010	SNOMED CT
Hypertensive heart disease without congestive cardiac failure	Finding	1236317010	SNOMED CT
Malignant hypertensive heart disease with congestive heart failure	Finding	137848017	SNOMED CT
Malignant hypertensive heart disease without congestive heart failure	Finding	60617018	SNOMED CT
Pleural effusion due to congestive heart failure	Finding	150352015	SNOMED CT
Red half-moon nail in congestive heart failure	Finding	1782351013	SNOMED CT
RHEUMATIC HEART FAILURE (CONGESTIVE)	Finding	368 91	ICD-9-CM

26 item(s)

OK Cancel



52

The screenshot shows a medical software interface. At the top, there is a menu bar with options like 'Edit', 'View', 'Patient', 'Chart', 'Links', and 'Help'. Below the menu bar, there are several tabs and buttons, including 'In-Box', 'Patient List', 'View Scheduling', 'Surgery Schedule', and various search and navigation tools. A patient information bar is visible, showing fields for 'Age: years', 'Sex:', 'Location:', 'DOB', 'MRN:U', and 'Inpatient [06/17/2008 15:25 - <No - Discharge date>]'. Below this, there is a 'Med Reference' section with a search bar containing 'pneumonia'. The search results area is empty, displaying the message 'No reference information available for losartan.'

53

The screenshot shows a web application interface. The browser address bar displays 'https://apps.medical.washington.edu/orcaweb/index.asp?user=TPAYNE - Microsoft Internet Explorer'. The page header includes 'UW Medicine' and 'ORCA Web Links'. The main content area is divided into three sections: 'Clinical Application Links', 'Clinical Information Links', and 'Communication'. The 'Clinical Application Links' section contains links for 'MINDscape', 'EPIC Web', 'CORES (Computerized Rounding and Sign-out)', 'UW Surgery Schedule', 'HMC Surgery Schedule', and 'HMC DocuView Anesthesia Application *** (Access limited to authorized DocuView users.)'. The 'Clinical Information Links' section contains links for 'Health Links', 'Health Links - Care Provider Toolkit', 'Health Links - Nurse Toolkit', 'Health Online', and 'Clinical Toolkit'. The 'Communication' section contains a link for 'UW Medicine'. On the left side, there is an 'In-Box' sidebar with various notification icons and counts, such as 'Sign and Review (0 new)', 'Inbox Messages (0 new)', 'Results to Endorse (25 new)', 'New Results FY1 (46 new)', and 'Sent Items (0 new)'. The bottom left corner features the University of Washington logo and the text 'Raghu, MD, FCC...'.

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PowerChart Organizer for Payne, MD, Thomas Howard

Task Edit View Patient Chart Links Navigation Help

In-Box Patient List View Scheduling | Surgery Schedule | Links and Reports UWMC Radiology Images HMC Radiology Images

New Sticky Note View Sticky Notes Tear Off Attach Change Suspend Charges Charge Entry Exit Calculator AdHoc

Recent MRN

Print 2 minutes ago

150%

Web Links

UpToDate. Search

Clinical Application Links

- EPIC Web
- CORES
- HMC DocuView Anesthesia Application ***

Clinical Information Links

- Health Links
- Health Links - Care Provider Toolkit
- Health Links - Nurse Toolkit
- Health Online
- Clinical Toolkit
- PSBC Links

Communication

- UWMC Oncall
- UWMC Paging

Support Links

Clinical Reports

Patient Labels

- Print Patient Labels
- Print Unit Labels

Worklists

- RN Assignment Report
- RN Charge Communication Sheet
- RN Charge Report
- RN Inpatient Census
- Unit Discharge Facilitator Report
- Diet Report

Census Reports

- Nutrition Personal Census
- Occupational Therapist Personal Census
- Physical Therapy Personal Census
- Respiratory Therapy Personal Census
- Speech Therapy Personal Census

Other Reports

Suspends the application. Login to resume.

PROD | TPAYNE | September 25, 2008 | 17:42

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ZZTEST, PATIENT A - U9699999 Opened by Payne, MD, Thomas Howard

Task Edit View Patient Chart Links Navigation Help

In-Box Patient List UWMC Radiology Images HMC Radiology Images UWMC Mindscape HMC Mindscape UWMC Surgery Schedule HMC Surgery Schedule ORCA Web Links

New Sticky Note View Sticky Notes Tear Off Attach Change Suspend Charges Charge Entry Exit Calculator AdHoc PM Conversation Explorer Menu

Recent Name

ZZTEST, PATI... x

ZZTEST, PATIENT A

Age: 77 years Sex: Female Location: 2.Cath Lab ** Allergies **

DOB: 05/05/1930 MRN: U9699999 Outpatient [02/01/2007 12:30]: Enc#: 1714110248

Information Resources

Print 0 minutes ago

150%

UpToDate. ONLINE 16.1

New Search Patient Info What's New

Click on patient data below to launch UpToDate search, or enter other search topic

New Search: Go Clear

Drug Interactions

Problems

- Acute respiratory failure
- Congestive heart failure
- Porphyria cutanea tarda

Medications

- lisinopril
- ezetimibe-simvastatin
- diltiazam

PROD | TPAYNE | April 22, 2008 | 10:...

56

Exchange between institutions has had very limited success

- Arden Syntax
- Eclipsys attempt
- Recent repository projects such as Morningside



57

tpayne@u.washington.edu, October 3, 2008

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Rule and guideline exchange

- Rule exchange can allow organizations to benefit from work done elsewhere
- Arden Syntax
 - HL7 standard for expressing rules to generate alerts and reminders
- GuideLine Interchange Format
 - Proposed standard for exchanging practice guidelines
- Information repositories

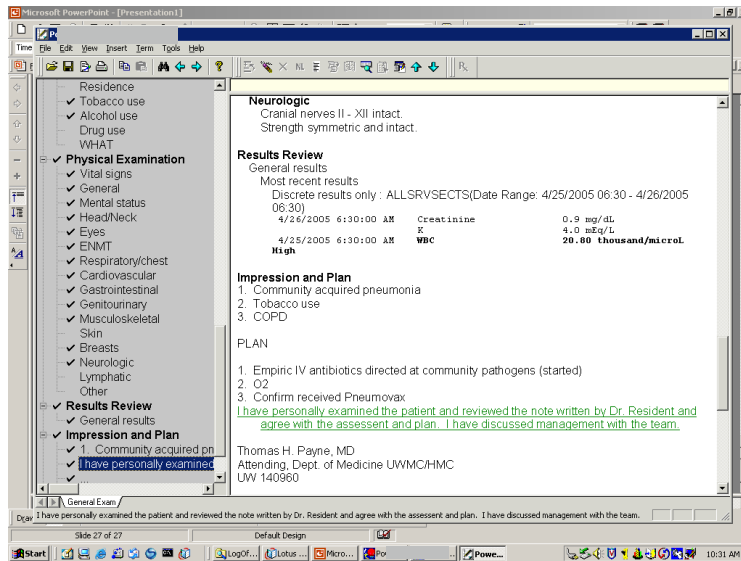


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tpayne@u.washington.edu, October 3, 2008

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Electronic documentation



59

How do I get started?

- Understand workflow
 - Go on rounds
 - Go to clinic
- Get to know the people, their role, their hours
- Find a need and fill it!



60

tpayne@u.washington.edu, October 3, 2008

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Summary

- Electronic health records are not yet widely used but are likely to be more common.
- Established EHRs need maintenance; most sites need help with this.
- Within most commercial EHRs are many opportunities for general and and context-specific links to external reference sites,
- CPOE presents special opportunities for management of embedded knowledge.
- Librarian training and aptitude coincide with need within EHR teams
- Get started!



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Questions?

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Thursday, September 25, 2008