Customizations of the EHR that Ensure Quality and Safety

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The Impact of eHealth on the Quality and Safety of Health Care: A Systematic Overview

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Abstract

Background: There is considerable international interest in exploiting the potential of digital solutions to enhance the quality and safety of health care. Implementations of transformative eHealth technologies are underway globally, often at very considerable cost. In order to assess the impact of eHealth solutions on the quality and safety of health care, and so inform policy decisions on eHealth deployments, we undertook a systematic review of systematic reviews assessing the effectiveness and consequences of various eHealth technologies on the quality and safety of care.

Methods and Findings: We developed novel search strategies, conceptual maps of health care quality, safety and eHealth interventions, and then systematically identified, scrutinized, and synthesized the systematic review literature. Major biomedical databases were searched to identify systematic reviews published between 1997 and 2010. Related theoretical, methodological, and technical material was also reviewed. We identified 53 systematic reviews that focused on assessing the impact of eHealth interventions on the quality and/or safety of health care and 33 supplementary systematic reviews providing relevant supportive information. This systematic review literature was found to be generally of substandard quality with regards to methodology reporting and utility. We thematically categorized eHealth technologies into three main areas: (1) storing, managing, and transmission of data; (2) clinical decision support; and (3) facilitating care from a distance. We found that despite support from policymakers, there was relatively little empirical evidence to substantiate many of the claims made in relation to these technologies. Whether the success of these relatively few solutions identified to improve quality and safety would continue if these were deployed beyond the contexts in which they were originally developed, has yet to be established. Importantly, best practice guidelines in effective development and deployment strategies are lacking.

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The Benefits Of Health Information Technology: A Review Of The Recent Literature Shows Predominantly Positive Results

ABSTRACT An unprecedented federal effort is under way to boost the adoption of electronic health records and spur innovation in health care delivery. We reviewed the recent literature on health information technology to determine its effect on outcomes, including quality, efficiency, and provider satisfaction. We found that 92 percent of the newest articles on health information technology reported conclusions that were positive overall. We also found that the benefits of this technology are beginning to emerge in smaller practices and organizations, as well as in large organizations that were early adopters. However, dissatisfaction with electronic health records among some providers remains a problem and a barrier to achieving the potential of health information technology. These realities highlight the need for studies that document the challenging aspects of implementing health information technology more specifically and how those challenges might be addressed.

Case report

Early cost and safety benefits of an inpatient electronic health record

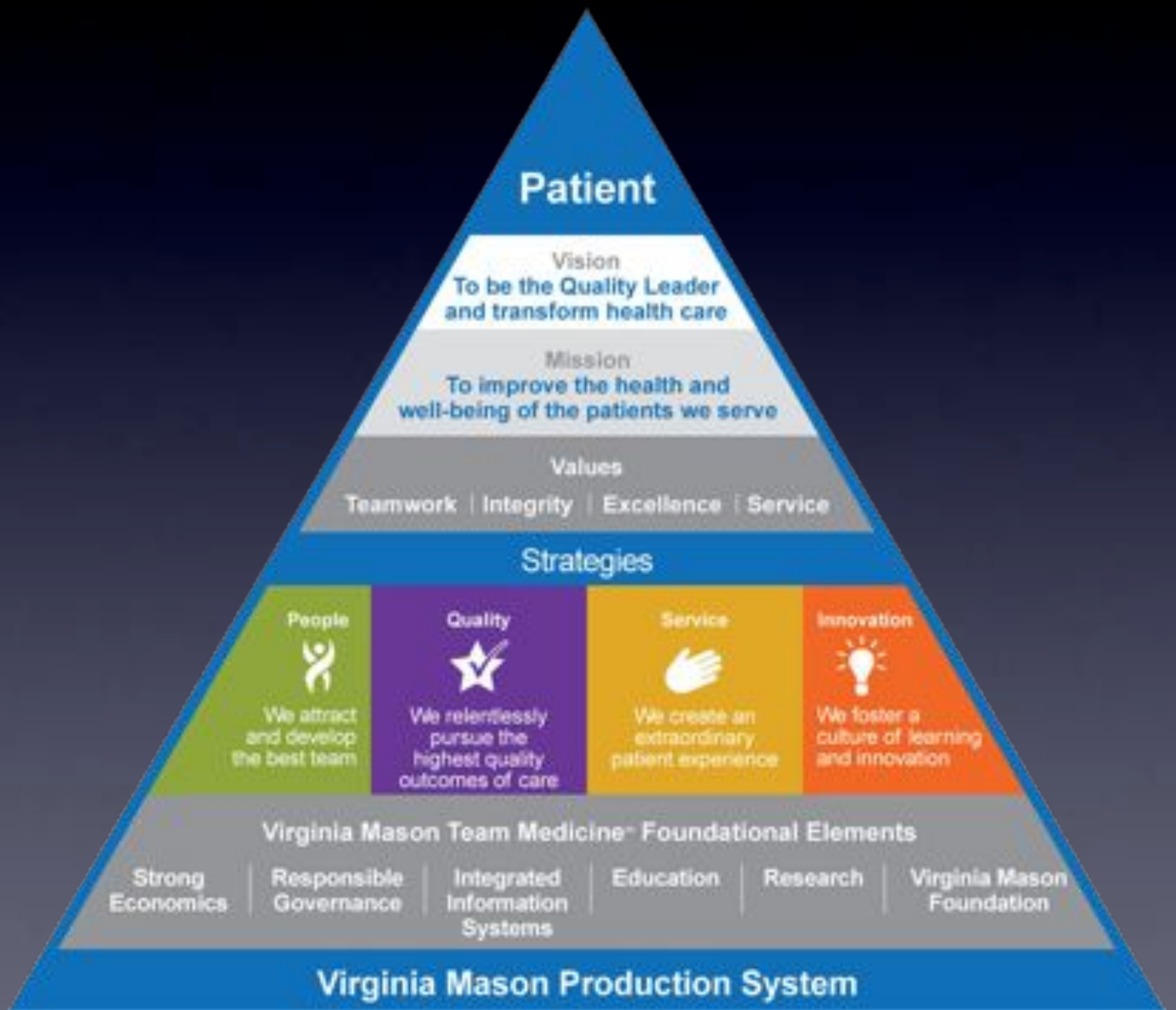
Jonathan A Zabek,[1] Jared W Wickus,[2] Michelle A Mathiason[3]

ABSTRACT

There is controversy over the impact of electronic health record (EHR) systems on cost of care and safety. The authors studied the effects of an inpatient EHR system with computerized provider order entry on selected measures of cost of care and safety. Laboratory tests per week per hospitalization decreased from 13.8 to 11.4 (18%, p<0.001). Radiology examinations per hospitalization decreased from 2.06 to 1.93 (6.3%, p=0.009). Monthly transcription costs declined from $74 106 to $70 656 (14.6%, p<0.001). Reams of copy paper ordered per month decreased from 1668 to 1229 (26.8%, p<0.001). Medication errors per 1000 hospital days decreased from 17.9 to 15.4 (14.0%, p<0.000), while near misses per 1000 hospital days increased from 9.0 to 12.5 (38.9%, p<0.037), and the percentage of medication events that were medication errors decreased from 68.2% to 55.2% (p<0.002). In this manuscript, we demonstrate that the implementation of an inpatient EHR with computerized provider order entry can result in rapid improvement in measures of cost of care and safety.

Friday, April 15, 2011

Using Health Information Technology to Ensure Quality and Safety



Patient

Vision

To be the Quality Leader and transform health care

Mission

To improve the health and well-being of the patients we serve

...le relentlessly pursue the ...ighest quality ...tcomes of care

We create an extraordinary patient experience

We foster a culture of le... and innovati...

...n Team Medicine Foundational Elements

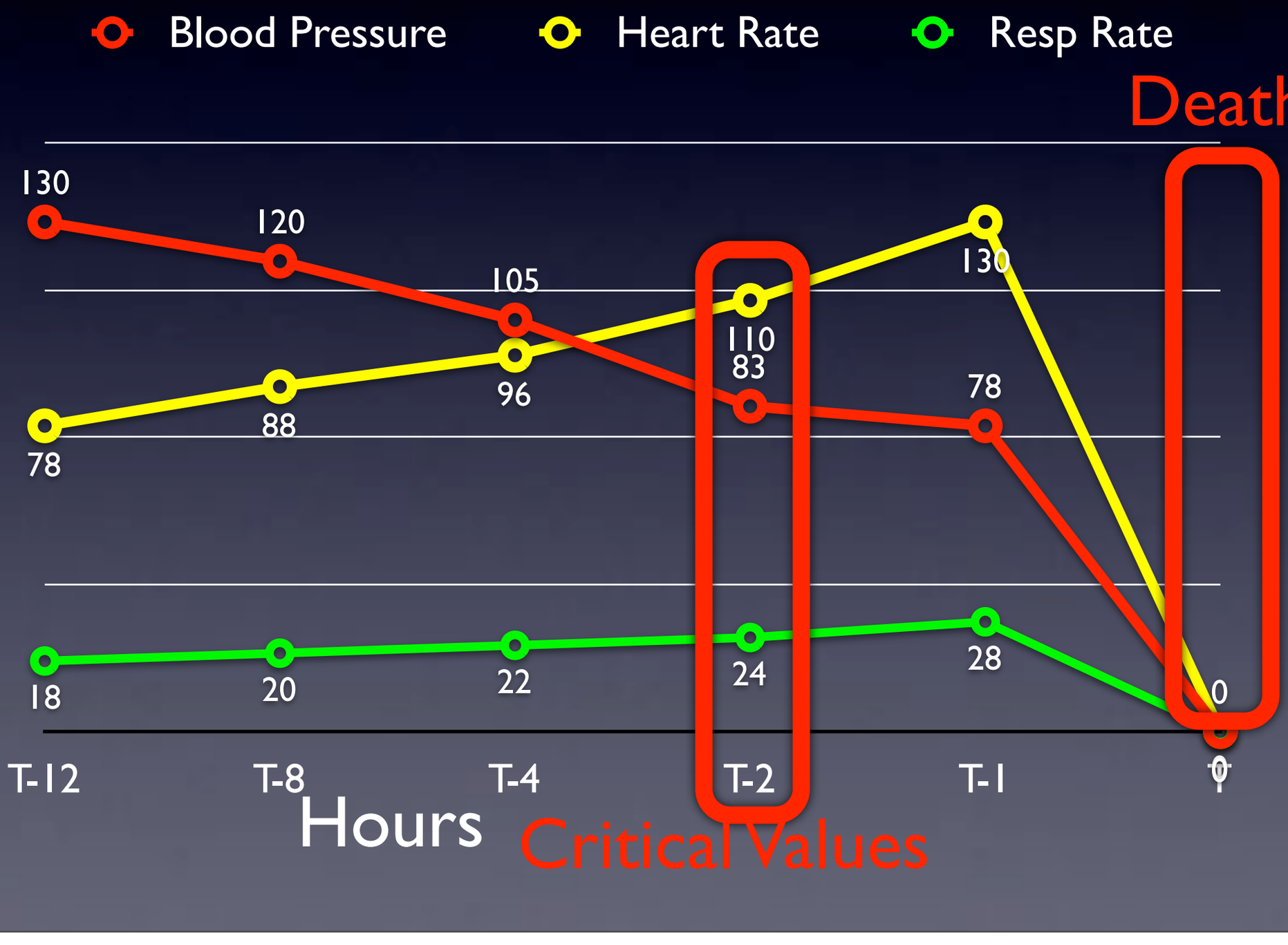
Integrated Information Systems

Education

Research

...a Mason Production System

Preventing Potentially Avoidable Deaths



Sepsis


sEPSIS
Sept. 9th 2006
@ The Drifter Lounge
Sepsis w/special guest
music starts at 9:30 pm


Sepsis
Severe Sepsis
SIRS with a
pneumonia or
confirmed
infection
Sepsis with ≥1 sign of
organ failure
– Cardiovascular
(refractory hypotension)
– Renal
– Respiratory
– Hepatic
– Hematologic
– CNS
– Unexplained metabolic
acidosis
Septic
Shock

Society of Critical Care Medicine

The Intensive Care Professionals

- 750,000 cases per year
- 200,000 deaths per year

Rapid Response Team

- SBP<90
- HR>130
- RR>24
- SaO2<90%

3,000 Hospitals

Fire Station Model

Institute of Medicine 1999

Reason for Failure?

There are 2 teams of players, one wearing white shirts and one wearing black shirts. Try to count the number of times the team wearing white passes the ball.

Reason for Failure?

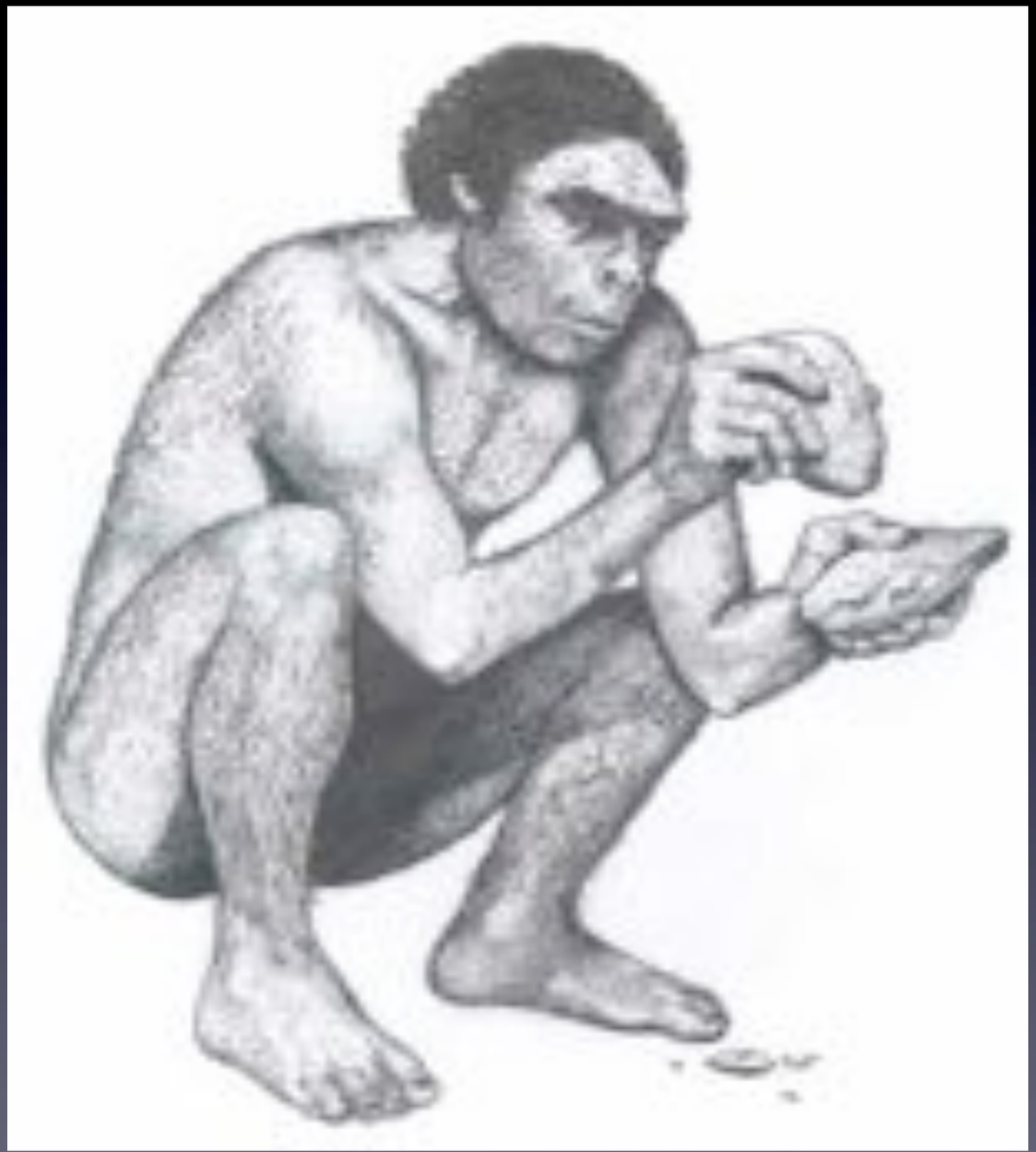
There are 2 teams of players, one wearing white shirts and one wearing black shirts. Try to count the number of times the team wearing white passes the ball.

Fire Station Model

Air Traffic Control Surveillance Model

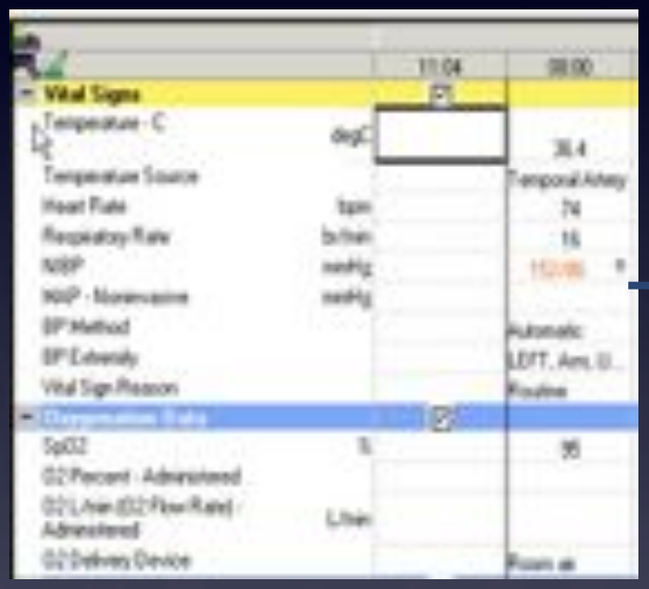
Friday, April 15, 2011

Cerner Command Language- CCL

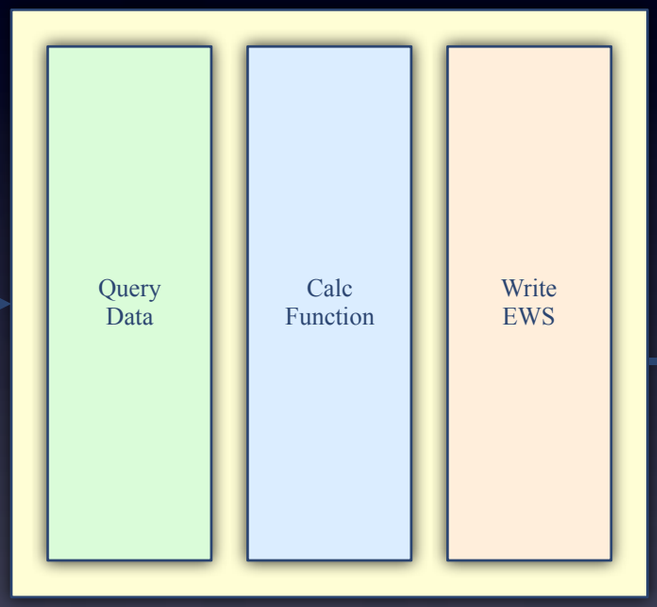


MPages

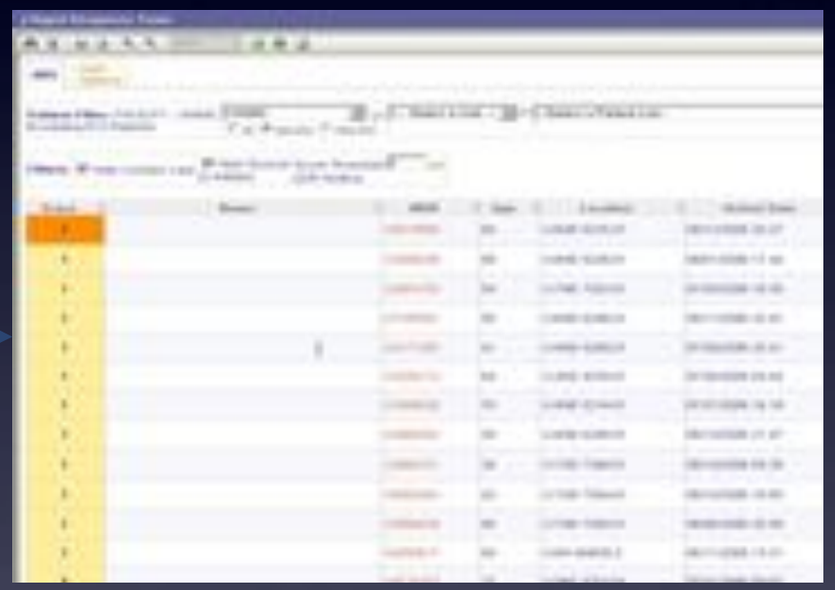
RN Charts Routine Data



CCL Script – runs every 5 minutes



Discern Desktop – CCL Script

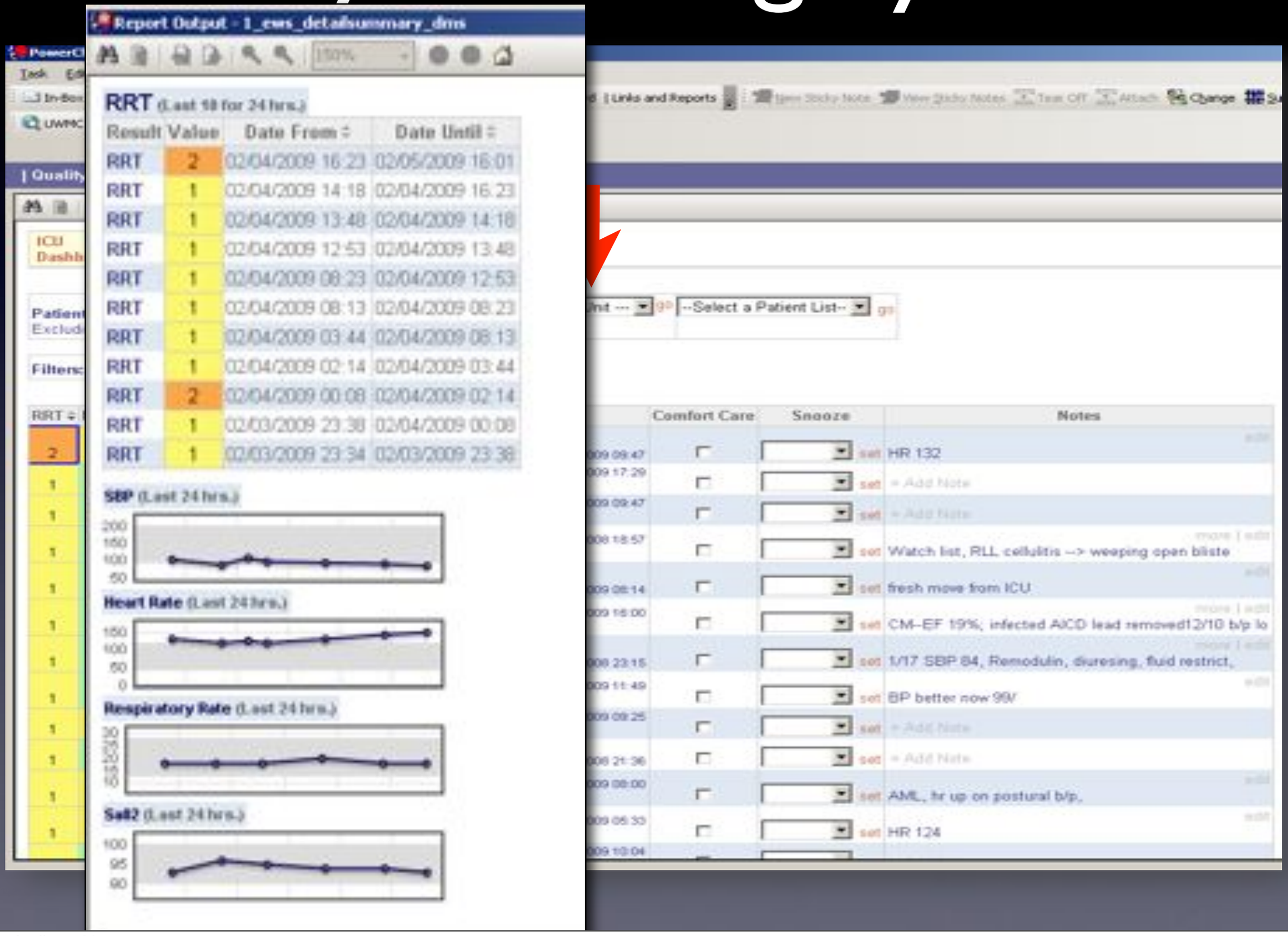


Clinical Data

CCL Script

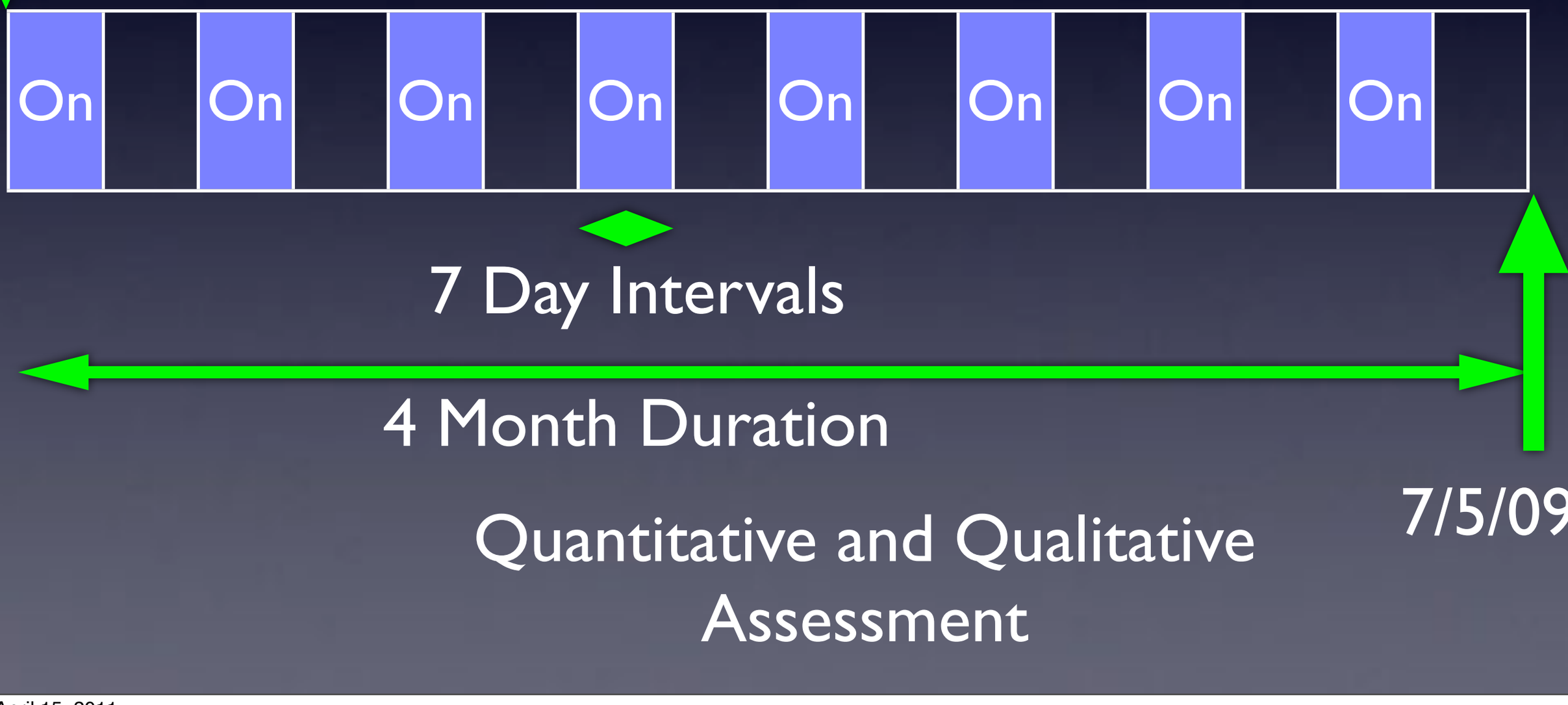
Web Page

Early Warning System



Single Blind Randomized Controlled Interrupted Time Series Trial

Feb 9, 2009



Clinical Outcomes

- Potentially avoidable death rate
- Cardiopulmonary arrest rate outside ICU
- Unexpected transfer to ICU rate
- RRT Activation Rate

EWS Results

	On	Off	p
Codes	21	12	0.3
RRT Activations	509	403	0.007
Deaths	34	31	0.51
Transfer to ICU	330	247	0.005

iPhone


AT&T
1:25 PM
ORCA
ART + MEWS
Encounter Info
Notes
2
8
2
6.53
1
5.34
1
6.03
1
7.29
1
8.91
1
6.66
1
4.58
1
6.3
1
6.6
1
2.82

Safety

Quality

What is Quality?

Medicare.gov - Hospital Compare Home - Hospital Results -

Hospital Profile

« Return to Provider Page

Process of Care Measures

Outcome of Care Measures

Use of Medical Imaging

Survey of Patients' Hospital Experiences

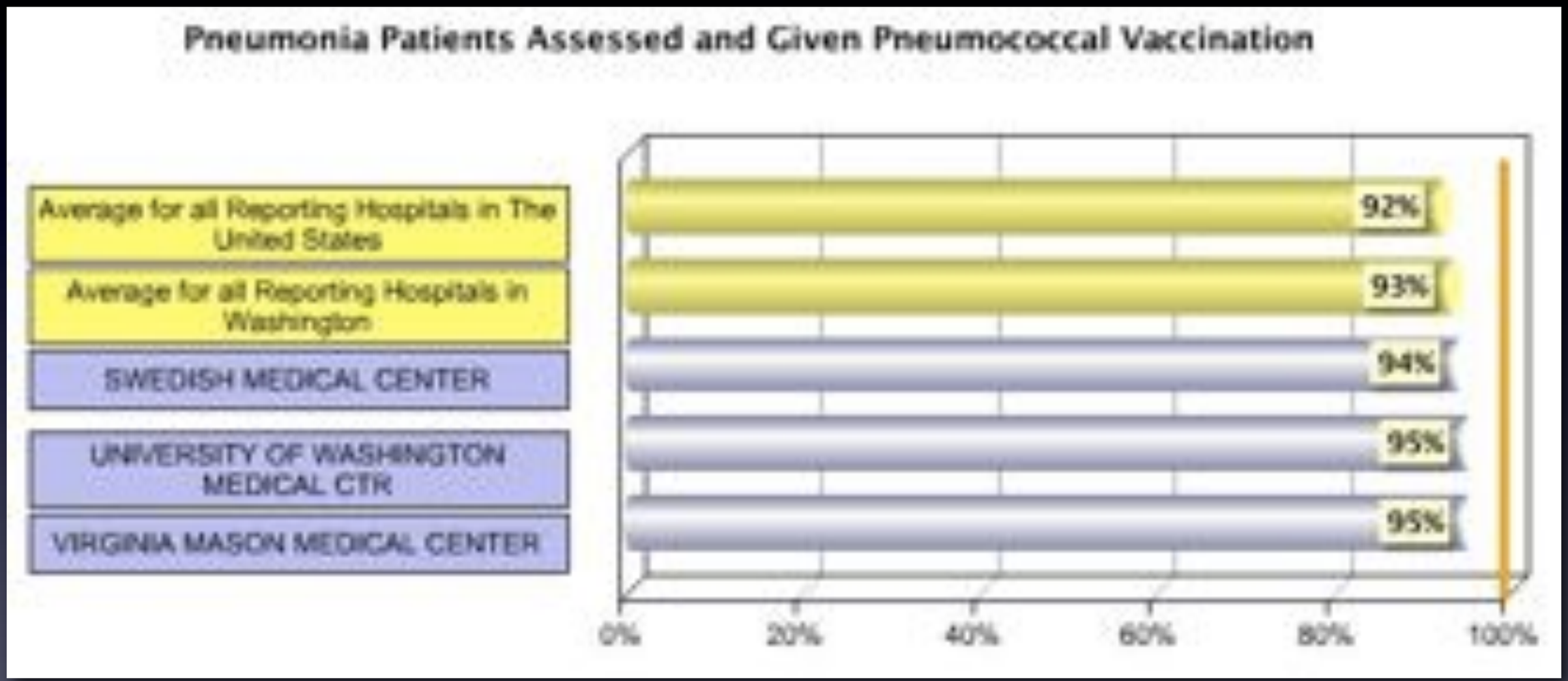
VIRGINIA MASON MEDICAL

VIRGINIA MASON MEDICAL CENTER
925 SENECA STREET
SEATTLE, WA 98101
(206) 223-6600
Type of Hospital: Acute Care
Provides Emergency Services: Yes
Participates in:
Cardiac Surgery Registry
Stroke Care Registry
Nursing Care Registry

Clinical Areas

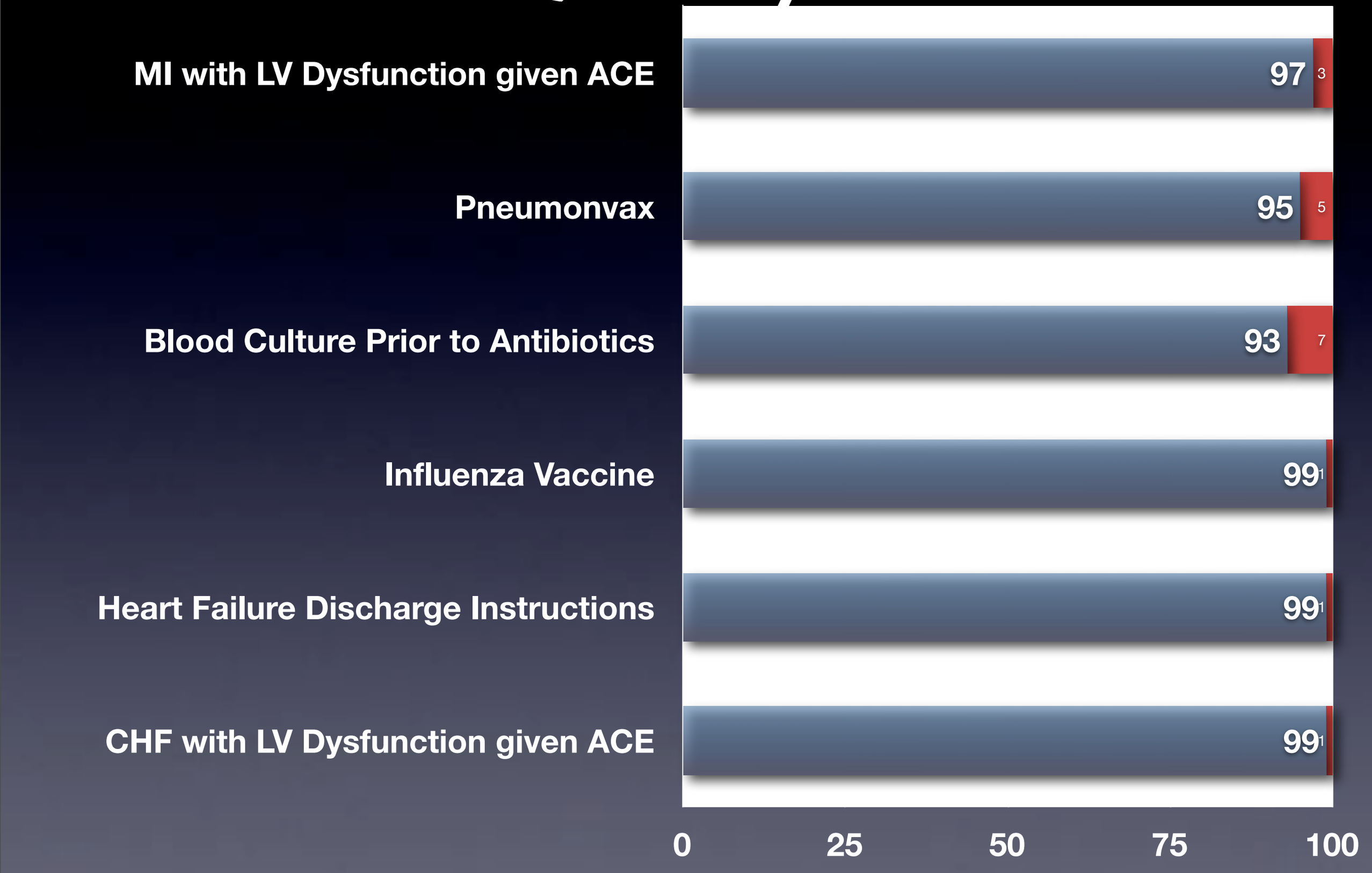
Outcomes of Care

Processes of Care



Also see whynotthebest.org

VM Quality Now



So what's good enough?

Imagine 96% quality at VM…

600 defective surgeries/year

501 defective transfusions/year

40,000 defective medication administrations/year

10,800 wrong meals served/year

68,000 defective bills sent/year

5,000 defective paychecks/year

Slide Courtesy of Virginia Mason Institute

So what's good enough?

Imagine 99.9% quality at VM…

15 defective surgeries/year

17 defective transfusions/year

1,000 defective medication administrations/year

182 wrong meals served/year

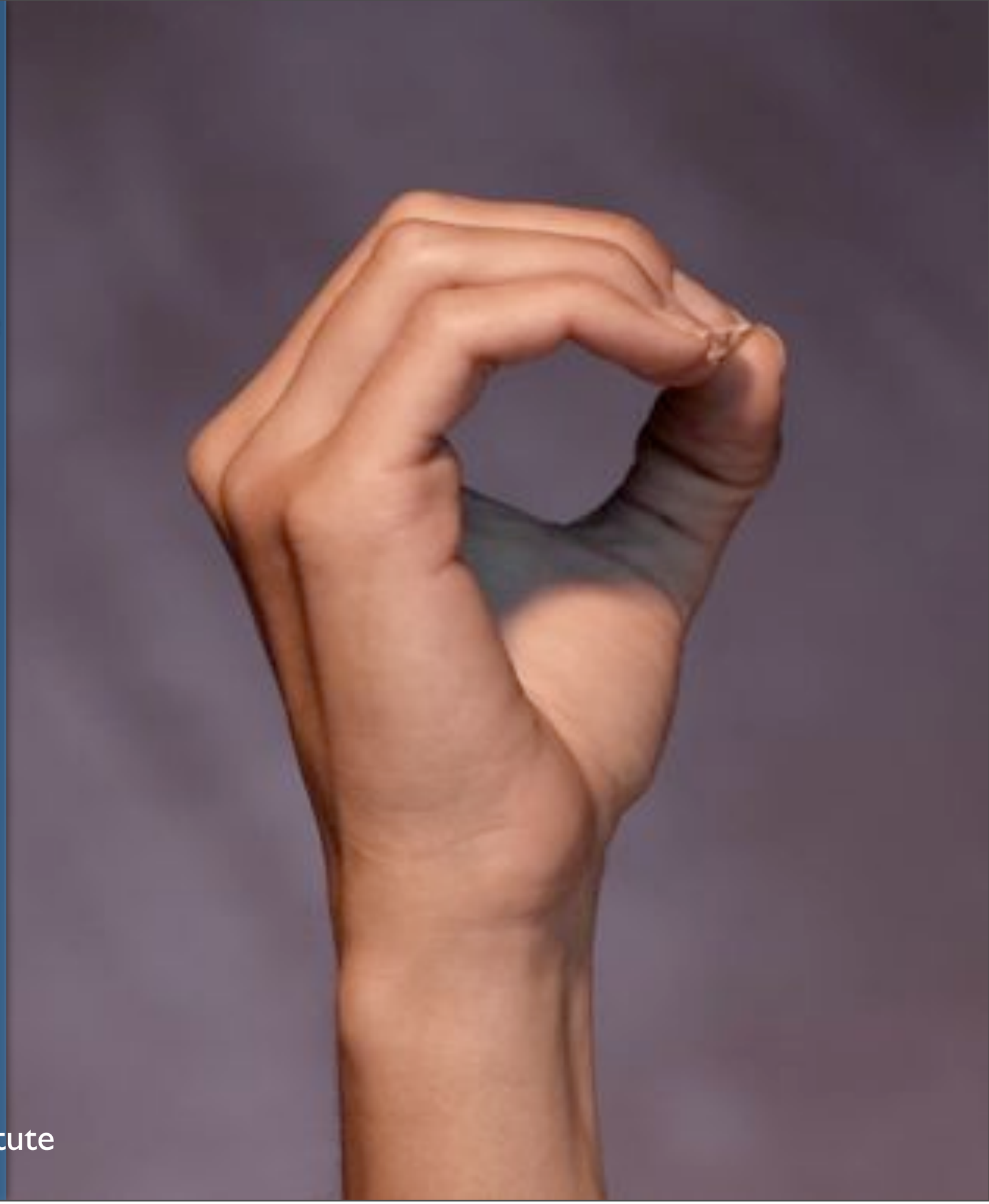
17,000 defective bills sent/year

125 defective paychecks/year

Slide Courtesy of Virginia Mason Institute

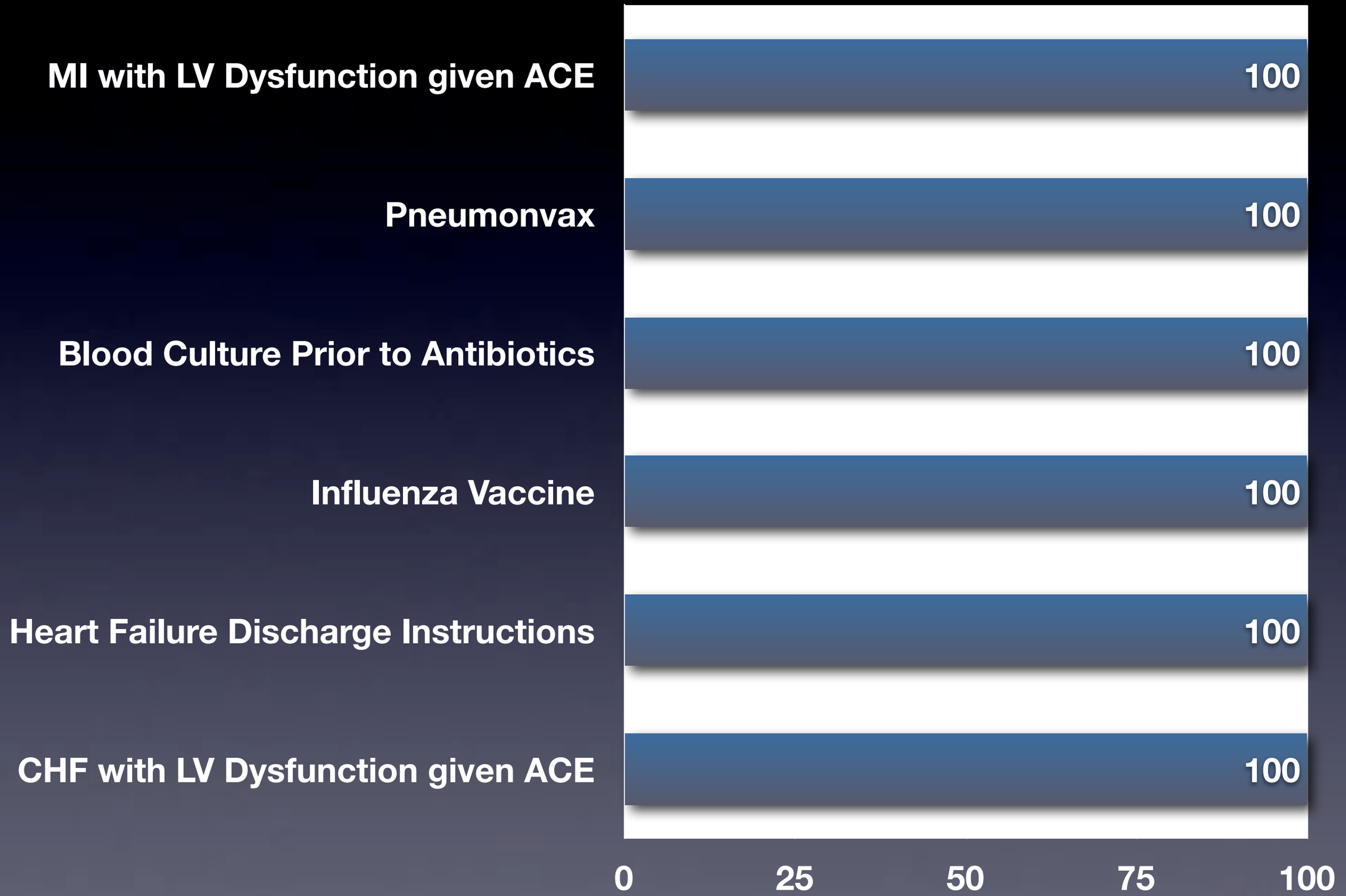
Defects are mistakes that go uncorrected

The purpose of VMPS is to ensure zero defects



Slide Courtesy of Virginia Mason Institute

Quality Goal



ORIGINAL INVESTIGATION

Improving Outcomes in Elderly Patients With Community-Acquired Pneumonia by Adhering to National Guidelines

Community-Acquired Pneumonia Organization International Cohort Study Results

Forest W. Arnold, DO; A. Scott LaJoie, PhD; Guy N. Brock, PhD; Paula Peyrani, MD; Jordi Rello, MD; Rosario Menéndez, MD; Gustavo Lopardo, MD; Antoni Torres, MD; Paolo Rossi, MD; Julio A. Ramirez, MD; for the Community-Acquired Pneumonia Organization (CAPO) Investigators

Background: To define whether elderly patients hospitalized with community-acquired pneumonia (CAP) had better outcomes if they were treated with empirical antimicrobial therapy adherent to the 2007 Infectious Diseases Society of America (IDSA)/American Thoracic Society (ATS) guidelines for CAP.

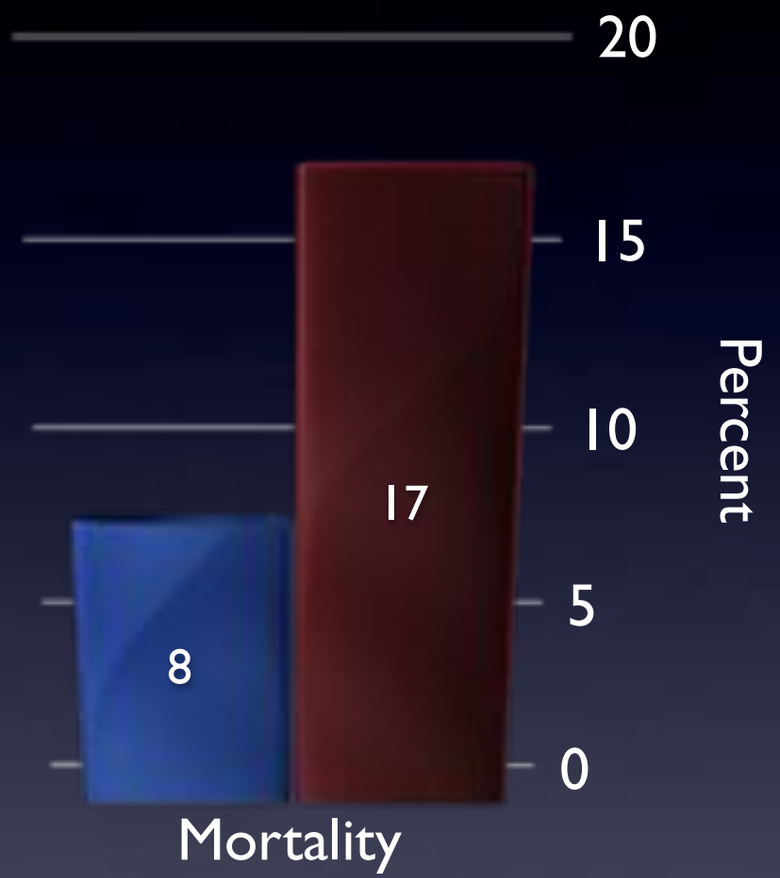
Methods: This was a secondary analysis of the CAPO International Cohort Study database, which contained data from a total of 1725 patients aged 65 years or older who were hospitalized with CAP. Data from June 1, 2001, until January 1, 2007, were analyzed from 43 centers in 12 countries including North America (n=2), South America (n=4), Europe (n=4), Africa (n=1), and Southeast Asia (n=1). Initial empirical therapy for CAP was evaluated for guideline compliance according to the 2007 IDSA/ATS guidelines for CAP. Time to clinical stability, length of stay (LOS), total in-hospital mortality, and CAP-related mortality for each group were calculated. Comparisons between groups were made using cumulative incidence curves and competing risks regression.

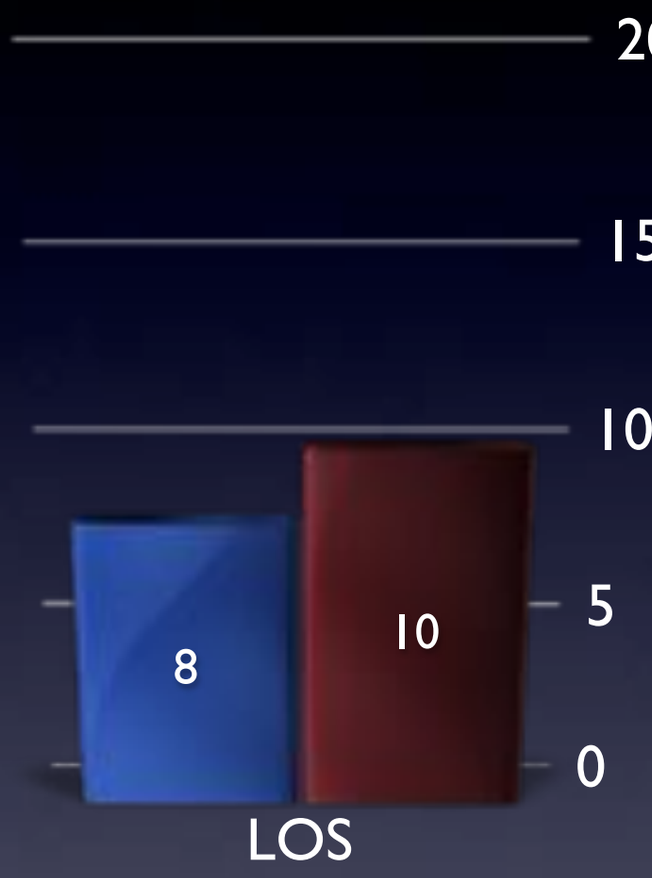
Results: Among the 1649 patients with CAP, aged 65 years or older, 975 patients were given antimicrobial regimens adherent to the IDSA/ATS for CAP guidelines, while 660 patients were treated with nonadherent regimens (465 patients were "undertreated"; 195 were "overtreated"). Adherence to guidelines was associated with a statistically significant decreased time to achieve clinical stability compared with nonadherence: the proportion of patients who reached clinical stability by 7 days was 71% (95% confidence interval [CI], 68%-74%) and 57% (95% CI, 53%-61%) ($P<.01$), respectively. Guideline adherence was also associated with shorter LOS (median adherence LOS, 8 days; interquartile range [IQR], 5-15 days; median nonadherence LOS, 10 days; IQR, 6-24 days) ($P<.01$) and decreased overall in-hospital mortality (8%; 95% CI, 7%-10% vs 17%; 95% CI, 14%-20%) ($P<.01$).

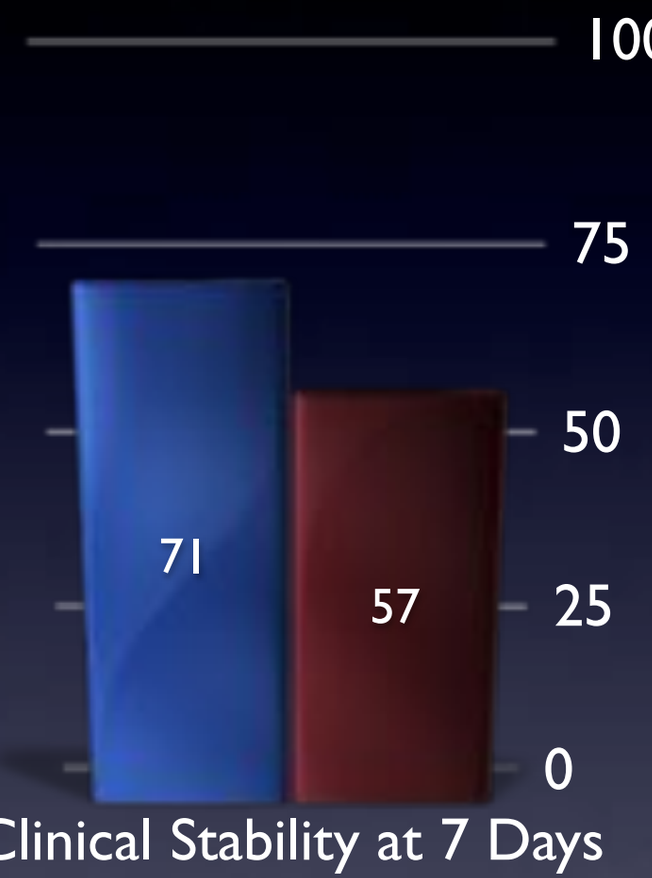
Conclusion: Implementation of national guidelines at the local hospital level will improve not only mortality and LOS of elderly patients hospitalized with CAP but also time to clinical stability.

Arch Intern Med. 2009;169(16):1515-1524

Guideline Adherence





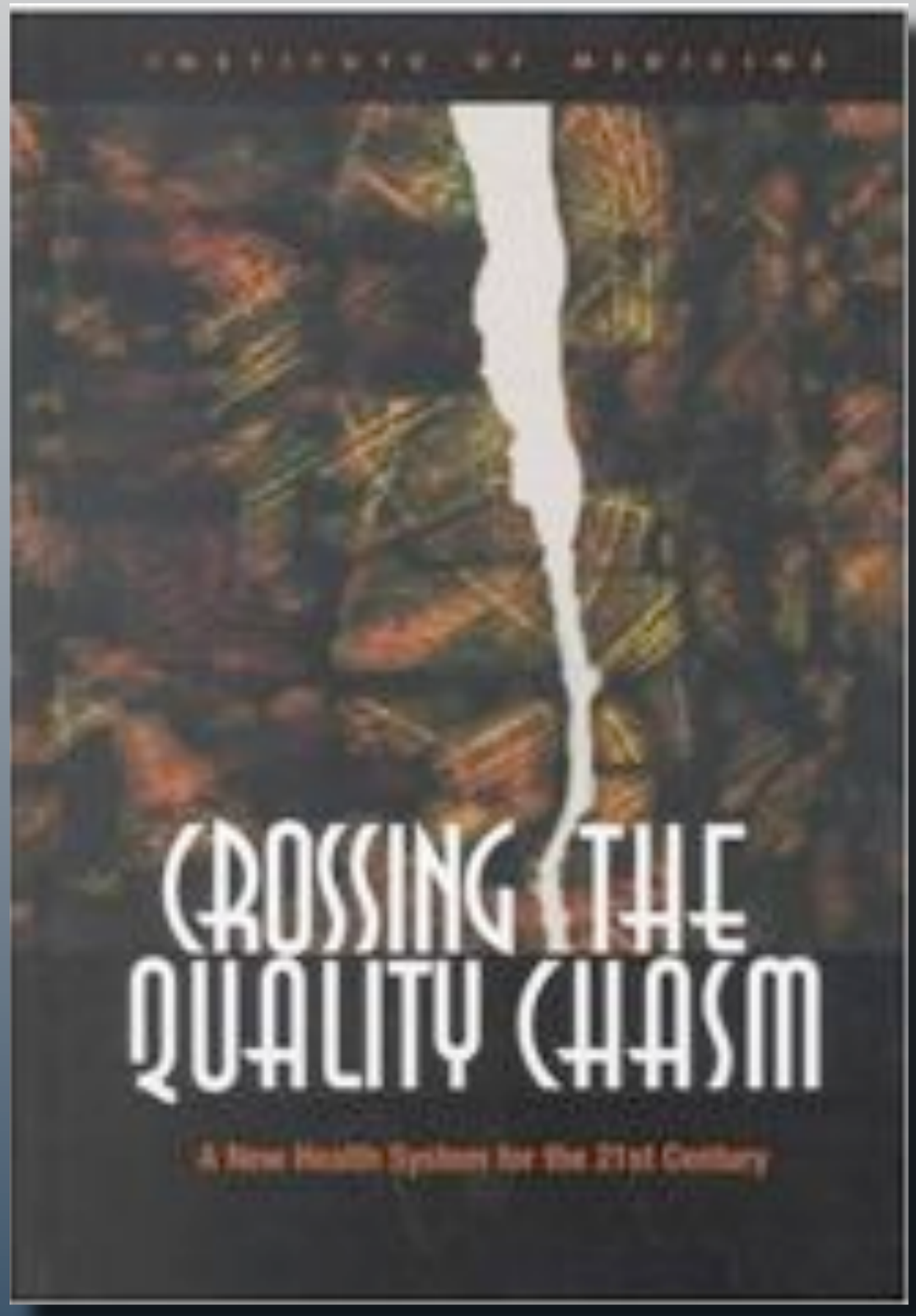


Compliant

Non-Compliant

Rate Hospitals with 1-5 Stars Based on Quality

"If all hospitals performed at the level of a 5-star rated hospital ... 20,688 Medicare deaths could have been avoided while saving the US nearly $1.8 billion from 2007 through 2009."



2001

"... information technology must play a central role in the redesign of the health care system if a substantial improvement in quality is to be achieved over the coming decade."

"... the elimination of most handwritten clinical data by the end of the decade."

Clinical Information Technologies and Inpatient Outcomes

A Multiple Hospital Study

Ruben Amarasingham, MD, MBA; Laura Plantinga, ScM; Marie Diener-West, PhD; Darrell J. Gaskin, PhD; Neil R. Powe, MD, MPH, MBA

Background: Despite speculation that clinical information technologies will improve clinical and financial outcomes, few studies have examined this relationship in a large number of hospitals.

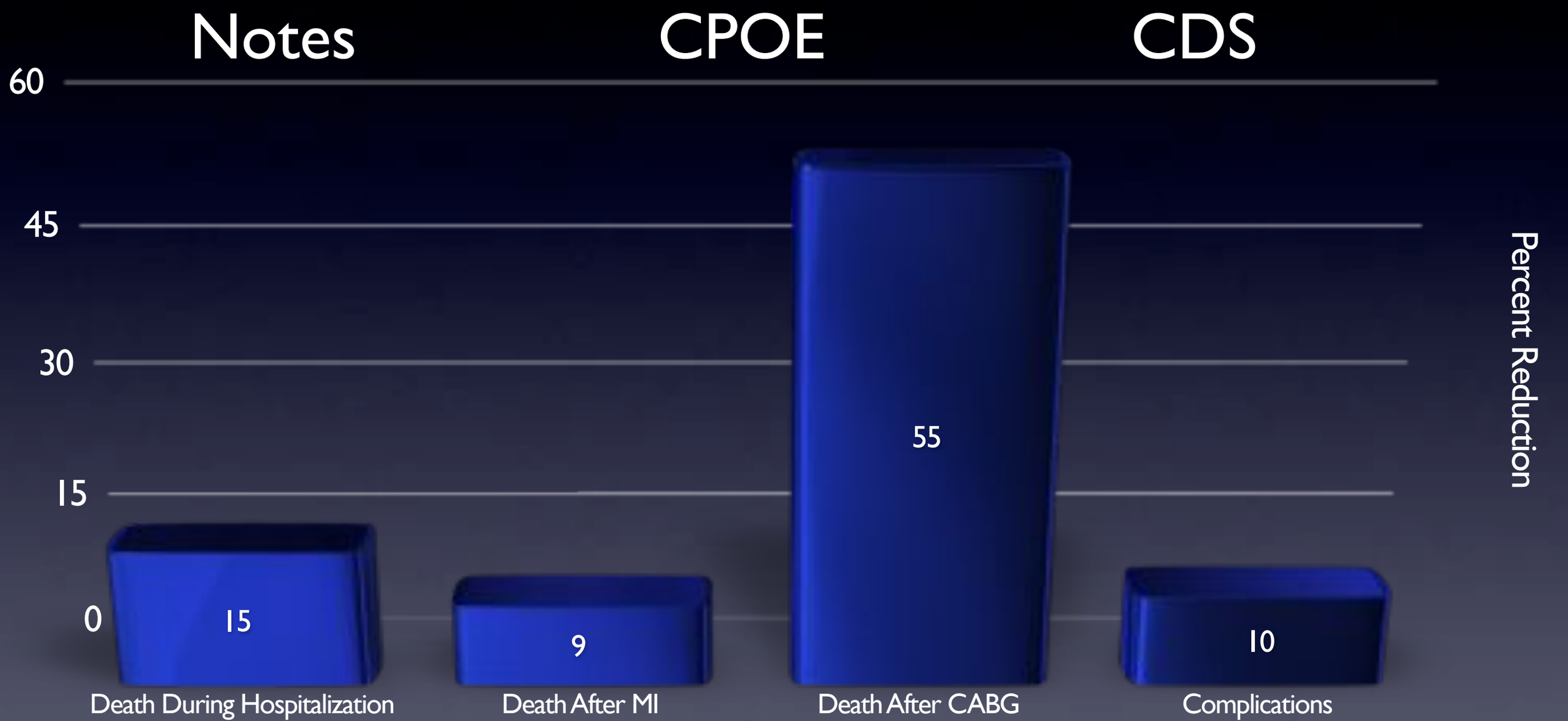
Methods: We conducted a cross-sectional study of urban hospitals in Texas using the Clinical Information Technology Assessment Tool, which measures a hospital's level of automation based on physician interactions with the information system. After adjustment for potential confounders, we examined whether greater automation of hospital information was associated with reduced rates of inpatient mortality, complications, costs, and length of stay for 167 233 patients older than 50 years admitted to responding hospitals between December 1, 2005, and May 30, 2006.

Results: We received a sufficient number of responses from 41 of 72 hospitals (58%). For all medical conditions studied, a 10-point increase in the automation of notes and records was associated with a 15% decrease in the adjusted odds of fatal hospitalizations (0.85; 95% confidence interval, 0.74-0.97). Higher scores in order entry were associated with 9% and 55% decreases in the adjusted odds of death for myocardial infarction and coronary artery bypass graft procedures, respectively. For all causes of hospitalization, higher scores in decision support were associated with a 16% decrease in the adjusted odds of complications (0.84; 95% confidence interval, 0.79-0.90). Higher scores on test results, order entry, and decision support were associated with lower costs for all hospital admissions (−$110, −$132, and −$538, respectively; $P < .05$).

Conclusion: Hospitals with automated notes and records, order entry, and clinical decision support had fewer complications, lower mortality rates, and lower costs.

Arch Intern Med. 2009;169(2):108-114

IT and Inpatient Outcomes



Survey of 41 Hospitals in Texas

Critical HIT Components Needed to Ensure Quality

- Computer System
- Discrete Data
- Right Software/Programing
- Realtime Provider Feedback
- Group (Team) Situational Awareness

Critical HIT Components Needed to Ensure Quality

- Computer System
- Discrete Data
- Right Software/Programing
- Realtime Provider Feedback
- Group Situational Awareness

VM Record Storage in Georgetown

UW Record Storage Sand Point Naval Hanger

Server Cabinet

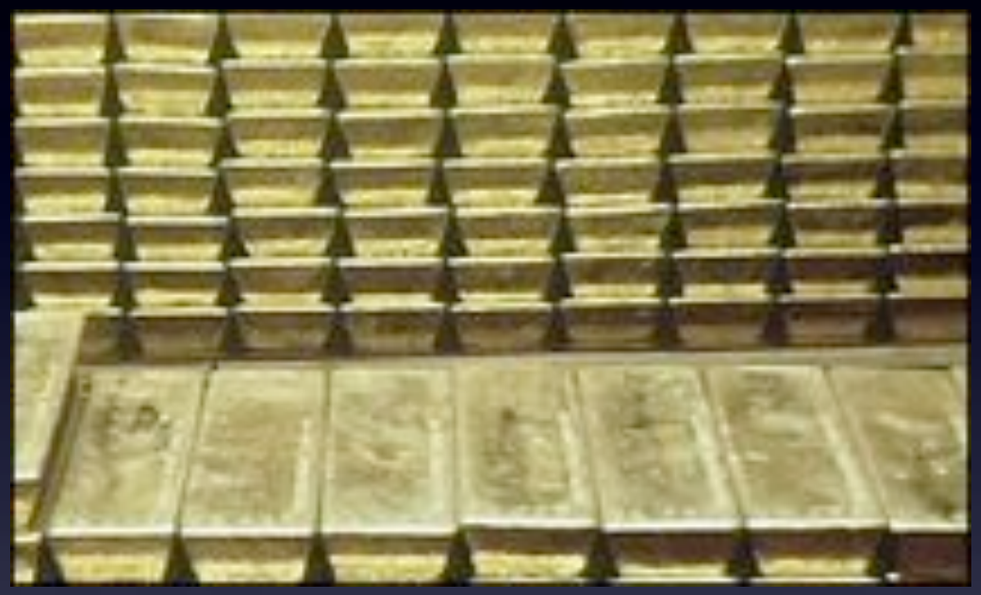
$40M of Computer Equipment

30 Terabytes of Disk

7,500,000 Songs or 60 Years of Listening!

Tape Backup

Electronic Health Record



American Hospital Assn. study, "Continued Progress: Hospital Use of Information Technology," Feb. 27, 2007

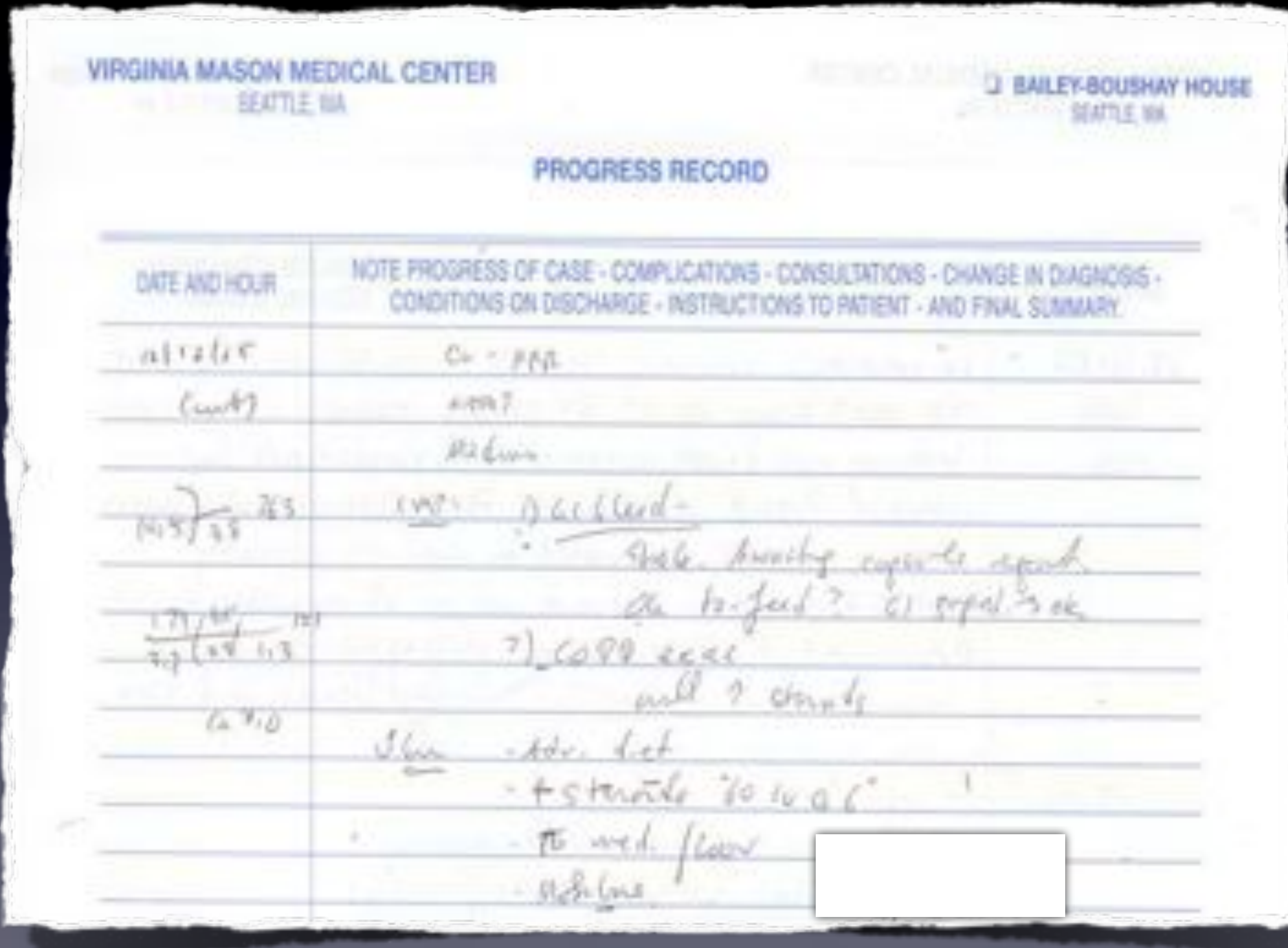
- $17,616 per bed in 2006
  - $12,060 for operating costs
  - $5,556 for capital costs
- 400 Bed Hosp-> $10 Million

Critical HIT Components Needed to Ensure Quality

✓ Computer System

- Discrete Data
- Right Software/Programing
- Realtime Provider Feedback
- Group Situational Awareness

Handwritten Note



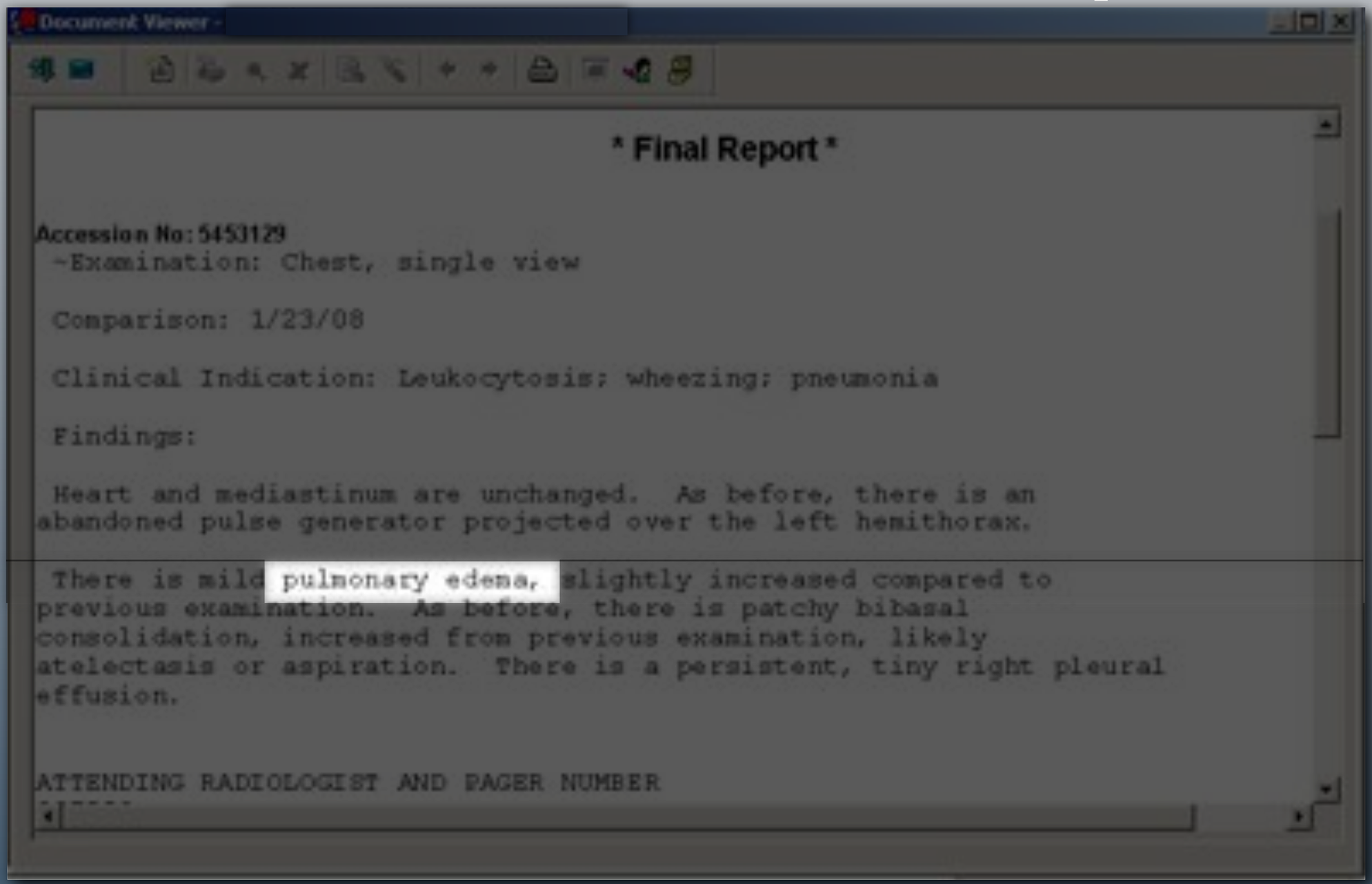
VIRGINIA MASON MEDICAL CENTER
SEATTLE, WA

☐ BAILEY-BOUSHAY HOUSE
SEATTLE, WA

PROGRESS RECORD

DATE AND HOUR	NOTE PROGRESS OF CASE - COMPLICATIONS - CONSULTATIONS - CHANGE IN DIAGNOSIS - CONDITIONS ON DISCHARGE - INSTRUCTIONS TO PATIENT - AND FINAL SUMMARY

Free Text Rads Report



Clinical Notes, Pathology Reports

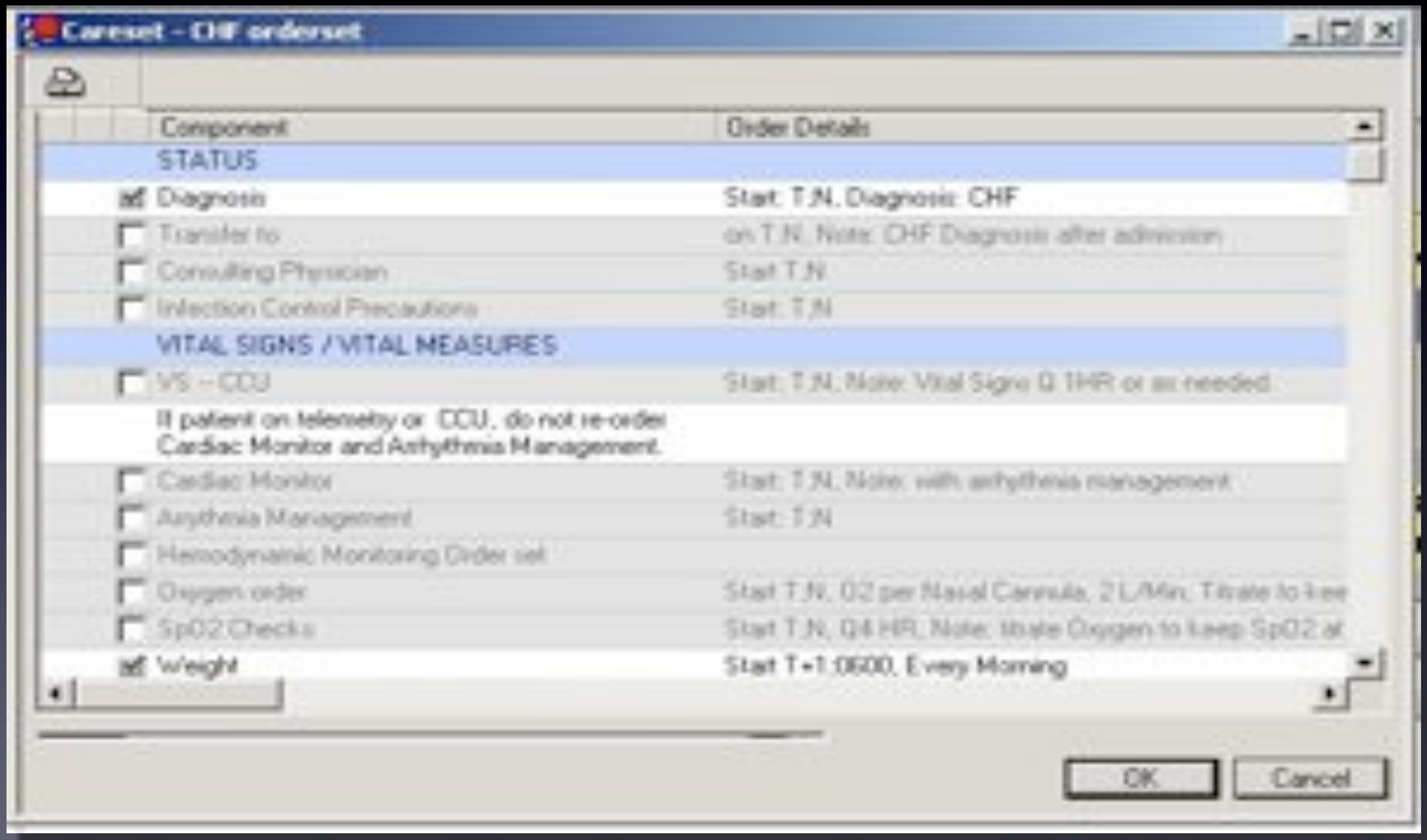
Discrete Data- Meds

MAR Summary 48H

09 August 2009 0700 - 13 August 2009 0659

Time View	08/09/2009 0700 - 0659	08/10/2009 0700 - 0659	08/11/2009 0700 - 0659	08/12/2009 0700 - 0659
Scheduled				
aspirin 325 mg, ec tablet, PO, Daily, NOW, Start: 08/10/09 15:18:00		Not Given: dcd per MD order @1626		
aspirin 325 mg, tab, PO, Daily With Breakfast, NOW, Start 08/10/09 20:26:00		325 mg @1807 325 mg @2030 Pain Intensity: 8 Pain Location: Head Frontal	325 mg @0800	@0800
docusate 200 mg, cap, PO, Daily, Routine, Start 08/10/09 14:41:00		200 mg @2100	200 mg @0900	@0900
docusate 100 mg, cap, PO, Q12 HR, Routine, Start: 08/10/09 21:00:00				
lisinopril 10 mg, tab, PO, Daily, NOW, Start: 08/11/09 9:55:00			10 mg @0955	@0900
metoprolol (metoprolol oral tablet) 25 mg, tab, PO, Q12 HR, Routine, Start: 08/10/09 21:00:00		25 mg @1807 25 mg @2100 Systolic Blood Pressure: 143 mmHg Heart Rate: 60 bpm	25 mg @0900 Systolic Blood Pressure: 152 mmHg Heart Rate: 66 bpm 25 mg @2107	@0900 @2100
sodium chloride (saline lock flush-peripheral line) 2 mL, inj, IV, Q12 HR, Routine, Start 08/10/09 9:46:00, for 4 hr, Stop 08/10/09 9:46:00, Note: Flush every 12 hours -		2 mL @0946		
sodium chloride (saline lock flush-peripheral line) 2 mL, inj, IV, Q12 HR, Routine, Start 08/10/09 9:49:00,		2 mL @0949	Not Given: Not Appropriate at this Time @0900	@0900

Discrete Data- Orders

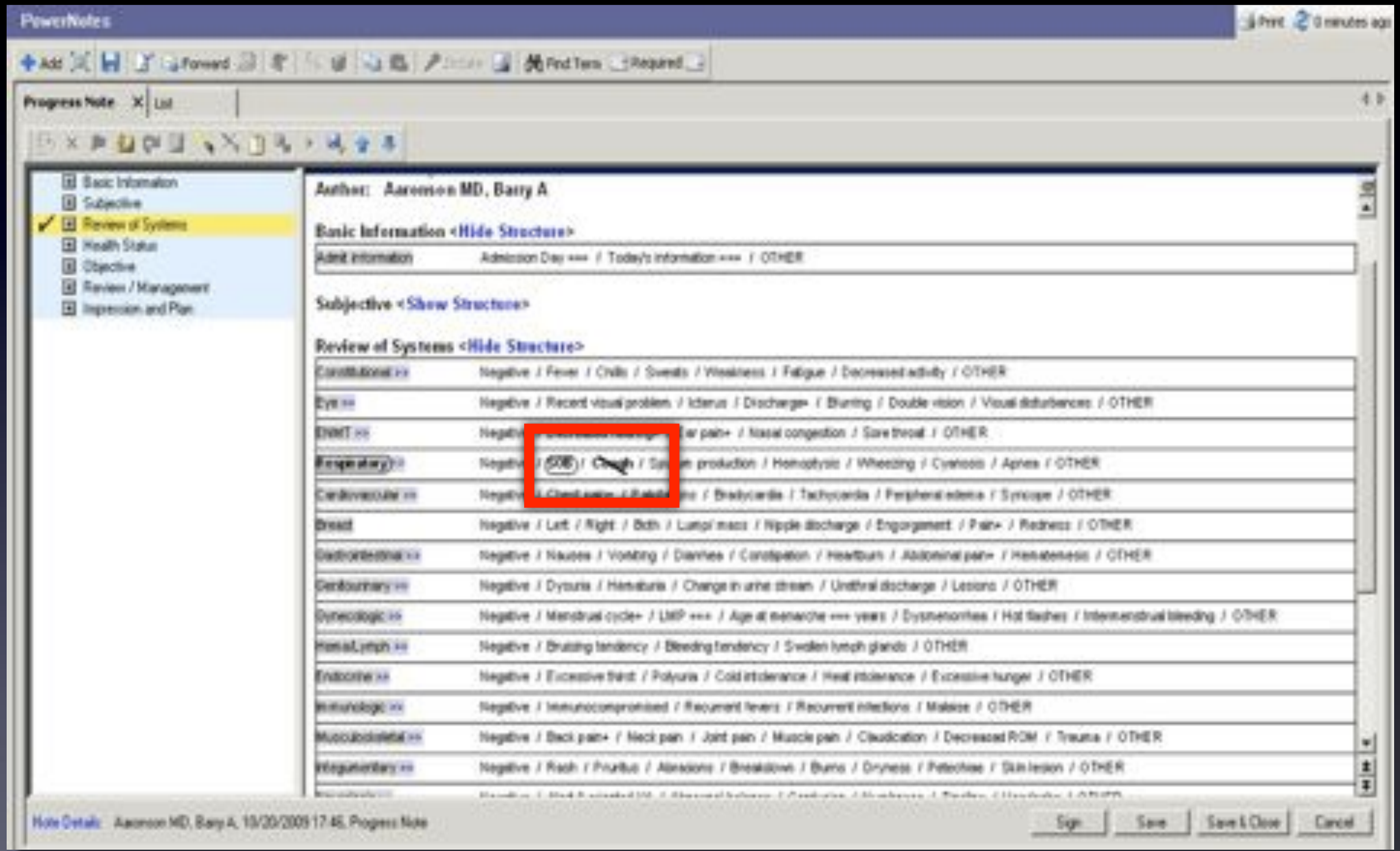


Discrete Data- Labs

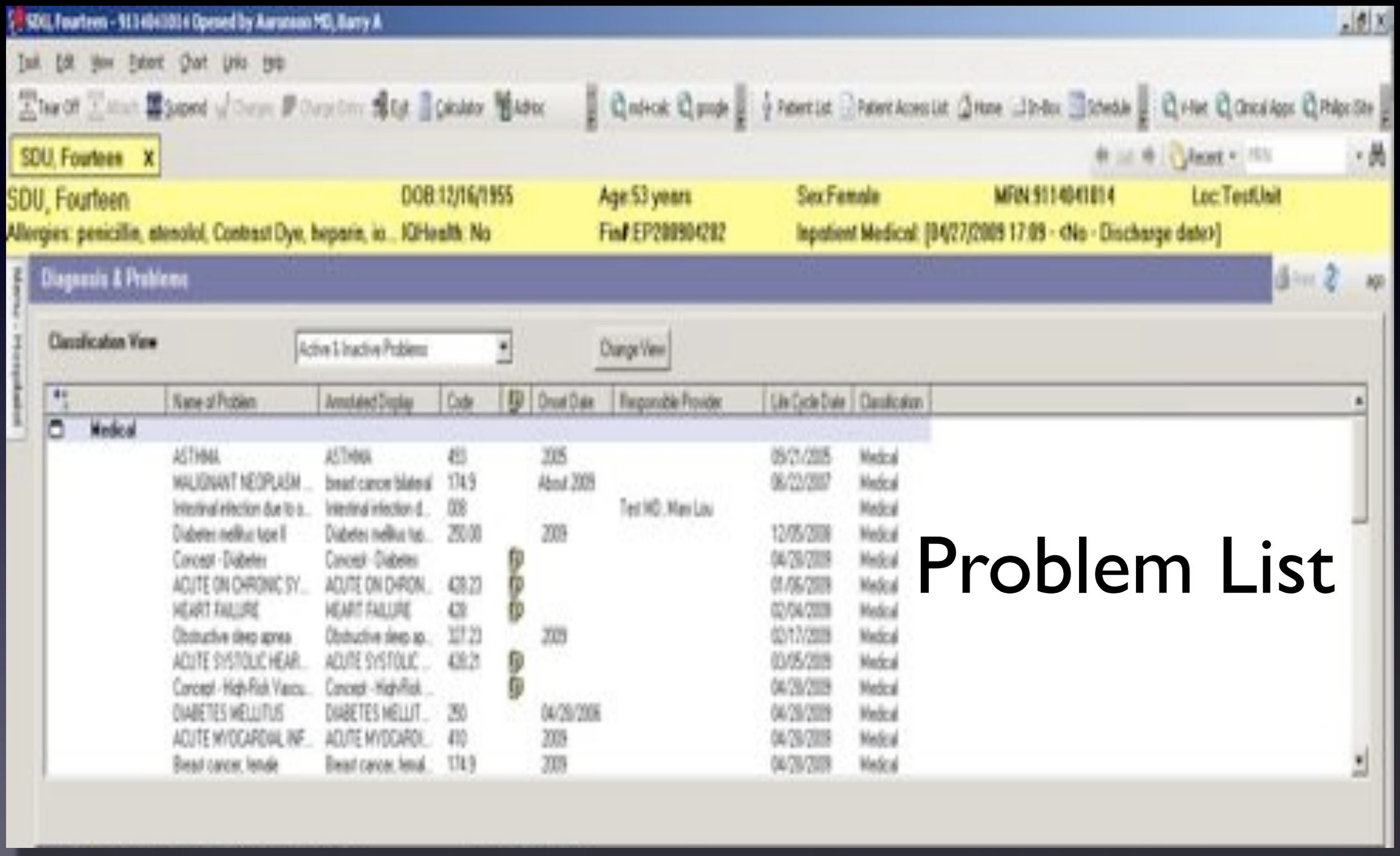
Lab and Rad Results	10/20/2009 6:10	10/15/2009 9:30	10/13/2009 8:50	10/13/2009 5:05	10/13/2009 5:00	10/18/2009 21:22	10/18/2009 10:00	10/18/2009 6:55	10/18/2009 5:01	10/18/20 4:55
Hemogram										
White Blood Cell Count	6.9 K/cmm				7.7 K/cmm					9.1 K/cmm
Red Blood Cell Count	L 3.52 M/cmm				L 3.32 M/cmm					L 3.08 M/cr
Hemoglobin	L 8.6 g/dL				L 8.0 g/dL					L 7.5 g/dL
Hematocrit	L 27 %				L 25 %		L 23 %			L 23 %
Mean Corpuscular Volume	L 76 fL				L 75 fL					L 76 fL
Mean Corpuscular HGB	L 24 pg				L 24 pg					L 24 pg
Mean Corpuscular HGB Concentrn	L 32 g/dL				L 32 g/dL					L 32 g/dL
RBC Distribution Width	H 19.5 %				H 18.5 %					H 19.0 %
Platelet Count	371 K/cmm				251 K/cmm					162 K/cmm
Reticulocyte Count										
Differential: Percent (Automated)										
Lymphocytes, Percent	25.4 %				19.7 %					
Monocytes, Percent	8.7 %				8.2 %					
Granulocytes, Percent	60.8 %				70.5 %					
Eosinophils, Percent	3.4 %				1.3 %					
Basophils, Percent	0.7 %				0.3 %					
Differential: Absolute Count (Automated)										
Lymphocytes, Absolute Count	1.8 K/cmm				1.5 K/cmm					
Monocytes, Absolute Count	0.6 K/cmm				0.6 K/cmm					
Granulocytes, Absolute Count	4.2 K/cmm				5.4 K/cmm					
Eosinophils, Absolute Count	0.2 K/cmm				0.1 K/cmm					
Basophils, Absolute Count	0.1 K/cmm				0.0 K/cmm					
Differential: Percent (Manual)										
Lymphocytes Percent										L 11 %
Monocytes Percent										L 1 %
Polymorphonuclear Leukocytes Percent										74 %
Bands Percent										H 12 %

Discrete Data- Forms

Discrete Data- Note



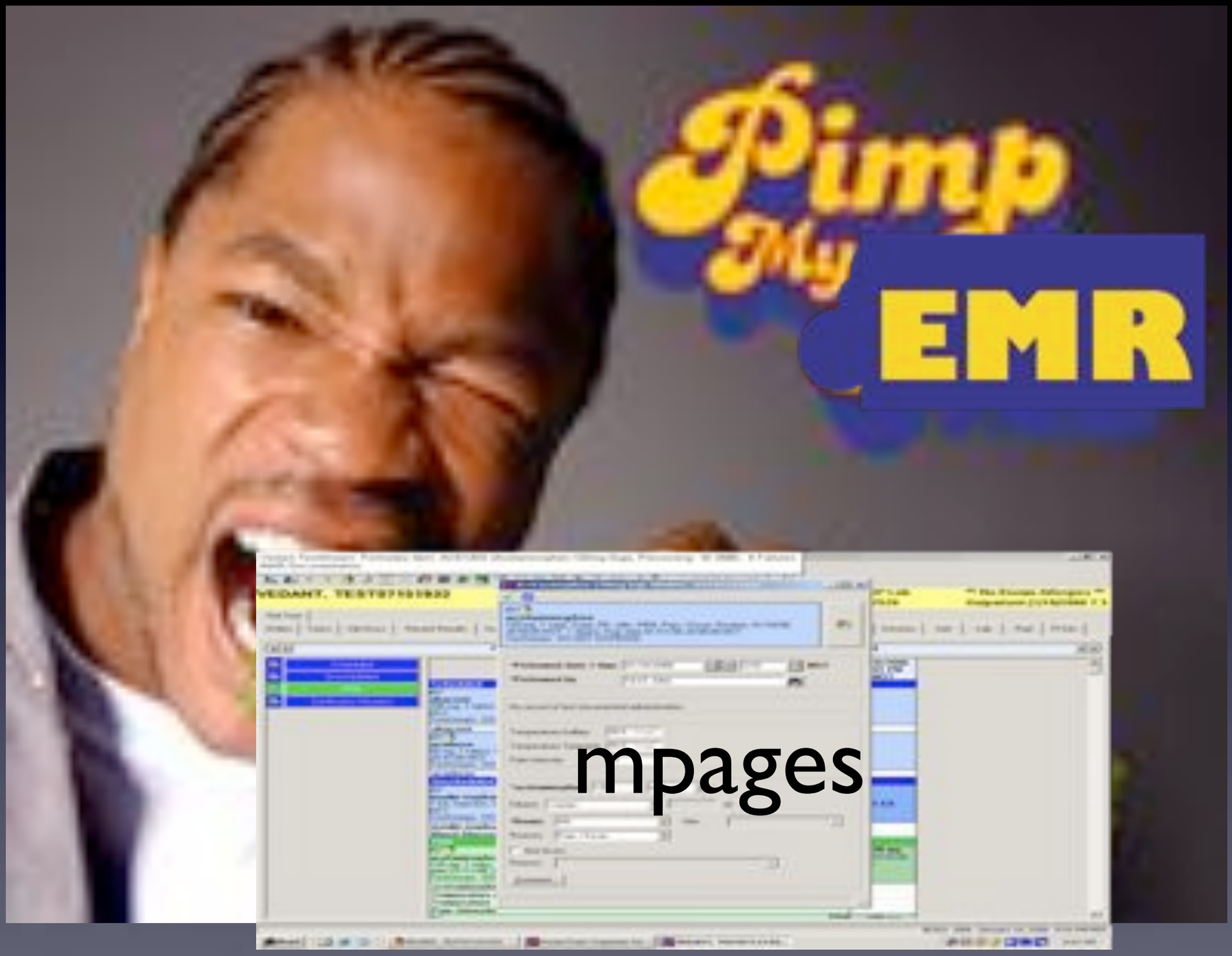
Discrete Data



Problem List

Critical HIT Components Needed to Ensure Quality

- ✓ Computer System
- ✓ Discrete Data
- Right Software/Programing
- Realtime Provider Feedback
- Group Situational Awareness


Pimp My
EMR
mpages

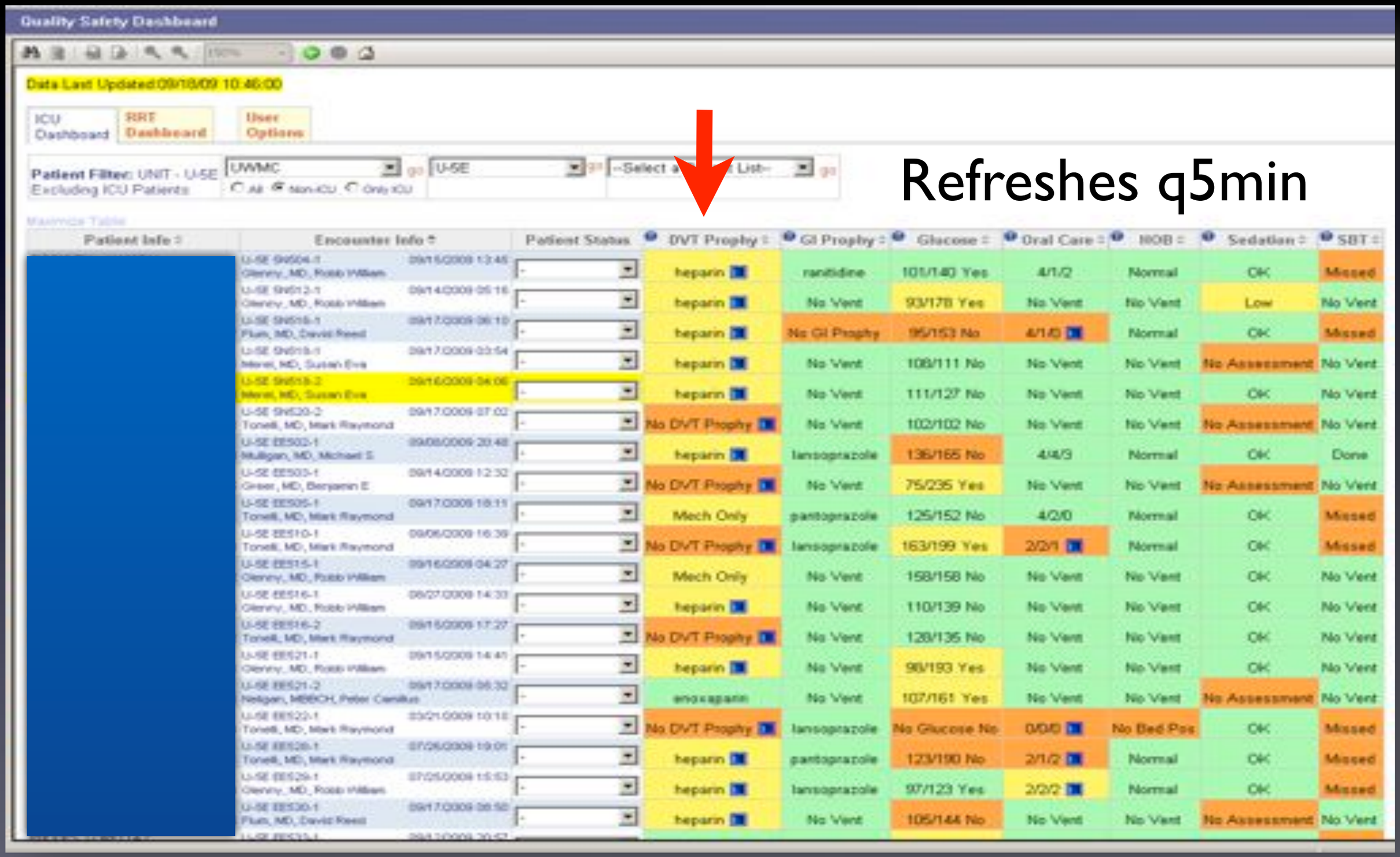
Critical HIT Components Needed to Ensure Quality

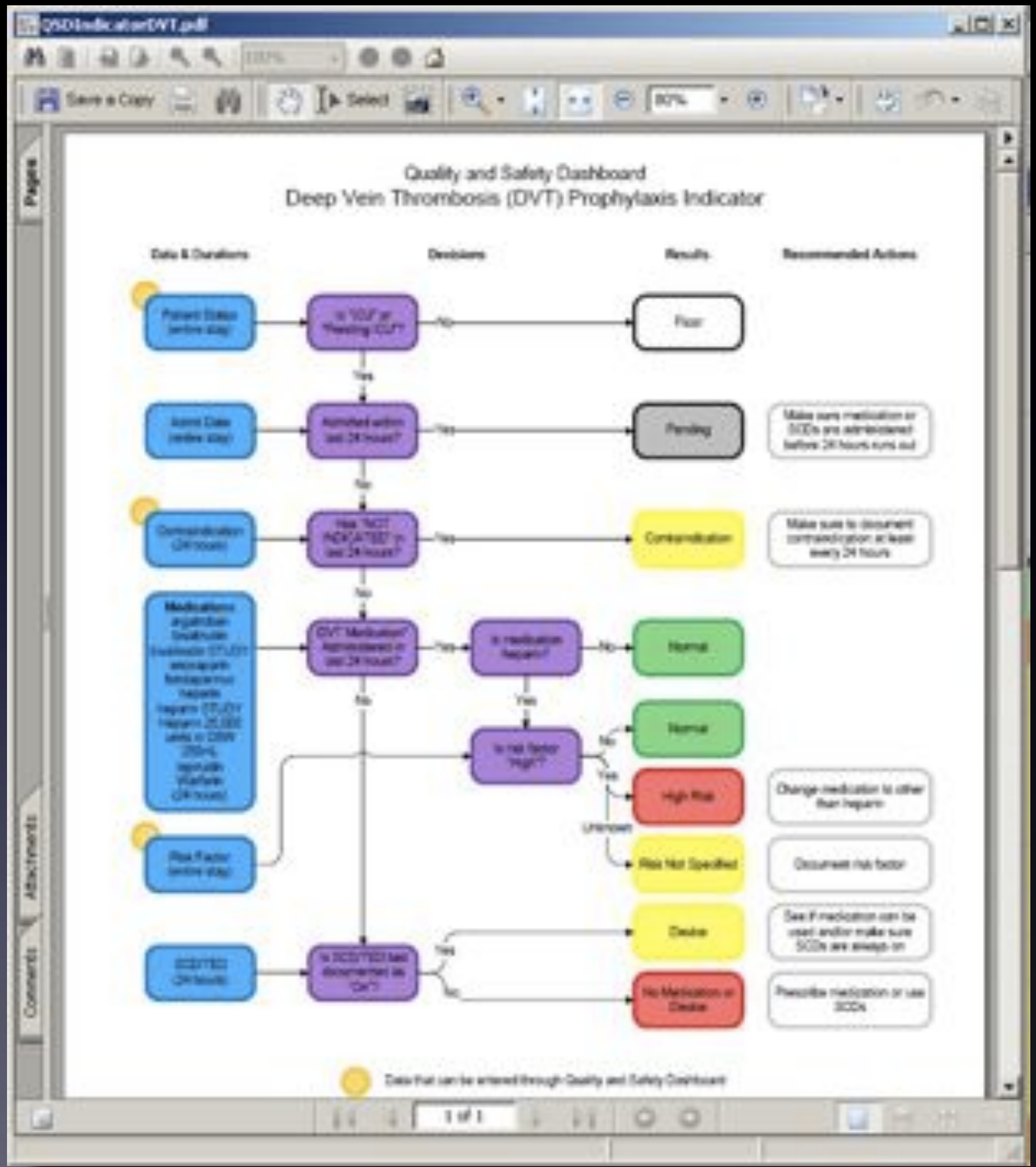
- ✓ Computer System
- ✓ Discrete Data
- ✓ Right Software/Programing
- Realtime Provider Feedback aka Clinical Decision Support
- Group Situational Awareness

Retrospective Improvement Efforts

- Conferences
- Journal Clubs
- Section Meetings
- Housestaff Orientations
- M&M

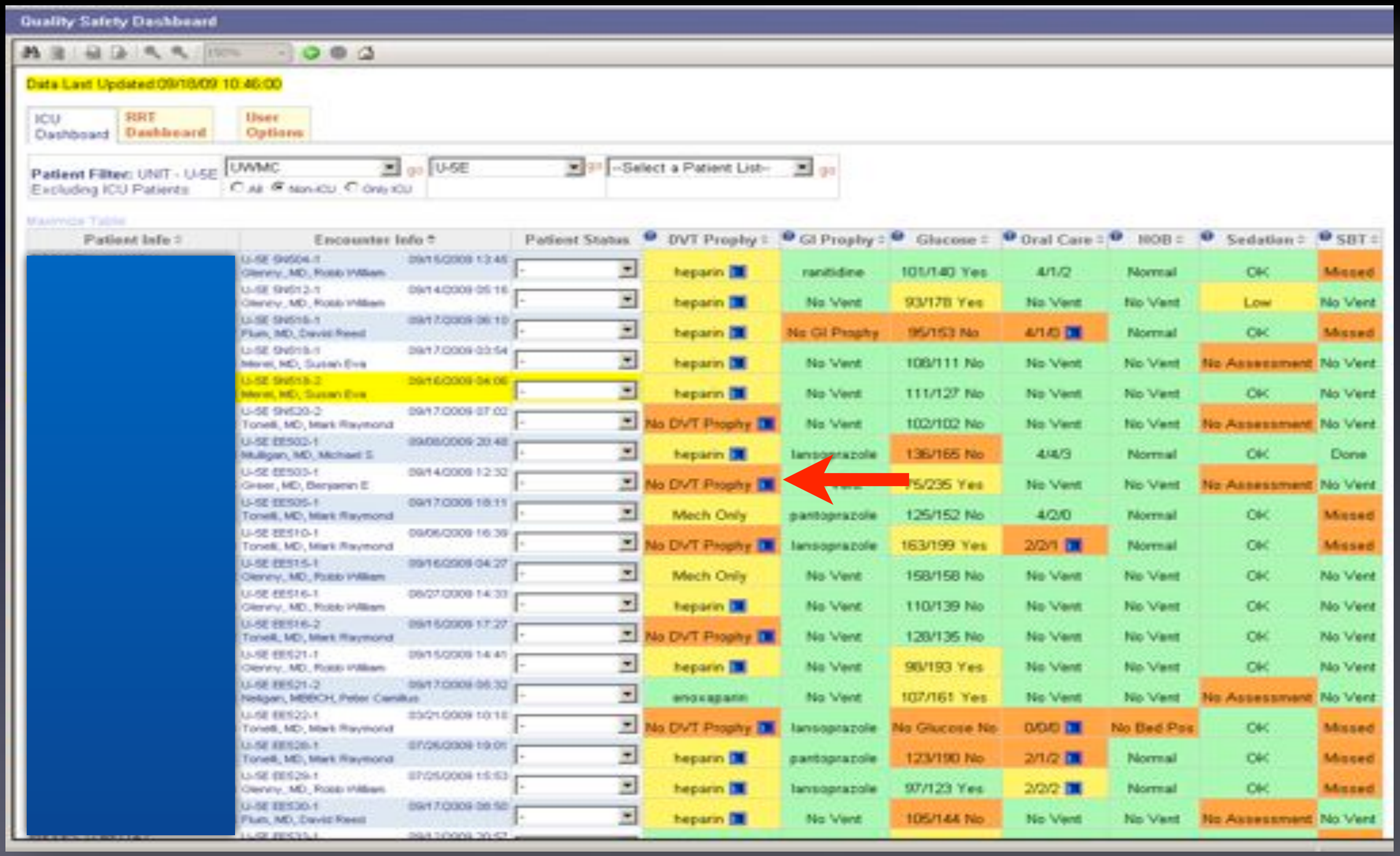
Quality Safety Dashboard



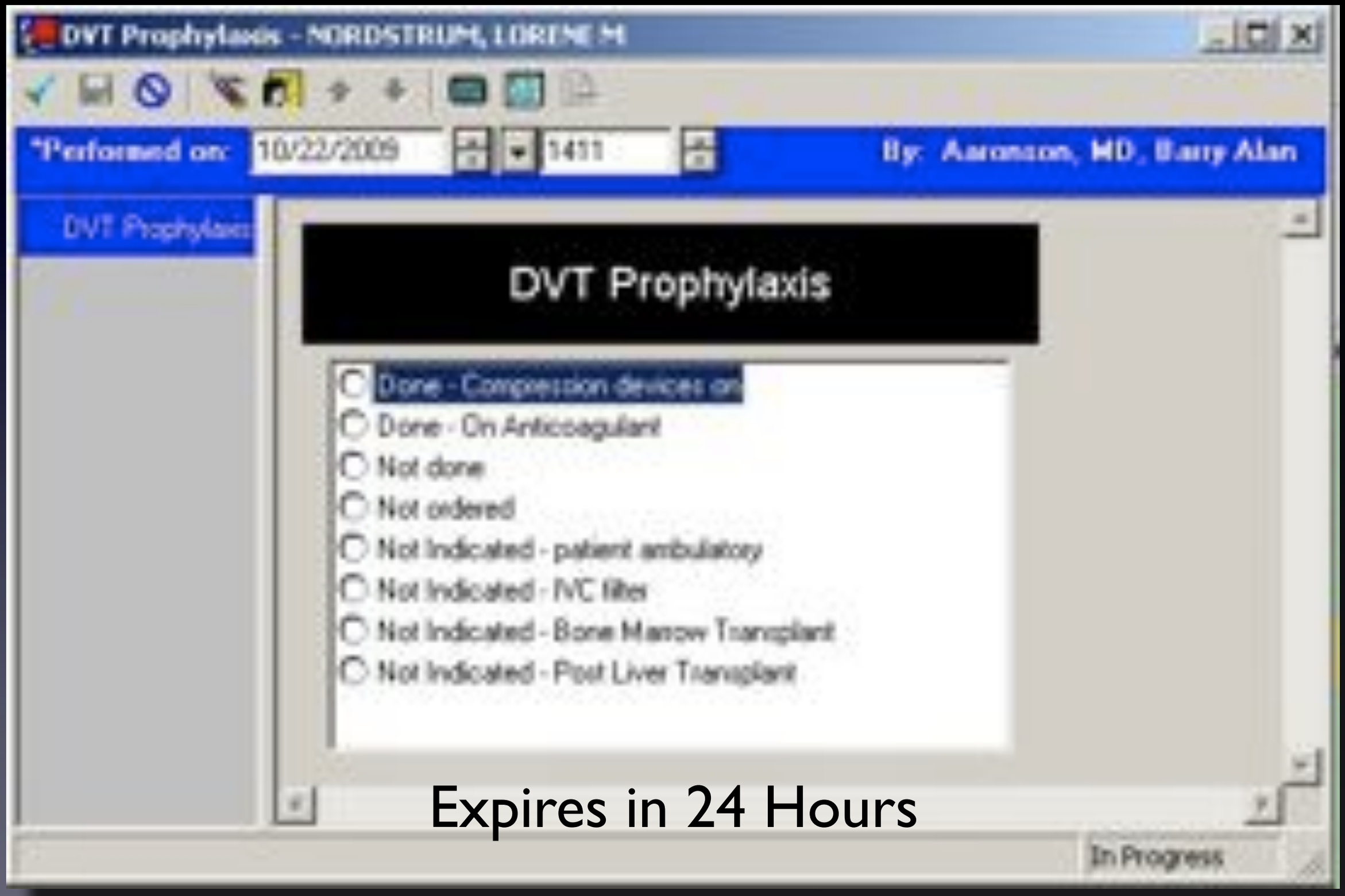


Clinical Algorithm

Quality Safety Dashboard

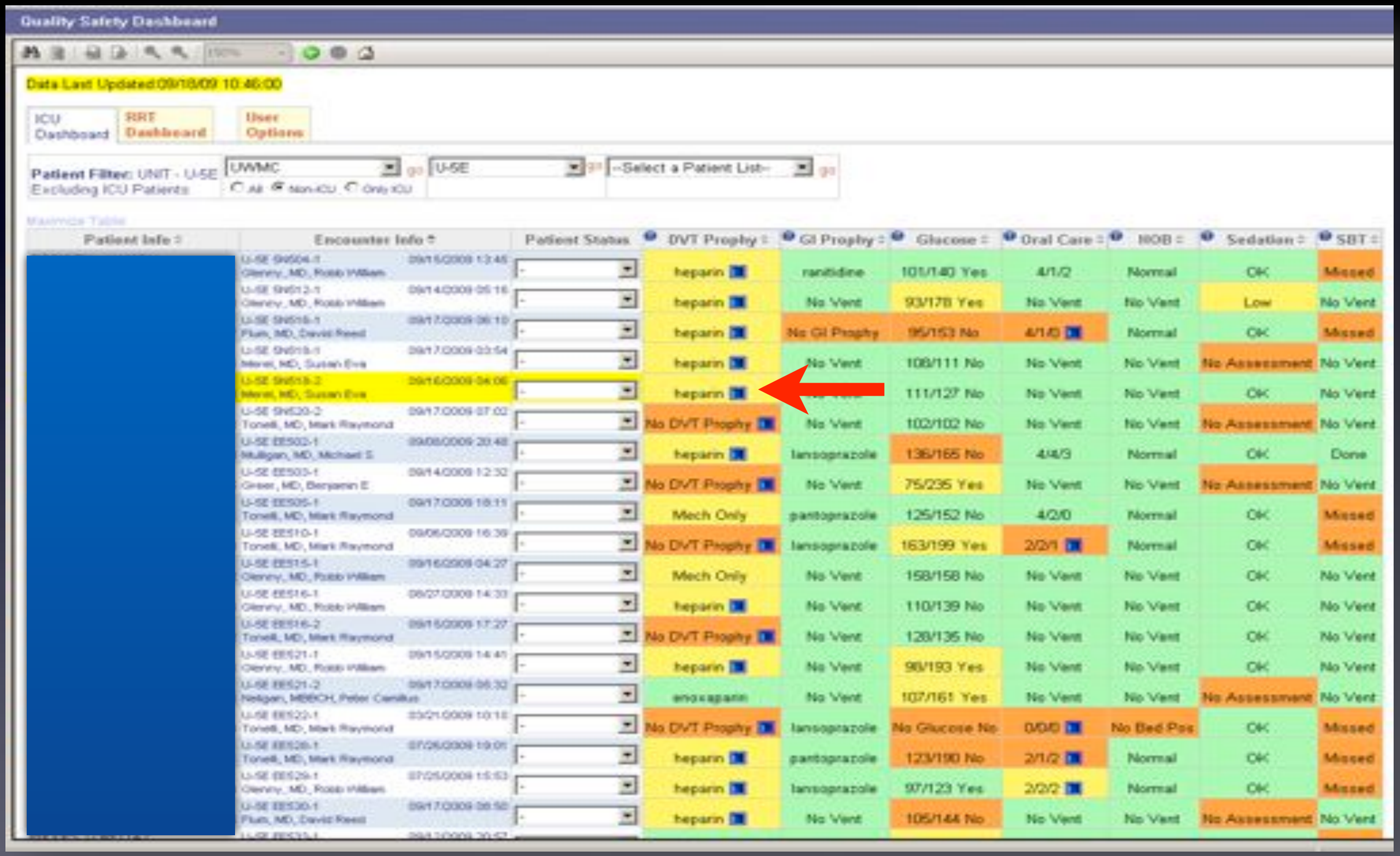


Document

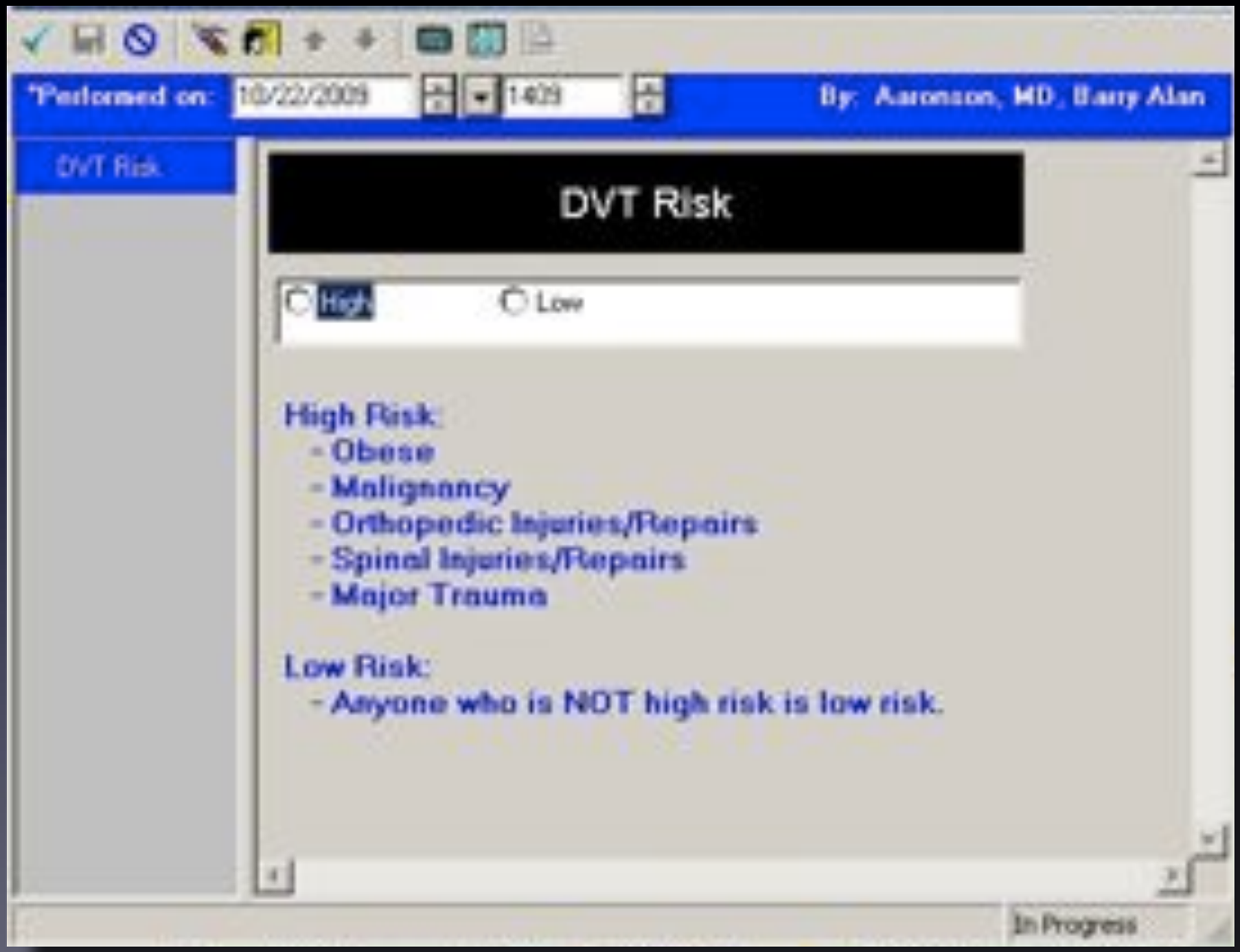


Expires in 24 Hours

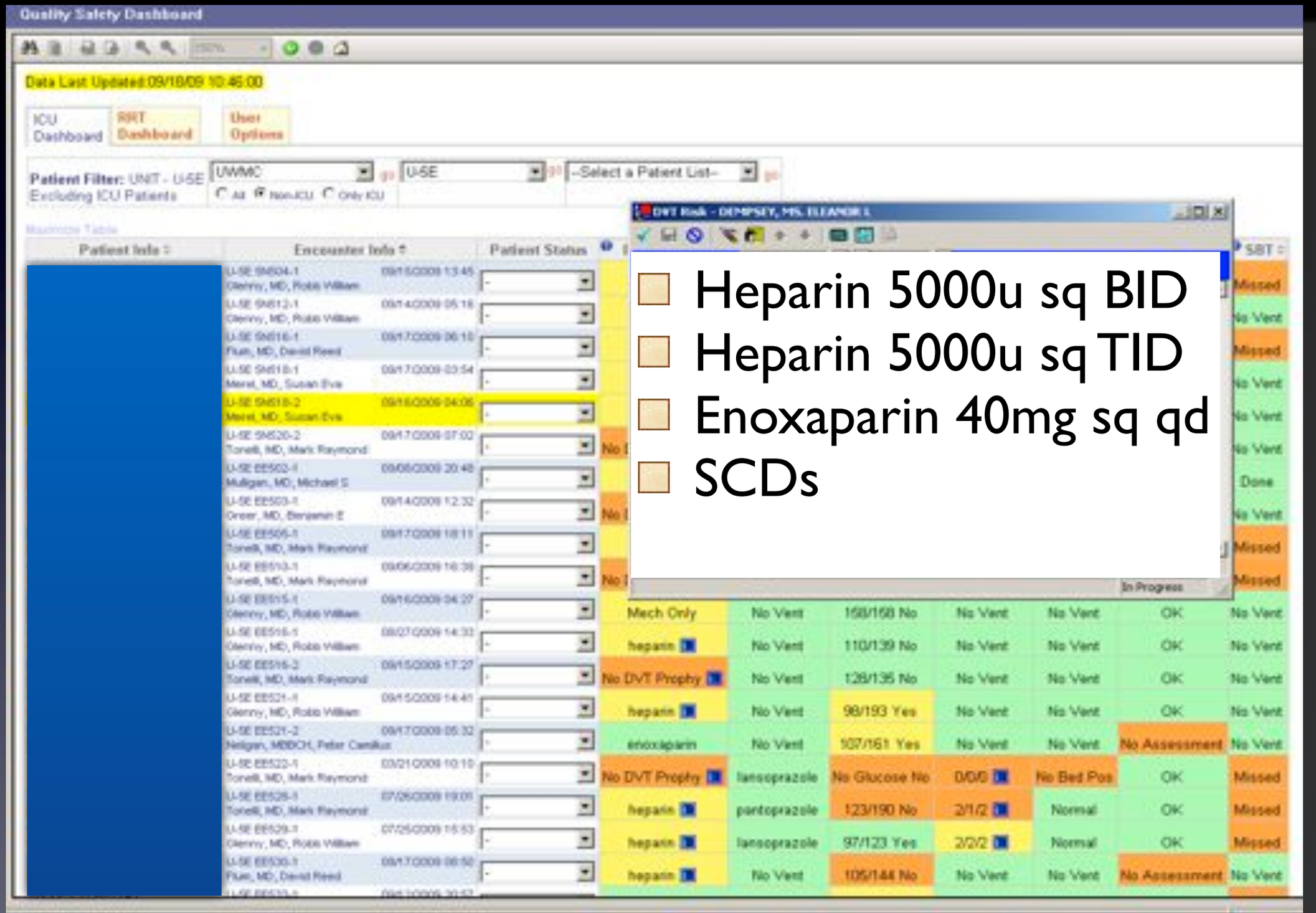
Quality Safety Dashboard



Specify Risk



Write Orders



Critical HIT Components Needed to Ensure Quality

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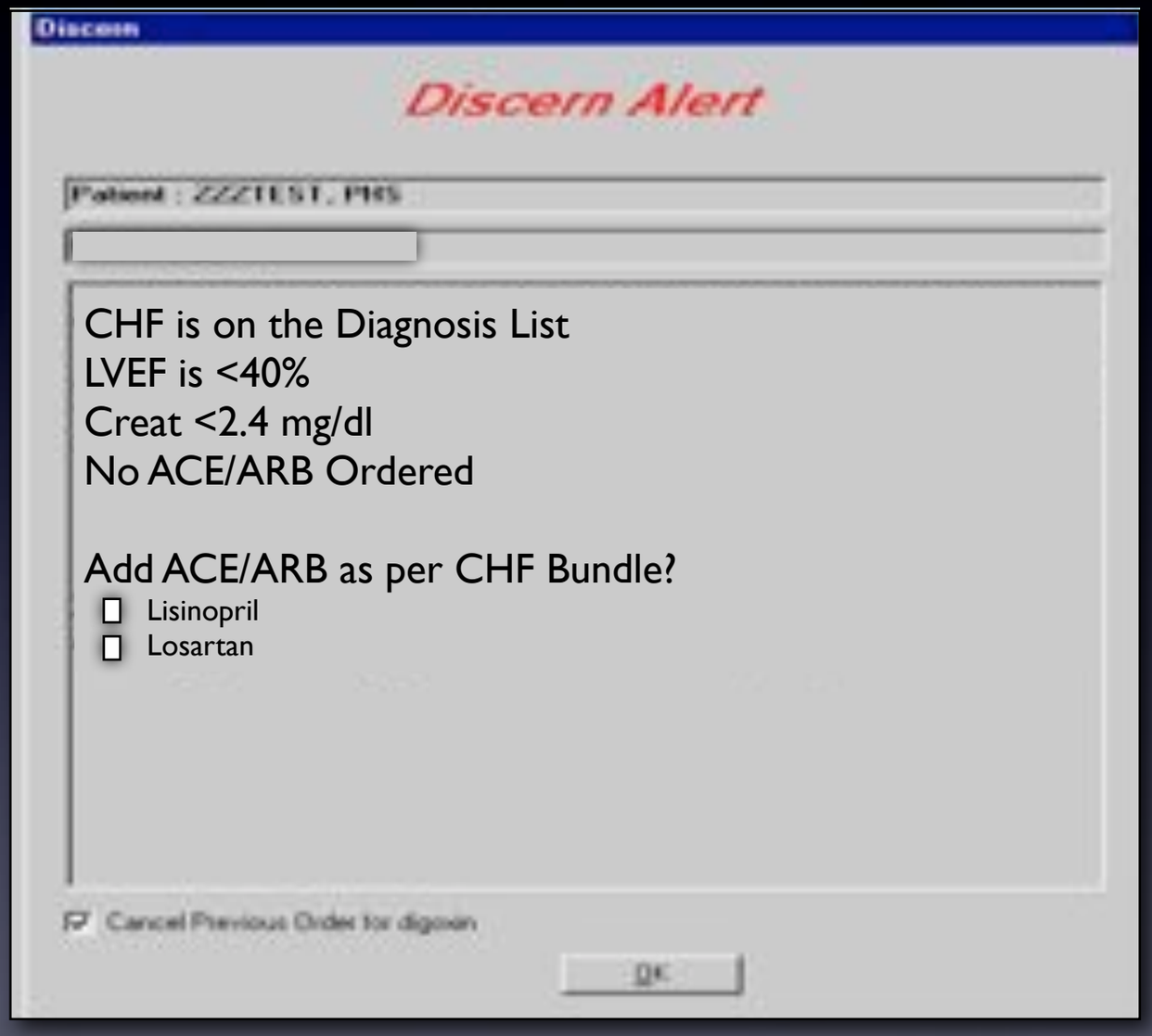
- ✓ Right Software/Programing
- ✓ Realtime Provider Feedback aka Clinical Decision Support
- Group (Team) Situational Awareness

Alert Fatigue



JAMA®

Online article and related content current as of November 19, 2008.

Patient Care, Square-Rigger Sailing, and Safety

Steven J. Henkind; J. Christopher Sinnett

JAMA. 2008;300(14):1691-1693 (doi:10.1001/jama.300.14.1691)

http://jama.ama-assn.org/cgi/content/full/300/14/1691

OR Dashboard

Bed Control

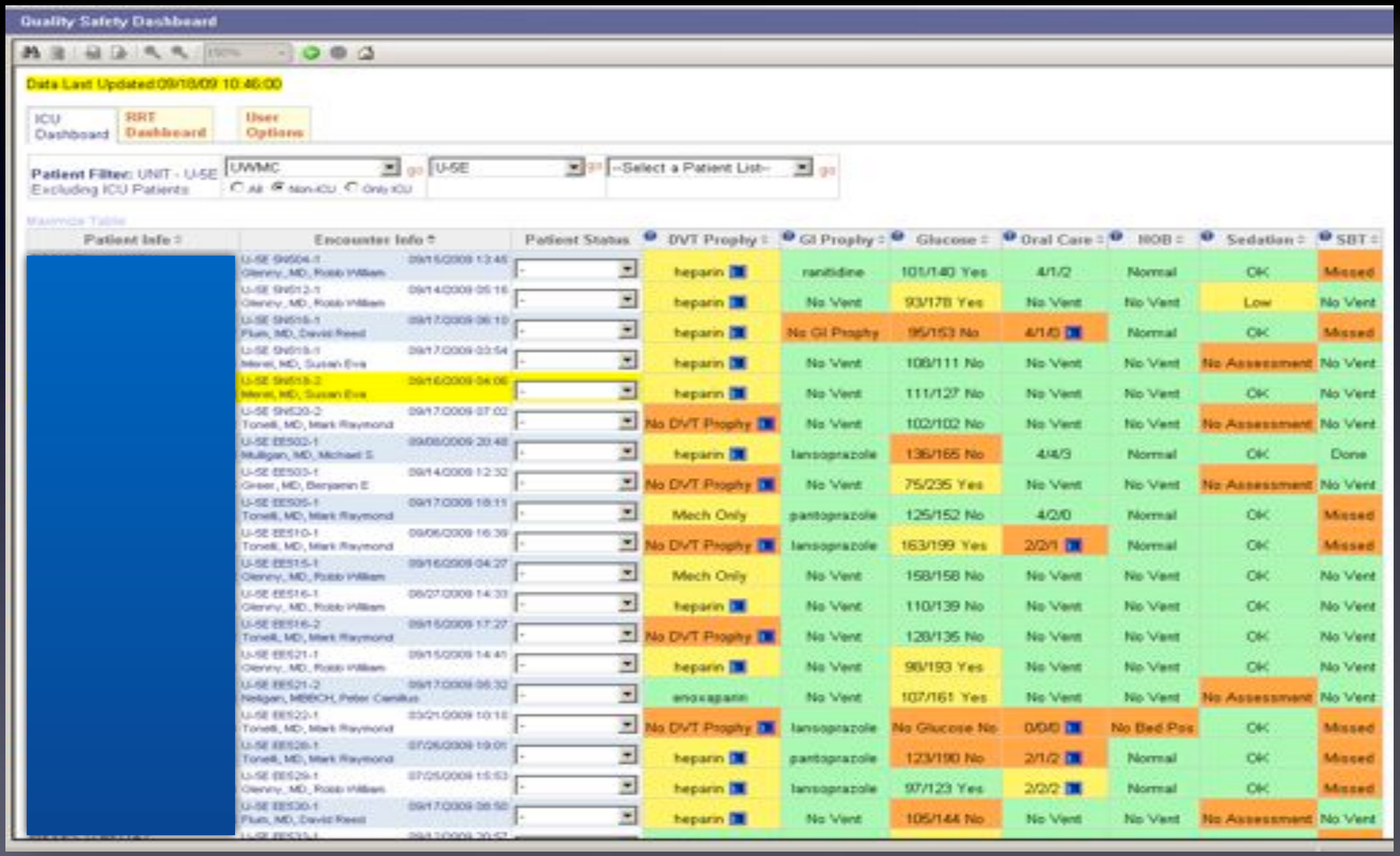
Hospital Dispatch

Harborview Cafe

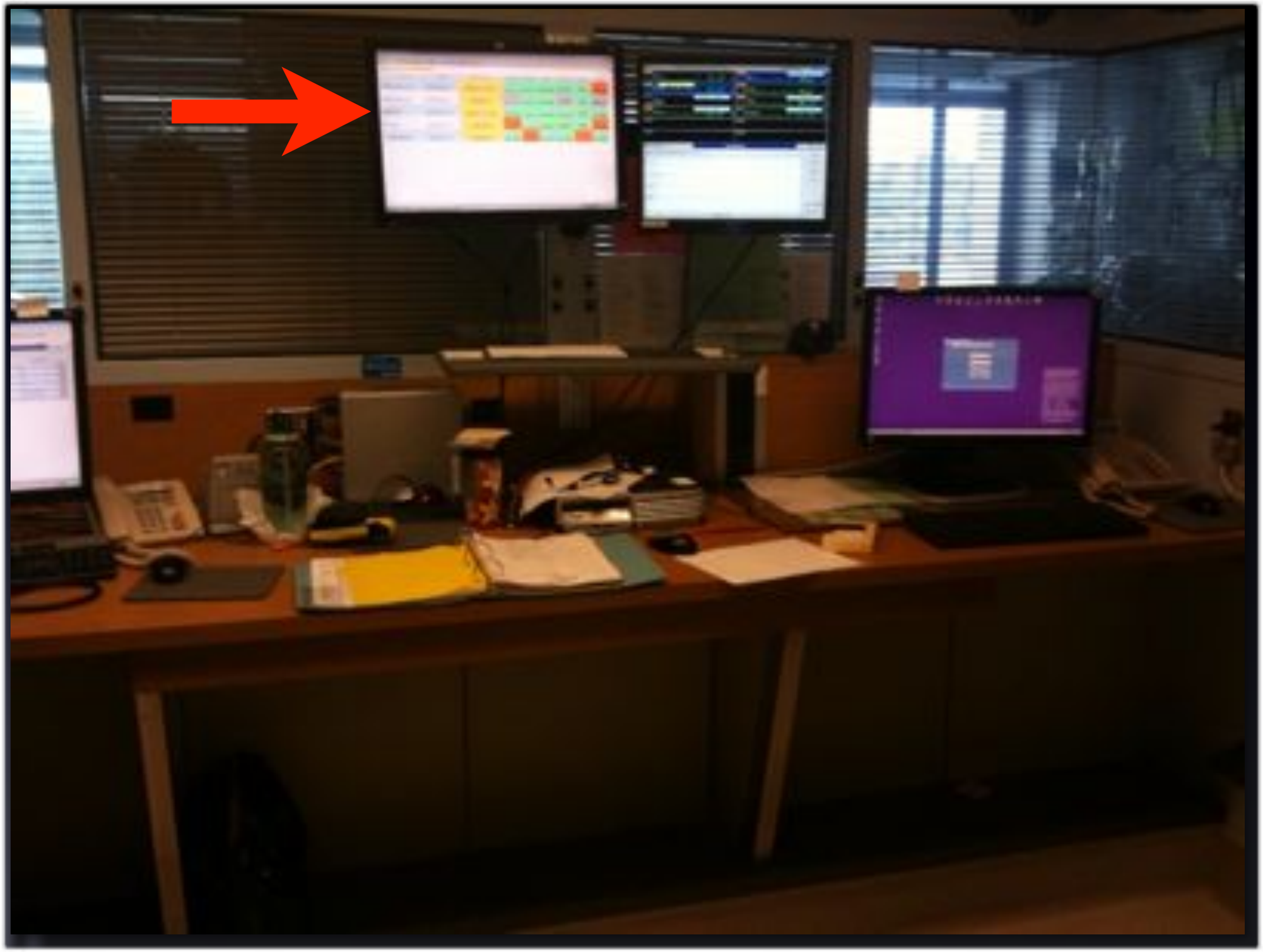
White Board


ROOM
PATIENT
ON DUTY
755-1
756-2
766
757-1
757-2
758
759-1
759-2
763
764
766
768
Alison
Alison
Alison
Alison
Alison
BJ
Alison
Alison
BJ

Quality Safety Dashboard



UW ICU



Harborview ICU

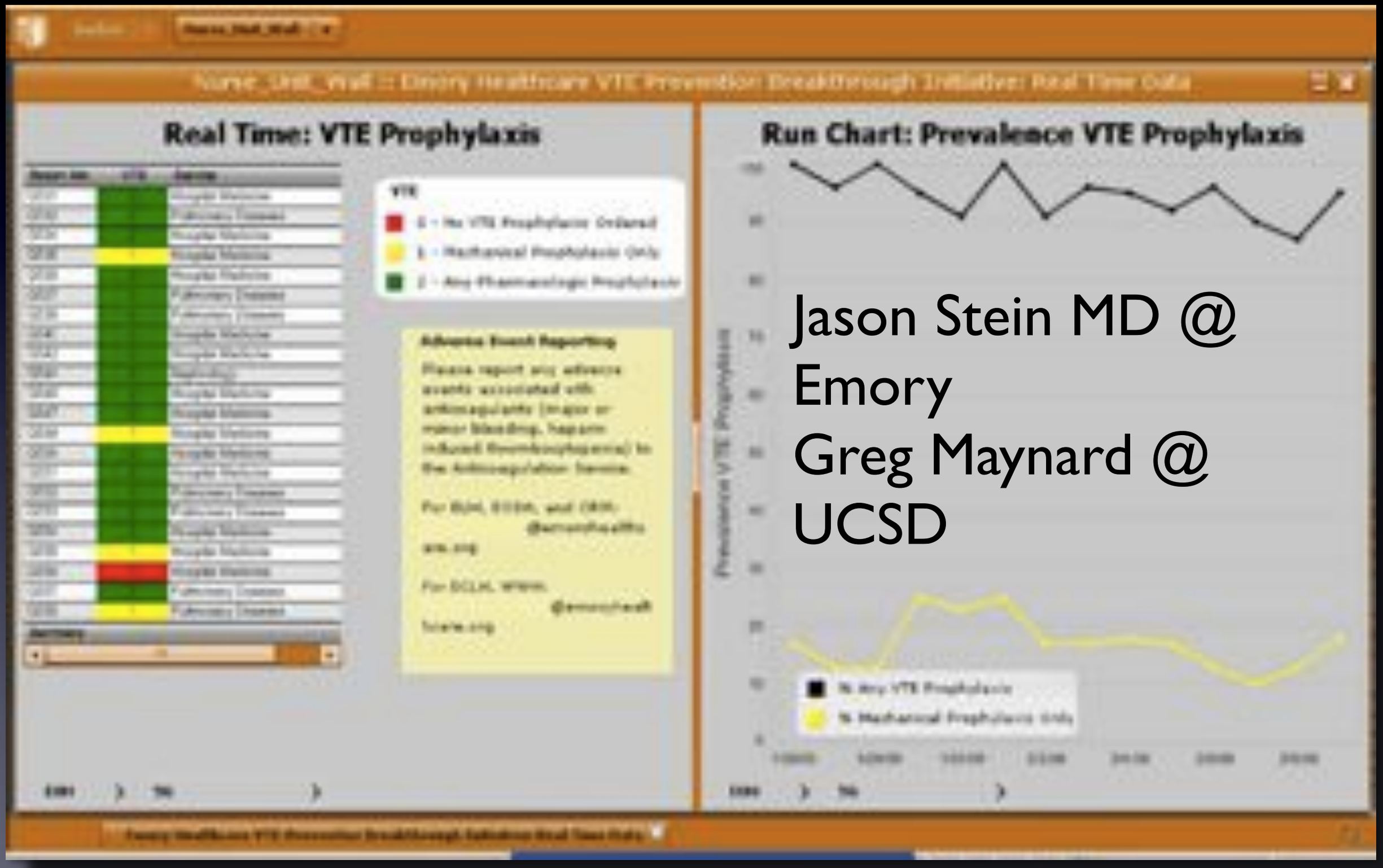
Dashboard Study Design

Measure of Compliance with Quality Parameter

	6 Week Control Period	6 Week Intervention Period
Control Unit	No Dashboard	No Dashboard
Intervention Unit	No Dashboard	Dashboard

Med-Surg Dashboard

Measurevention



Jason Stein MD @ Emory

Greg Maynard @ UCSD

Critical HIT Components Needed to Ensure Quality

- ✓ Computer System
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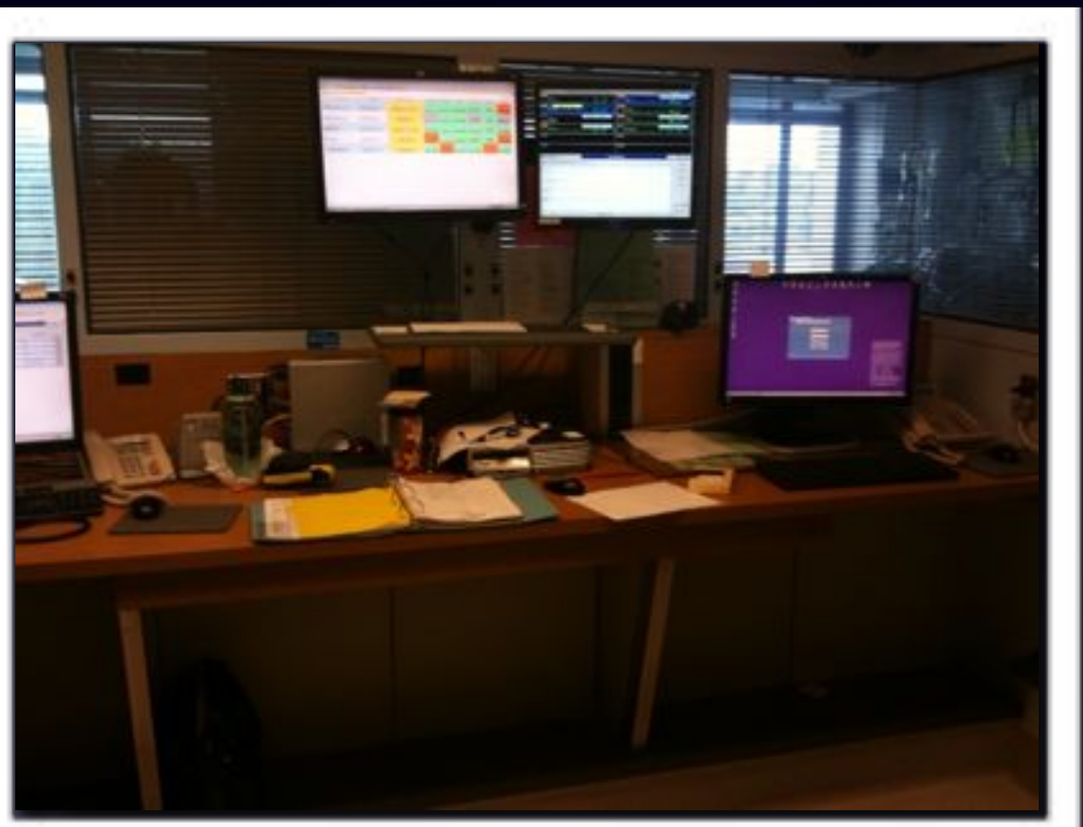
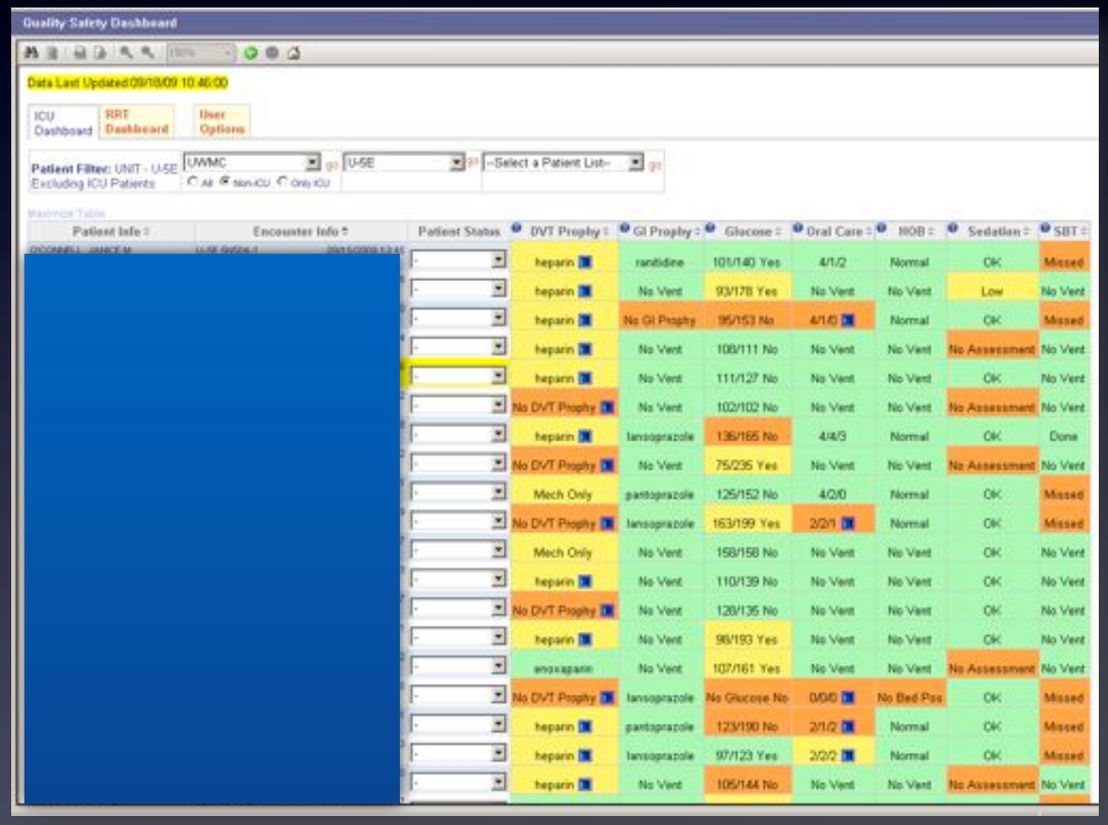
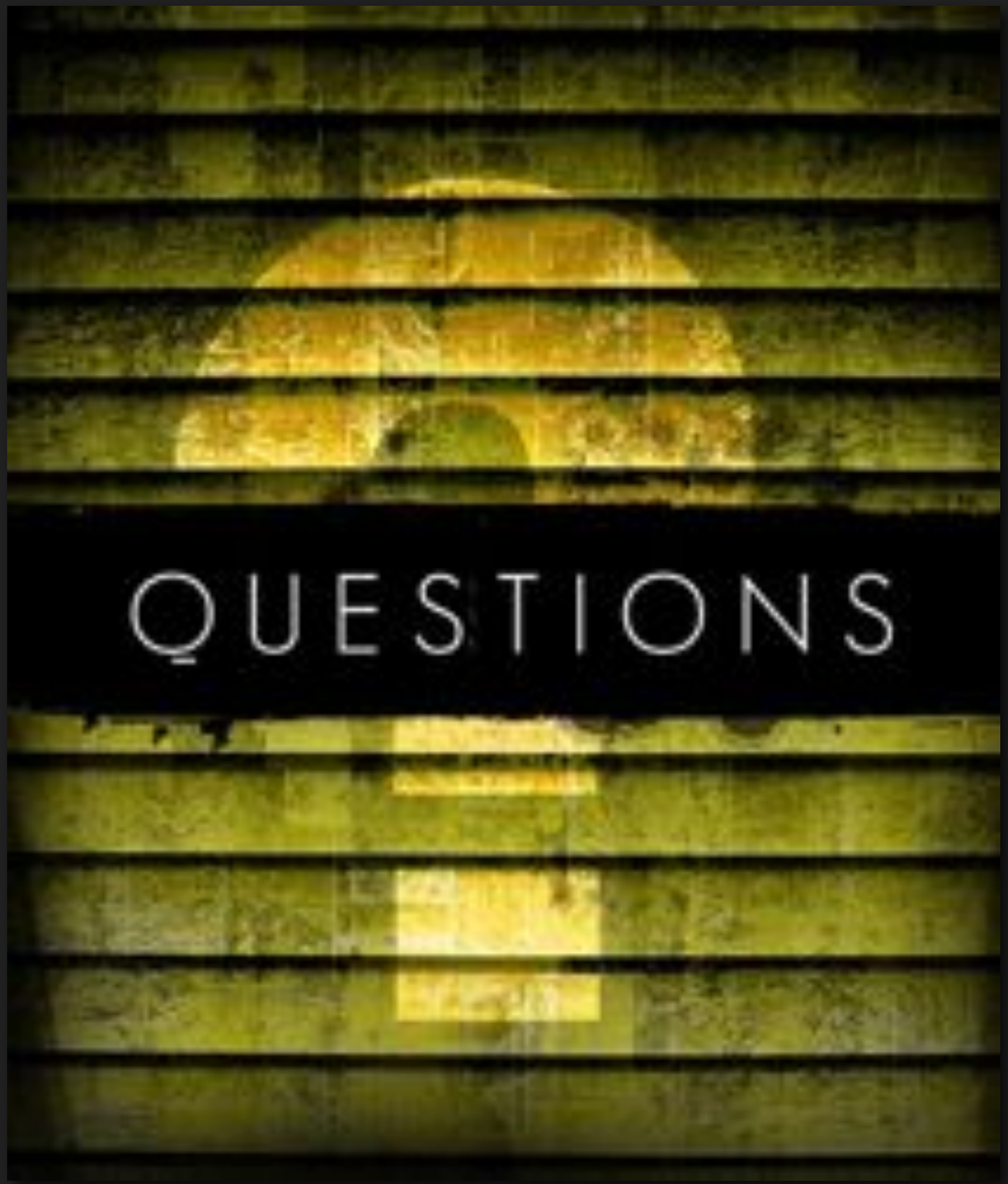
- ✓ Realtime Provider Feedback aka Clinical Decision Support
- ✓ Realtime Provider Feedback aka Clinical Decision Support
- ✓ Group Situational Awareness

Health IT- Ensuring Quality and Safety






QUESTIONS