Clinical Decision Support Track Kick-Off: Improving Outcomes with Clinical Decision Support

Session S03

AMIA Spring Congress

22 May 2007

Track Co-Chairs

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CDS Track:
Voting with Your Feet

Track Name	Total
Clinical Decision Support	92
Nursing Informatics	36
Personal Health Records	35
Public Health Informatics	54
Translational Research Informatics	37

CDS Definition

"**Providing clinicians or patients with clinical knowledge** and patient-related information, intelligently filtered or presented at appropriate times, **to enhance patient care**."

- ***NOT** just physicians…*
- ***NOT** just rules and alerts…*
- *(**NOT** just computer-based…)*

CDS Track: Learning Objectives

- To learn a framework for developing, deploying and assessing clinical decision support.
- To acquire techniques for implementing specific clinical decision support interventions.
- To appreciate how clinical decision support may be deployed to enhance patient safety and disease management.
- To review and gain an understanding of key lessons learned by clinical decision support implementers.

Types of CDS Goals

- Best clinical practices
  - quality measures, dz mgt, accreditation, EBM
- Patient/medication safety
  - Avoid sentinel events, litigation/malpractice
- Patient empowerment
  - satisfaction (MD/patient), retention, quality
- Financial well-being
  - P4P, cost-effective care, adverse events

➢ *Deliver the **right information** to the **right person** in the **right format** at the **right point in workflow** through the **right channel***

CDS Track Presentations

- 4 panels (18 speakers)
- 8 individual presenters
- 16 posters (2 sessions)

Panel S03: CDS in Context

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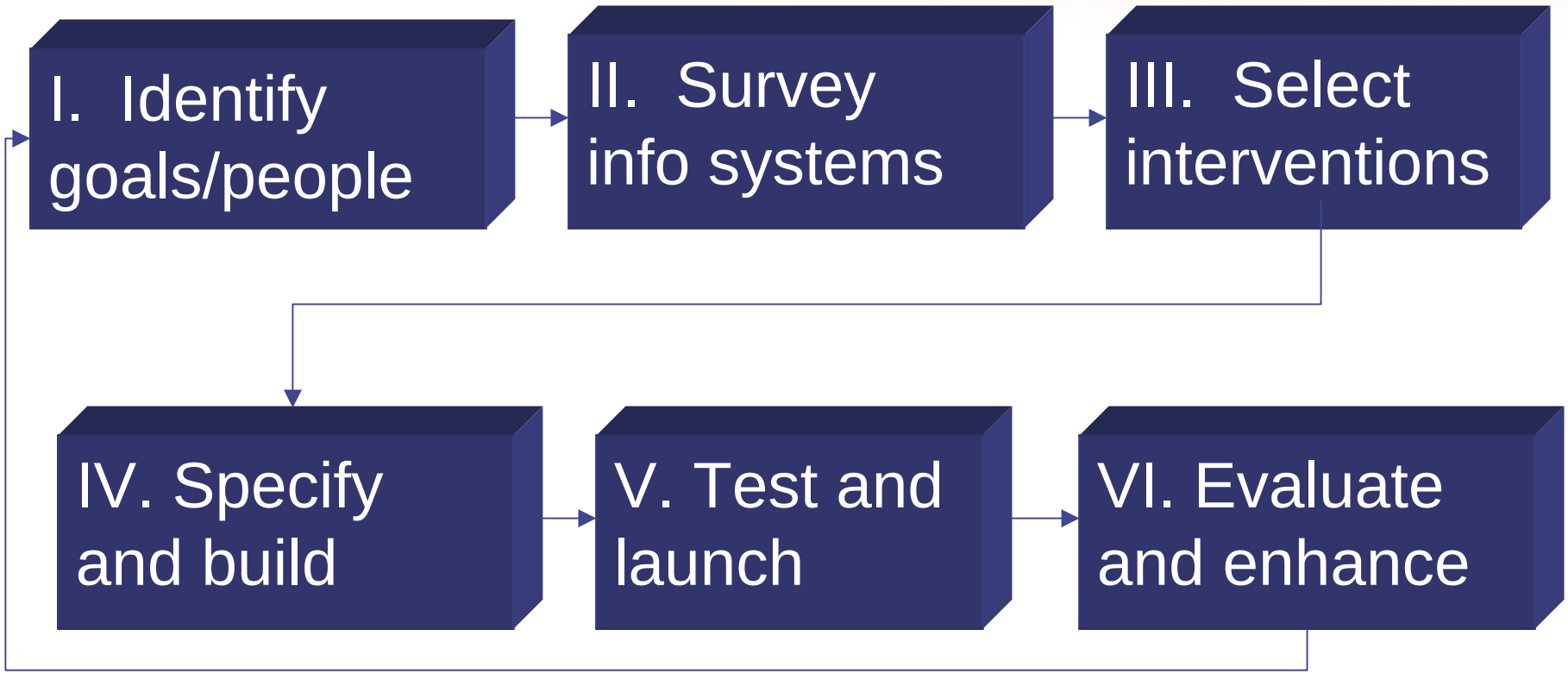
How can we improve care process/outcomes with CDS?



Step 1: CDS Stakeholders, Goals

- Who needs to be involved?
- What goals will the CDS program address?
- How will CDS activities be governed/managed?
- How can the CDS program be cost-justified?

Stakeholders

CDS is a team sport!

- **Positions:** *CMO, CMIO, CQO*
- **Committees:** *quality, safety, P&T*
- **Admin:** *hospital/office staff*
- **Clinicians:** *Nurses, pharmacists, MDs*
- **Patients!**
- **Others…**

Determining CDS Goals

- External drivers
  - P4P
  - Reporting, accreditation
- Internal drivers
  - Process/outcome data
  - Committees (quality, safety, P&T, UR)
  - Departments
  - Clinicians/patients/community

Step 2: Catalogue Available Information Systems

- Key Steps
  - Prepare an inventory of available information systems
  - Document:
    - CDS capabilities: 6 types.
    - Coding systems and vocabularies
  - ***Tip***: CPOE and EHR systems are key but not the only game in town

Systems to Consider: Data & Knowledge

- Departmental data management
  - Lab, radiology and pharmacy systems
- Clinical Records
  - EHR, OR systems, medication administration
- Ordering
  - CPOE and e-prescribing.
- Content
  - Reference for clinicians
- Administrative.
  - Charge capture, scheduling and registration

Intervention Types

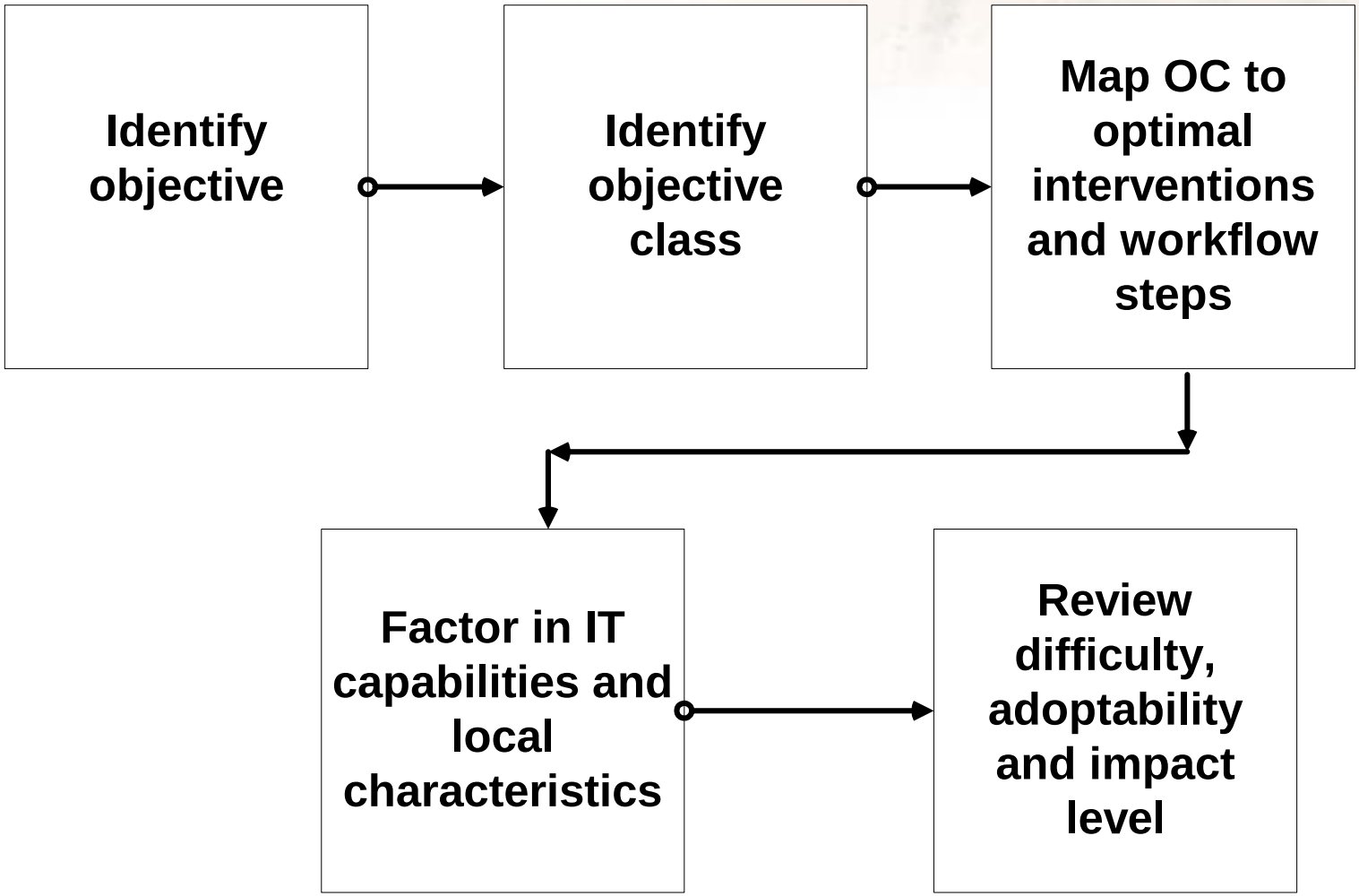
- Documentation forms and templates
- Relevant Data Presentation
- Order Creation Facilitators
- Time-based Checks and Pathway support
- Reference Information and Guidance
- Reactive Alerts and Reminders

CPOE and Decision Support

- Types of CDS common in CPOE:
  - Order creation facilitators
  - Relevant data display
  - Pathway support
  - Context sensitive reference information
  - Reactive alerts

- CPOE with CDS may result in as much as 55%-86% drop in medication errors.
  - Bates et al. 1998-1999

Step #3: Selecting CDS Interventions



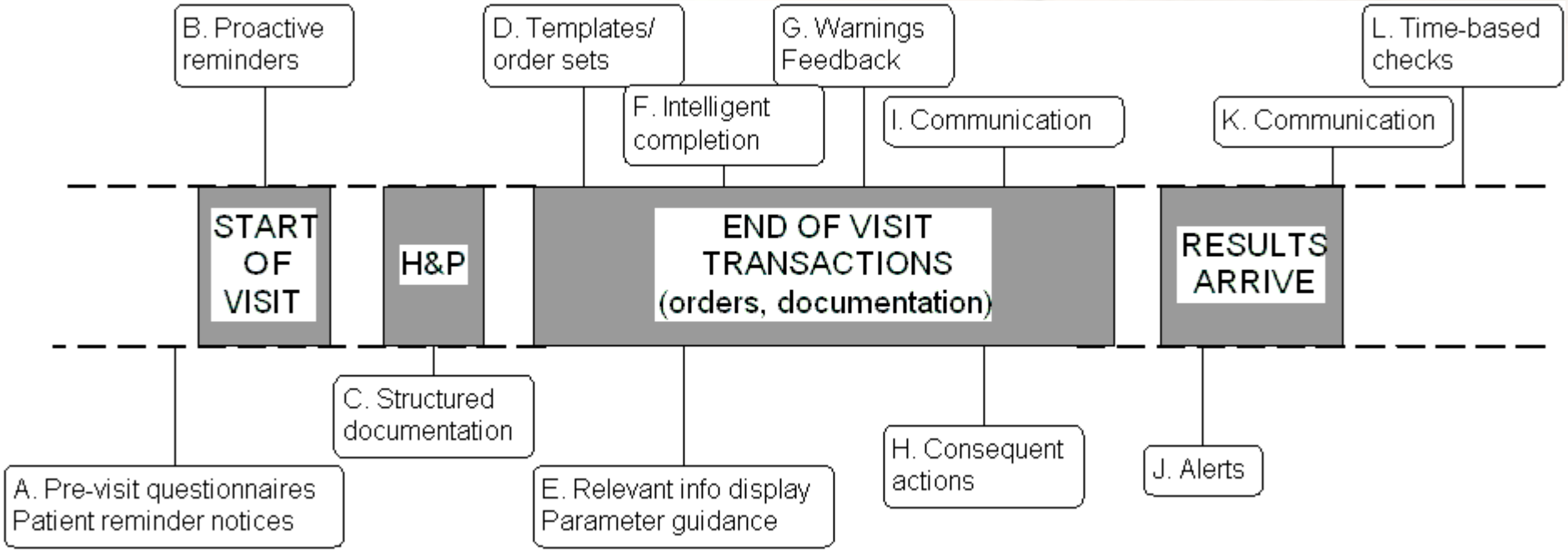
Objective Classes

- Prevent Errors
  - Errors of Omission
  - Errors of Commission
- Optimize Decision Making
  - Choice of Individual Tests and Therapies
  - Simple Care Guidelines Compliance
  - Appropriate Acute Workup
  - Chronic Condition Management
  - Compliance with Multi-Step Protocols

Objective Classes

- Improve Care Processes
  - Improve Documentation
  - Improve patient education
  - Improve Communication

Workflow Opportunities



Ease / Acceptability / Impact

- An intervention that is not received is not an intervention!
  - Ease of use + acceptability are key
- Special considerations
  - Changing codes
  - Unavailable data
  - Development costs

Moving right along…

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Step #4: Specifying Details and Building Interventions

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Intervention Parameters

- When/How is intervention triggered
- Criteria for intervention delivery
- Source of data to satisfy intervention logic
- Content of intervention
- Method of intervention
- Recipient of intervention
- Method for feedback from recipients

Optimize Intervention Effectiveness

- Provide clear, practical recommendations
- Link recommendation to action opportunities
- Prepare organization for result of successful interventions
- Special attention to interventions sent to patients (language, education level)

Optimize Intervention Safety

- Consider potential adverse consequences
- Develop a fail-safe plan if system (CDSS, underlying CIS) fails
- Minimize intervention overload

Management Considerations

- Establish clear accountability for results
  - Team with clinical, administrative, financial and informatics expertise
- Pay close attention to (re-engineering) workflow
- Engage detractors

Step #5: Putting Interventions into Action

Key Tasks

- Test content, mechanics and logistics
- Develop a rollout plan, including training, feedback and monitoring
- Gather and address feedback before, during and after rollout

Testing

- Incorporate typical use cases into testing scenarios
- Unit testing: Check intervention components with appropriate data
- Integration testing: Bring together all the components
- User acceptance testing
- Pilot launch
- Full-live evaluation

Aspects of Communication

- Apprise users of what's happening
- Listen to feedback
- Use champions/super users
- Use multiple methods (formal & informal):
  - Staff meetings
  - Notices: Email, brochures, posters

Aspects of Rollout

- Wait for stable underlying CIS
- Carefully analyze speed, scope and order of rollout of interventions
  - Complex interventions may require phasing
  - Potentially disruptive interventions may require limited live testing
- Consider pilot locations
  - Representative? Size? Availability of support staff?
- Start with greatest returns posing least disruption

Step # 6: Monitoring Results and Refining the Program

- Evaluate intervention effectiveness using both quantitative and qualitative approaches.
- Plan on iteratively refining interventions to improve their use and benefits.
- Develop a systematic approach to managing organizational knowledge assets.

Evaluation Philosophy

- **Availability** – CDS must be available to clinicians.
- **Use** – Clinicians must use the system.
- **Benefits** – Only after these are assured, can you begin looking for improvements.

Evaluate Availability…

- Did alerts fire?
- Were order templates available in the system?
- Was the web site functioning?
- Were reports printed?
  - Did clinicians get the reports?

Evaluate Use of the CDS

- Assess intervention use and usability.
  - Direct observations of users
  - Subjective user feedback
  - Input from clinical champions
  - Objective measurements of intervention usage.
- How often is each intervention used (reference material accessed, specific order sets and templates completed?
- How often are alerts presented? Heeded? Overridden?
- What do users perceive as the intervention's effects on workflow?

Evaluate benefits of CDS

- Let’s see how our other panelists do this…

Maintain Knowledge Assets

- Re-evaluate intervention logic to ensure clinical knowledge is accurate and up to date,
  - Changes to elements require revalidating to ensure that system continues to behave as expected.
- Assign responsibility for the different content areas to respected individuals with domain expertise
- Assign an “expiration date” to all CDS interventions.
- Vocabularies and coding schemes evolve
  - Ensure that changes don’t have any adverse effects on the behavior of CDS interventions.

Thank You!

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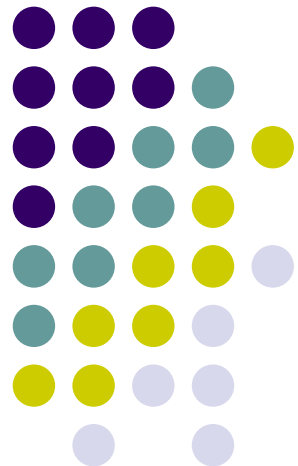
Design of the CPOE User Interface to Reduce Medication Errors



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May 22, 2007

CPOE circa 2004

- Terminal-based app: Technicon Data Systems
  - Local install was named “CHIPPER”
- In use at CHOP since the 1980’s
- Plans for CHIPPER retirement in October 2004
- Transition to Eclipsys Sunrise Clinical Manager
- Opportunity to revisit medication errors, build new safeguards

CHIPPER to SCM

- How does an organization prepare for this change?
- How can we derive the most value from the change?
  - Reduce errors?
  - Make patient care safer?
  - Make CPOE use easier, more efficient?

- **One solution:** turn to other industries for guidance
  - **Failure Mode & Effects Analysis**
  - Devised by the US Military in 1949
  - Used in aerospace, automotive industry
  - Later adopted for healthcare use

FMEA Principles

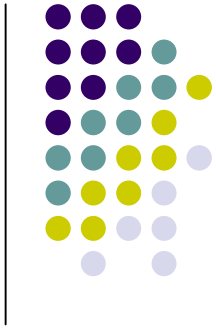
- **Step 1:** Create detailed flow diagram of a process
- **Step 2:** For each step, describe what happens if process fails
- **Step 3:** Rate each failure on a standardized scale x 3
  - Severity of harm if failure occurs **(S)**
    - 1=none; 5=fatal
  - Likelihood of occurrence **(O)**
    - 1=rare; 5=common
  - Inability of existing controls to detect failure **(D)**
    - 1=easily detectable; 5=failure would not be evident
- **Step 4:** Calculate Risk Priority Number **(RPN = S x O x D)**

Example: A fatal, but rare and detectable error = 5 x 1 x 1

High-Risk Meds

- **Opiates / Sedatives**
  - morphine, fentanyl, hydromorphone, codeine
  - midazolam, lorazepam, chloral hydrate
- **Electrolytes**
  - magnesium sulfate
  - calcium gluconate
  - Isotonic NaCl, 3% NaCl
  - KCl, K Phosphate, Bicarbonate
- Insulin
- Continuous med infusions
- Paralytic agents
  - vecuronium, pancuronium, cisatracurium
- Digoxin
- Anticoagulants
  - enoxaparin, warfarin, heparin
- **Various antibiotics**
  - vancomycin
  - gentamicin
  - amoxicillin
- Total Parenteral Nutrition*

FMEA Analysis: Acetaminophen



- Analysis
  - High RPN (very commonly ordered, errors were common)
  - Most potential errors were **interval** related
  - Changes frequently in newborn period
  - Potential for hepatotoxicity

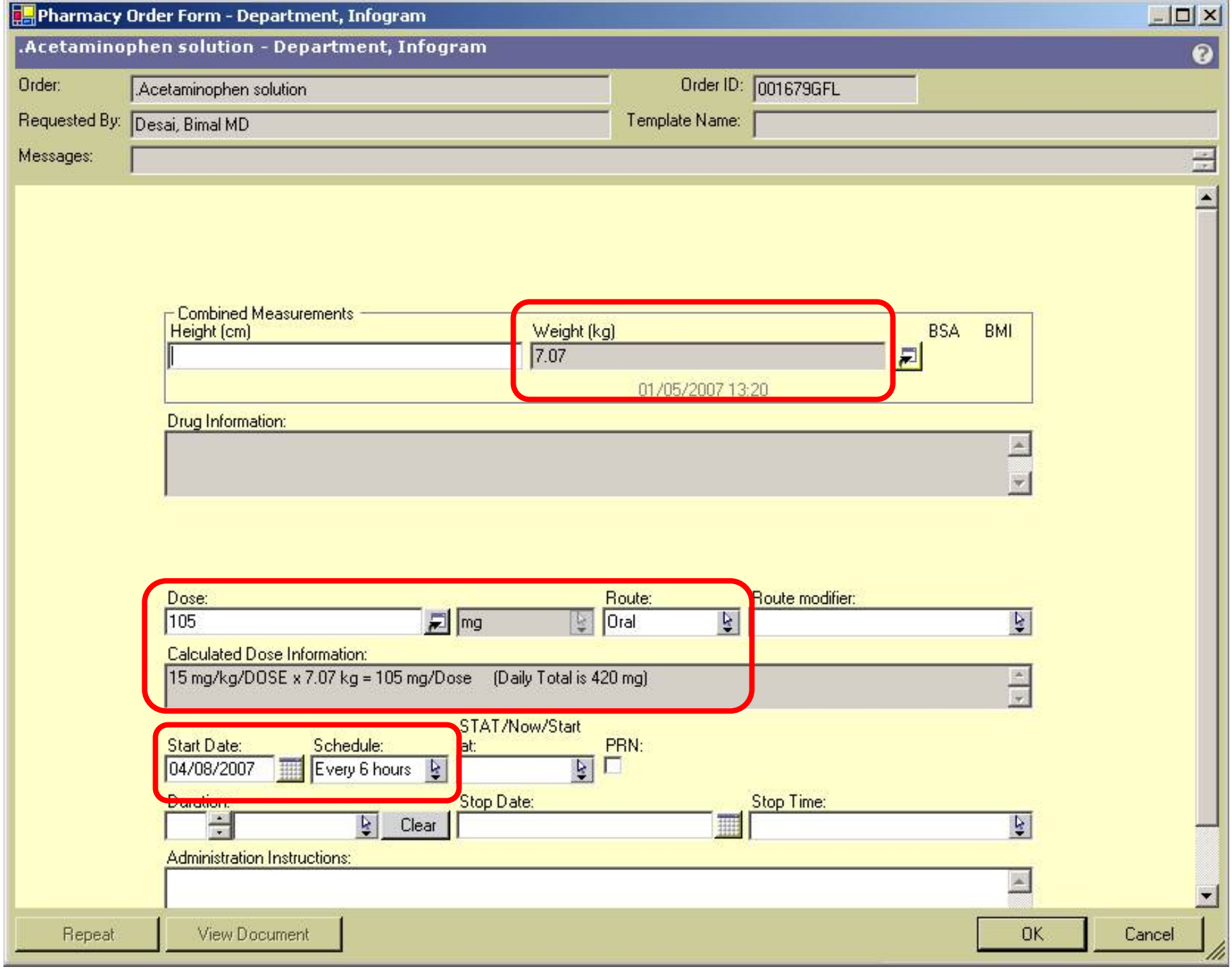
- CPOE Recommendations
  1. Combine various dosage forms into one order set
  2. Use order set layout to guide therapeutic choices
  3. Stratify dosing by age group to fix errors of interval
  4. Precalculate default doses by indication

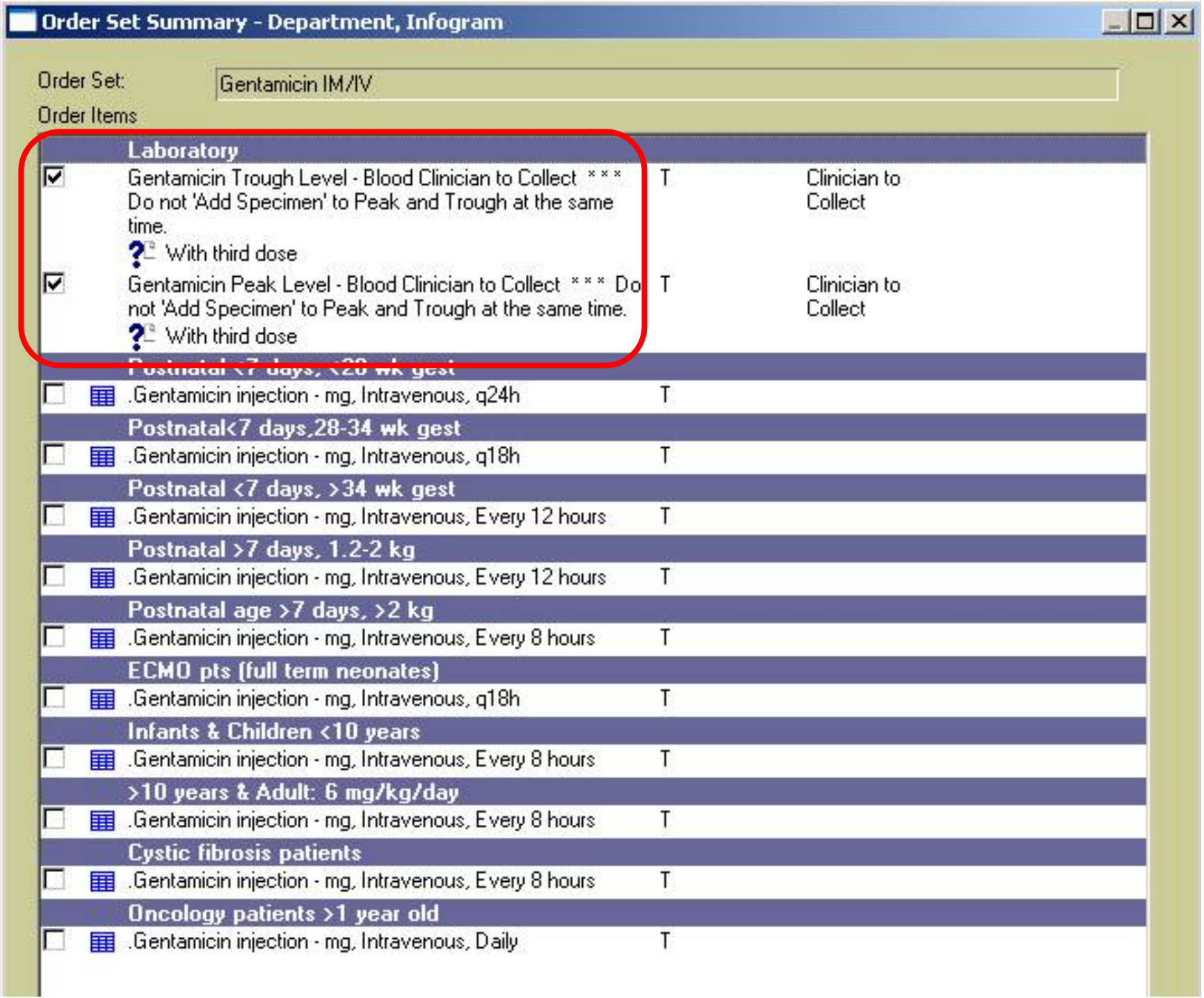
Order Set Summary - Department, Infogram

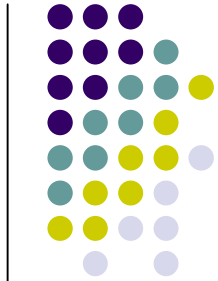
Order Set: Acetaminophen Antipyretic & Analgesia

Order Items

	Preterm 28-32 wk 10 mg/kg PO	
☐	.Acetaminophen solution - mg, Oral, Every 12 hours	T
	Preterm 28-32 wk 15 mg/kg PO	
☐	.Acetaminophen solution - mg, Oral, Every 12 hours	T
	Preterm 28-32 wk Rectal	
☐	.Acetaminophen suppository - mg, Rectal, Every 12 hours	T
	Preterm 32-36wk 10mg/kg/dosePO	
☐	.Acetaminophen solution - mg, Oral, Every 8 hours	T
	Preterm 32-36 wk 15 mg/kg PO	
☐	.Acetaminophen solution - mg, Oral, Every 8 hours	T
	Preterm 32-36 wk Rectal	
☐	.Acetaminophen suppository - mg, Rectal, Every 8 hours	T
	0-3 months 10 mg/kg PO	
☐	.Acetaminophen solution - mg, Oral, Every 8 hours	T
	0-3 months 15 mg/kg PO	
☐	.Acetaminophen solution - mg, Oral, Every 8 hours	T
	0-3 months Rectal	
☐	.Acetaminophen suppository - mg, Rectal, Every 8 hours	T
	>3 months 10 mg/kg/dose PO	
☐	.Acetaminophen solution - mg, Oral, Every 4 hours	T
☐	.Acetaminophen solution - mg, Oral, Every 6 hours	T
☐	.Acetaminophen chewable tablet - mg, Oral	T
	>3 months 15 mg/kg/dose PO	
☐	.Acetaminophen solution - mg, Oral, Every 4 hours	T
☐	.Acetaminophen solution - mg, Oral, Every 6 hours	T
☐	.Acetaminophen chewable tablet - mg, Oral	T
	>3 months 20 mg/kg/dose Rectal	
☐	.Acetaminophen suppository - mg, Rectal, Every 6 hours	T
	Adults PO	
☐	.Acetaminophen tablet - 325 mg, Oral, Every 4 hours	T
☐	.Acetaminophen tablet - 325 mg, Oral, Every 6 hours	T
☐	.Acetaminophen tablet - 650 mg, Oral, Every 4 hours	T
☐	.Acetaminophen tablet - 650 mg, Oral, Every 6 hours	T


Pharmacy Order Form - Department, Infogram
.Acetaminophen solution - Department, Infogram
Order: .Acetaminophen solution
Order ID: 001679GFL
Requested By: Desai, Bimal MD
Template Name:
Messages:
Combined Measurements
Height (cm)
Weight (kg)
7.07
01/05/2007 13:20
BSA
BMI
Drug Information:
Dose:
105
mg
Route:
Oral
Route modifier:
Calculated Dose Information:
15 mg/kg/DOSE x 7.07 kg = 105 mg/Dose (Daily Total is 420 mg)
Start Date:
04/08/2007
Schedule:
Every 6 hours
STAT/Now/Start at:
PRN:
Duration:
Clear
Stop Date:
Stop Time:
Administration Instructions:
Repeat
View Document
OK
Cancel


Order Set Summary - Department, Infogram
Order Set:
Gentamicin IM/IV
Order Items
Laboratory
Gentamicin Trough Level - Blood Clinician to Collect *** Do not 'Add Specimen' to Peak and Trough at the same time.
With third dose
T
Clinician to Collect
Gentamicin Peak Level - Blood Clinician to Collect *** Do not 'Add Specimen' to Peak and Trough at the same time.
With third dose
T
Clinician to Collect
.Gentamicin injection - mg, Intravenous, q24h
T
Postnatal<7 days,28-34 wk gest
.Gentamicin injection - mg, Intravenous, q18h
T
Postnatal <7 days, >34 wk gest
.Gentamicin injection - mg, Intravenous, Every 12 hours
T
Postnatal >7 days, 1.2-2 kg
.Gentamicin injection - mg, Intravenous, Every 12 hours
T
Postnatal age >7 days, >2 kg
.Gentamicin injection - mg, Intravenous, Every 8 hours
T
ECMO pts (full term neonates)
.Gentamicin injection - mg, Intravenous, q18h
T
Infants & Children <10 years
.Gentamicin injection - mg, Intravenous, Every 8 hours
T
>10 years & Adult: 6 mg/kg/day
.Gentamicin injection - mg, Intravenous, Every 8 hours
T
Cystic fibrosis patients
.Gentamicin injection - mg, Intravenous, Every 8 hours
T
Oncology patients >1 year old
.Gentamicin injection - mg, Intravenous, Daily
T



Did it work?

FMEA Project Evaluation

- **Hypothesis**
  - Does FMEA-directed design of a CPOE user interface reduce prescribing errors?
- **Design**
  - Two-group non-equivalent quasi-experimental study

	2/04	3/04	4/04		2/05	3/05	4/05
FMEA	O	O	O	X	O	O	O
Non-FMEA	O	O	O		O	O	O

Project Evaluation

- Compared monthly error rates for 3 month period on CHIPPER and 3 month period on SCM

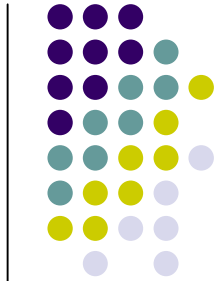
- Chose time points to mitigate “training effect” and seasonality of hospital census
  - **“Pre”** observation in Feb, March, April 2004
  - Transition took place October 2004
  - **“Post”** observation in Feb, March, April 2005

Project Evaluation

- Chose three representative **FMEA meds**
  - Gentamicin - IV anti-infective
  - Midazolam - IV or oral sedative
  - Acetaminophen - oral or rectal analgesic

- Chose three representative **non-FMEA meds** with high error rates
  - Oxacillin - IV anti-infective
  - Heparin - anticoagulant
  - Digoxin - cardiac glycoside with narrow therapeutic margin

Project Evaluation



- Compared rates of intercepted prescribing errors
- Data obtained from pharmacy-reported QI data
- Details the medication, intercepted-error, and action
- Normalized rates per 1000 inpatient episodes
- Categorized errors by type:
  - Drug-Allergy / Drug-Drug Interaction
  - Duplicate order
  - Therapeutic monitoring decision
  - Wrong route
  - Wrong interval
  - Wrong dose

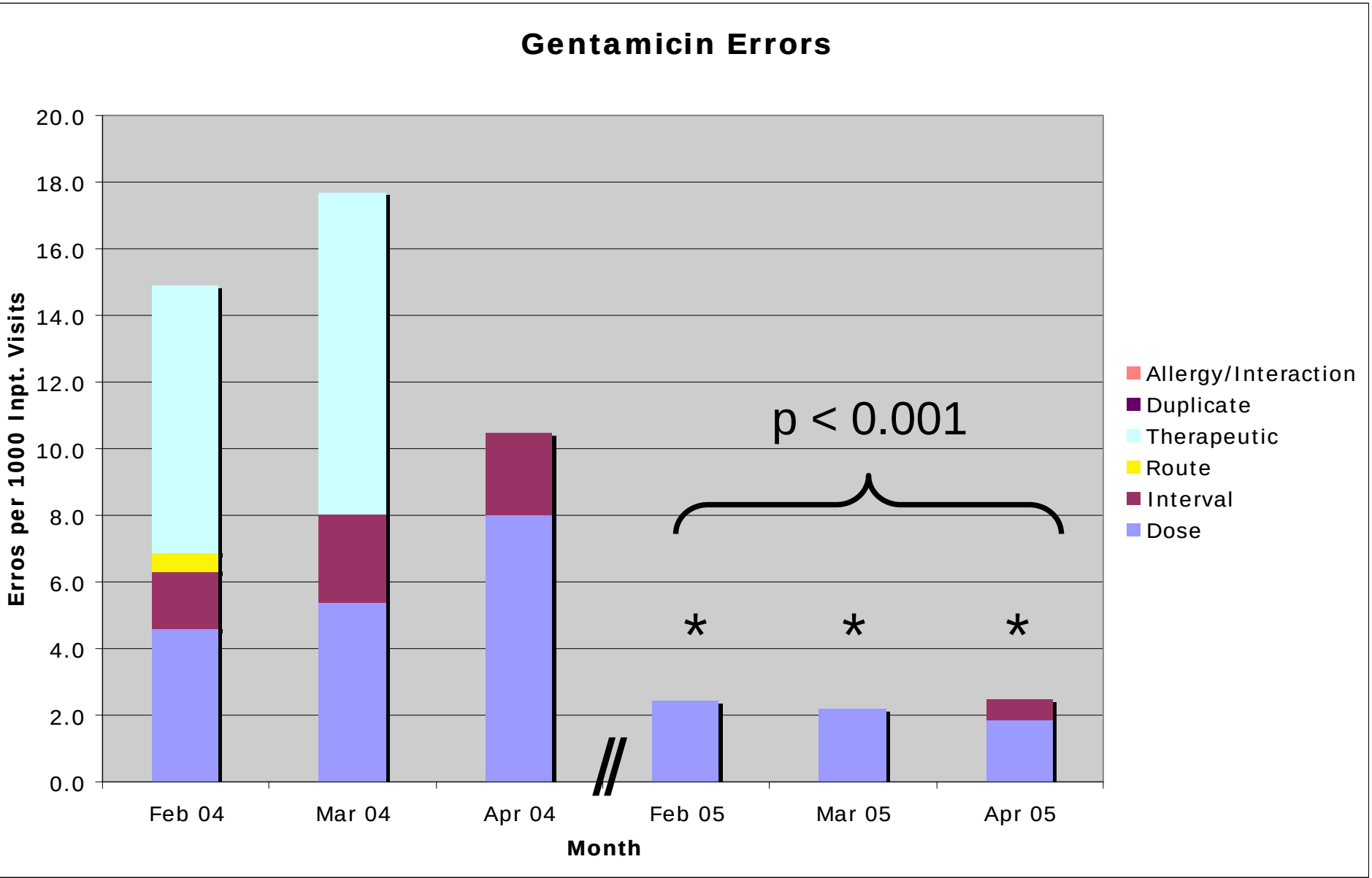
Inpatients per Month

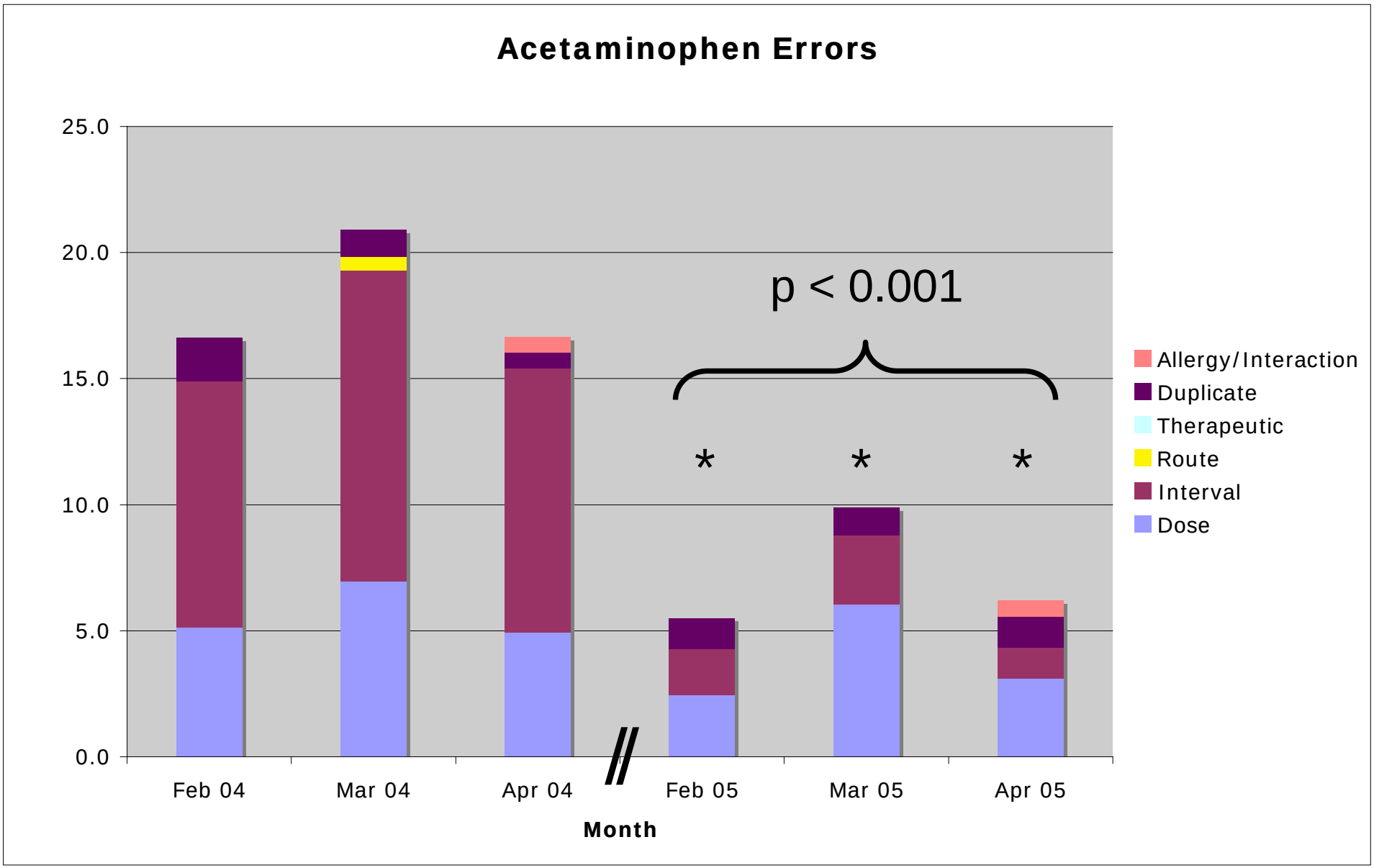
Month	Inpatient Episodes
Feb 2004	1747
March 2004	1866
April 2004	1623
2004 Total:	5236
Feb 2005	1636
March 2005	1824
April 2005	1617
2005 Total:	5077

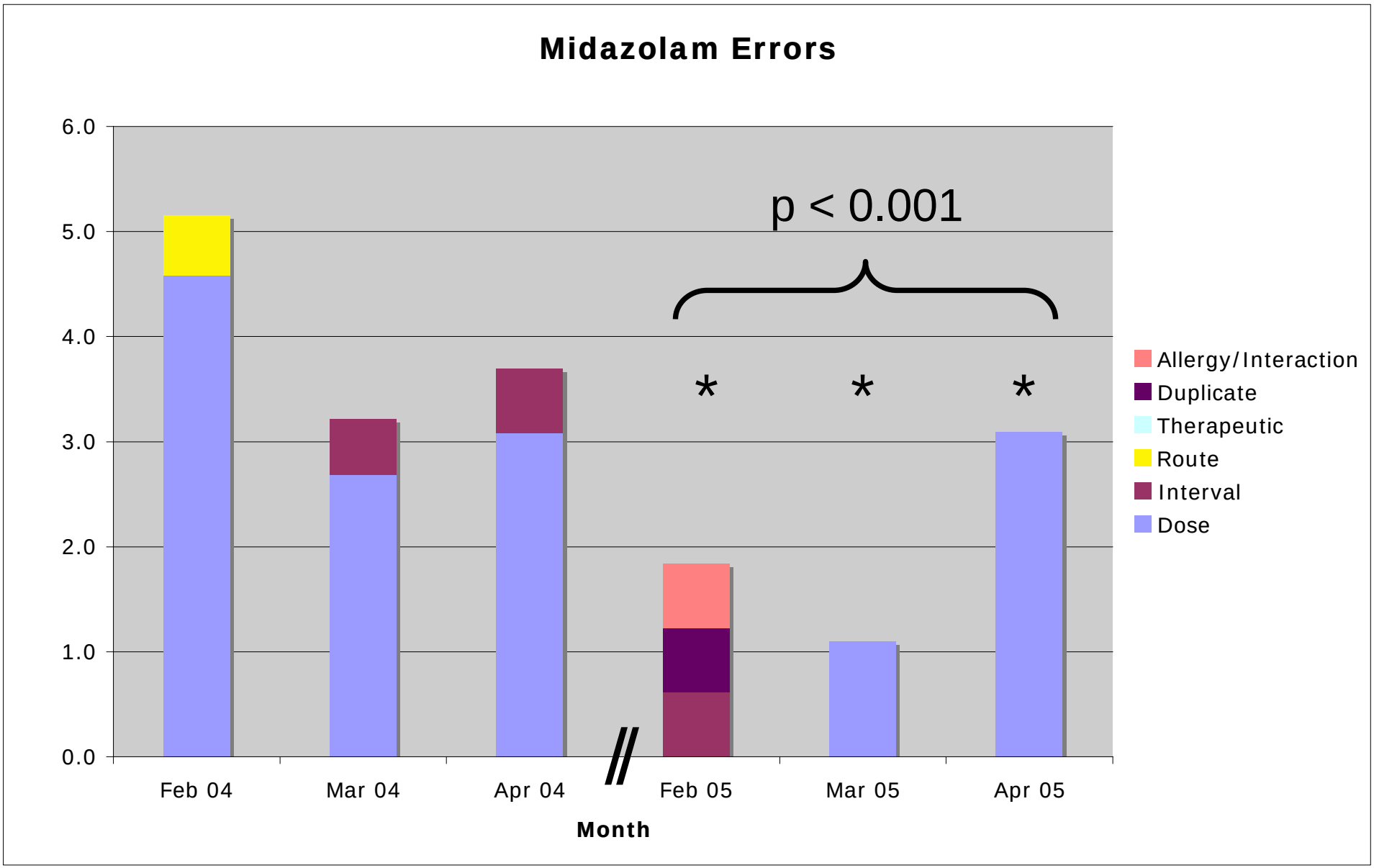
Errors per 1000 Patients

Medication	Feb-Apr 2004	Feb-Apr 2005	IRR*	95% CI	p
Gentamicin	19.1	4.5	**0.24**	0.14-0.38	<0.001
Acetaminophen	22.3	8.7	**0.39**	0.27-0.55	<0.001
Midazolam	10.7	4.7	**0.44**	0.26-0.72	<0.001
Oxacillin	4.0	2.7	0.69	0.32-1.42	0.28
Heparin	4.0	2.2	0.54	0.24-1.17	0.10
Digoxin	2.5	1.4	0.55	0.19-1.50	0.21

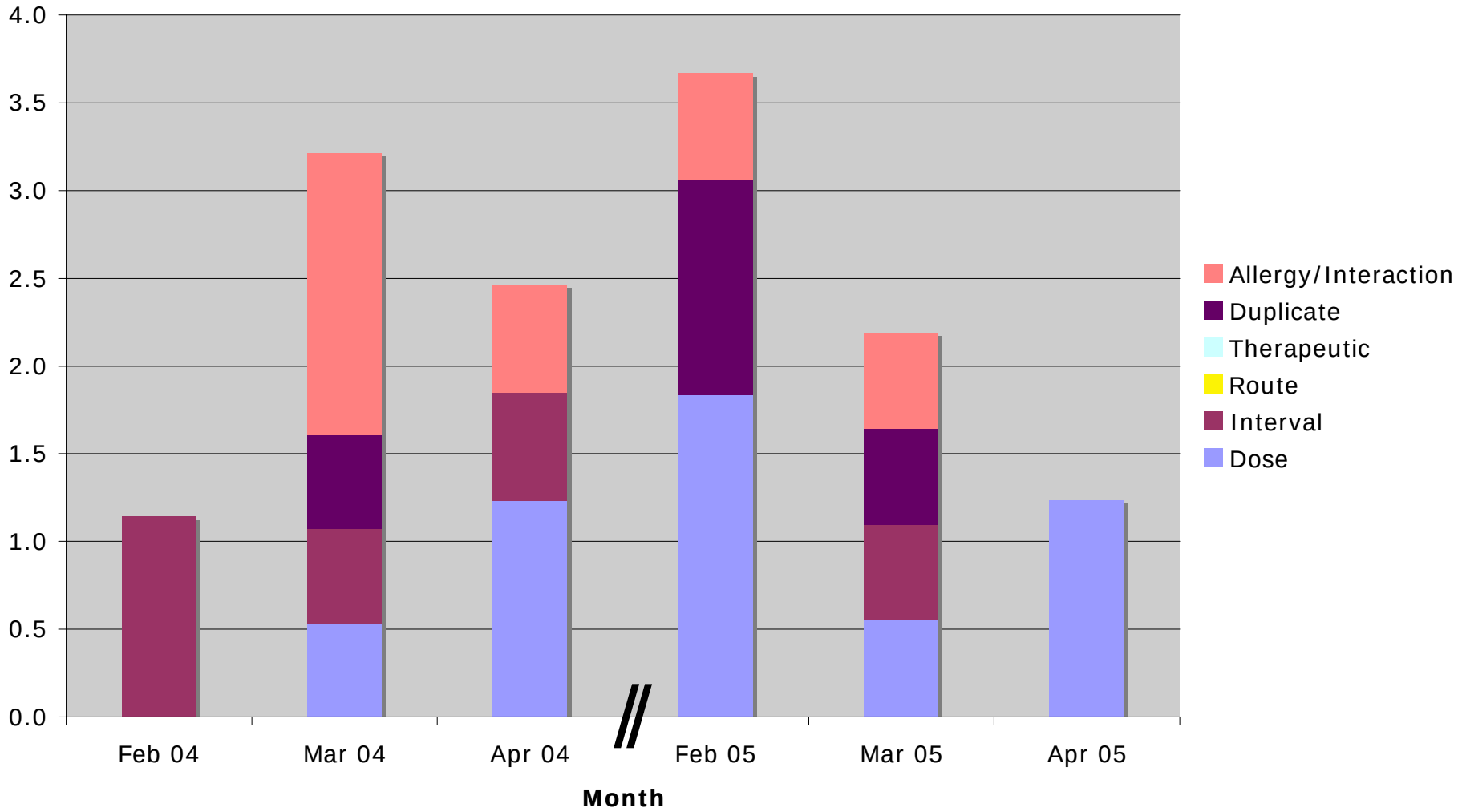
*Incidence rate ratio



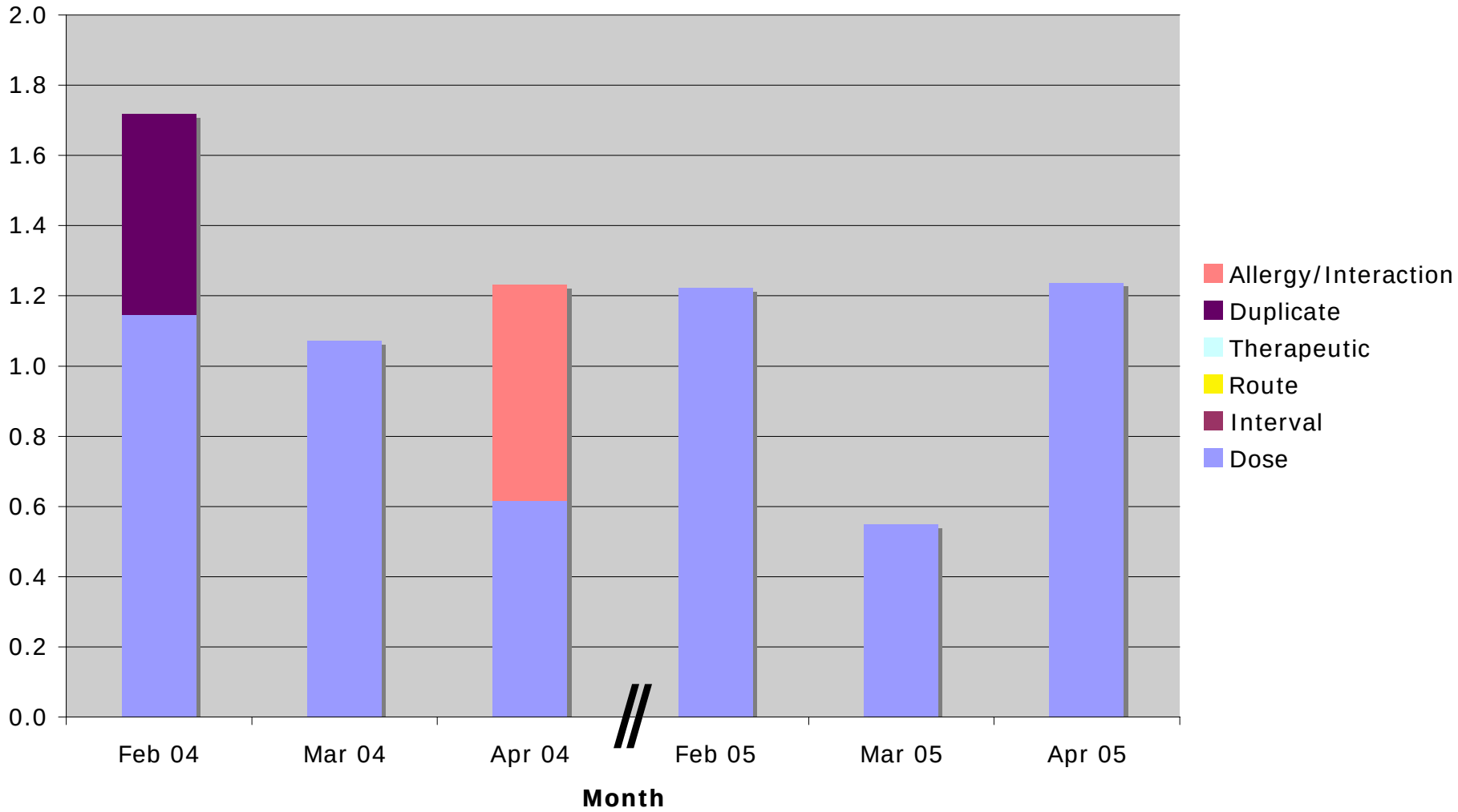




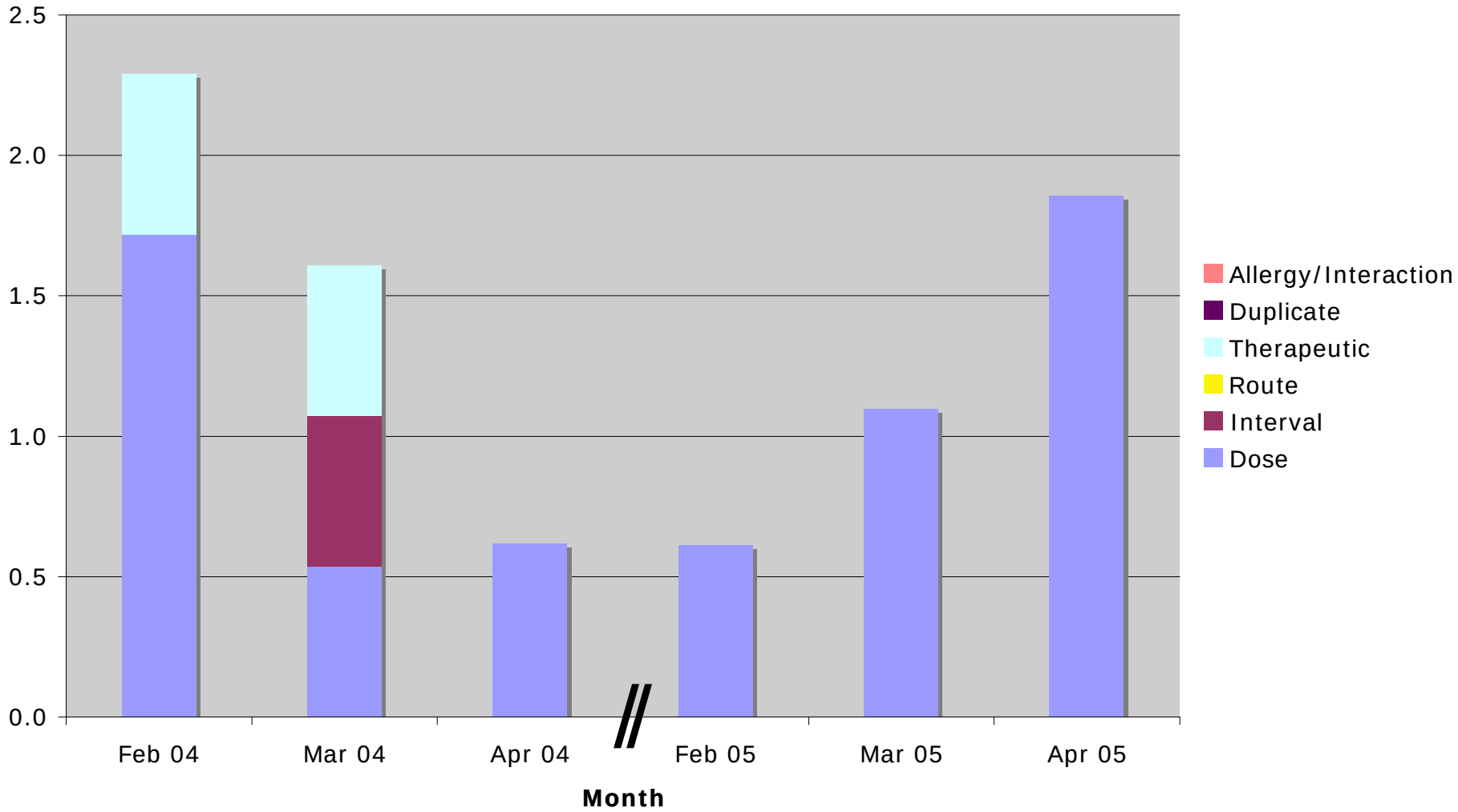
Oxacillin Errors



Heparin Errors



Digoxin Errors

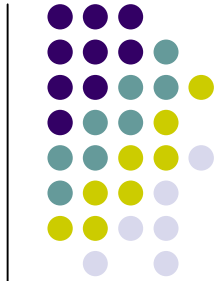


Results

- **FMEA meds**
  - significant reduction in incidence of prescribing errors
- **Non-FMEA meds**
  - no significant reduction in errors

- **Simply upgrading CPOE systems doesn't reduce errors**
- Rational design of user interface can be used for **targeted** reduction of prescribing errors

Limitations & Next Steps



- Quasi-experimental design
- Focused on meds with high rates of prescribing errors
- Only looked at 6 medications – really need all FMEA meds
- Only looked at 6 months – really need a run chart, time series
- Couldn't look at total orders in time-period
- Based on total charges, prescribing rate of heparin was lower and digoxin was higher in post-intervention period
  - Looking at all FMEA meds vs. all non-FMEA meds will minimize this variability

Acknowledgements

CHOP - CDS

- Rick Womer
- Tara Trimarchi
- Winson Soo-Hoo
- Deb Joers
- Gordon Zeis
- CDS Members

CHOP - PGRG

- Samir Shah

CBMI

- Pete White
- Bob Grundmeier

IRB

- Barbara LoDico

OHSU - MBI

- Bill Hersh
- Dean Sittig
- Paul Gorman

UIC
The University of Illinois at Chicago
Medical Center

CDS implementation to improve VTE prophylaxis at an academic medical center

AMIA Spring Congress 2007
CDS Panel S03

Bill Galanter MD/PhD
Medical Director, Clinical Information Systems
Department of Medicine
University of Illinois at Chicago

UIC
The University of Illinois at Chicago Medical Center

-450 Bed tertiary teaching hospital

-400,000 outpatient visits

-Near paperless inpatient & outpatient

-Large residencies

CPOE with TDS 1982→1999

CPOE with Cerner *Millennium*® >1999

UIC
The University of Illinois at Chicago Medical Center

Implemented CDS at UICMC

Medication related

Radio contrast Renal ←→ Renal/Metformin
Enoxaparin ←→ Heparin
Drug←→Renal Function
Drug➔Liver Disease
Digoxin
IV==>PO
Renal Function ←→ Nephrotoxic Drug
Hyperkalemia ←→ Medication
Heparin Dosing
Promethazine in Infants
NPO-Insulin
Drug←→Pregnancy
MRI-Patch
Saquinavir-Ritonavir-Rifampin
VTE Prophylaxis Checks
Drug←→Tube Feeds
Erythropoetin←→HCT
Medication Indication Documentation

Quality of Care

Lipid Screening
Mammography
Diabetic
Influenza
VTE Risk Assessment
VTE Treatment Prompts

Administrative

Admit Order
Unsigned orders at discharge

Communication

Admission notification
Discharge notification
New pathology notification
Renal Insufficiency

Documentation

Airborne Isolation
Fall Alerts
Discharge Planning
Social Work
Smoking Cessation Referral
Polypharmacy referral
Diagnosis Documentation

Calculations

Anion Gap
Creatinine Clearance
MDRD eGFR
Non-HDL Cholesterol
Adjusted Dilantin
Mean Blood Pressure

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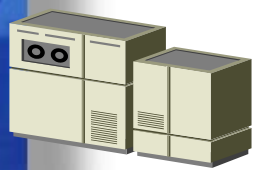
Alerts for Contraindication

Proportion of patients with renal dysfunction receiving Metformin when order started by clinician

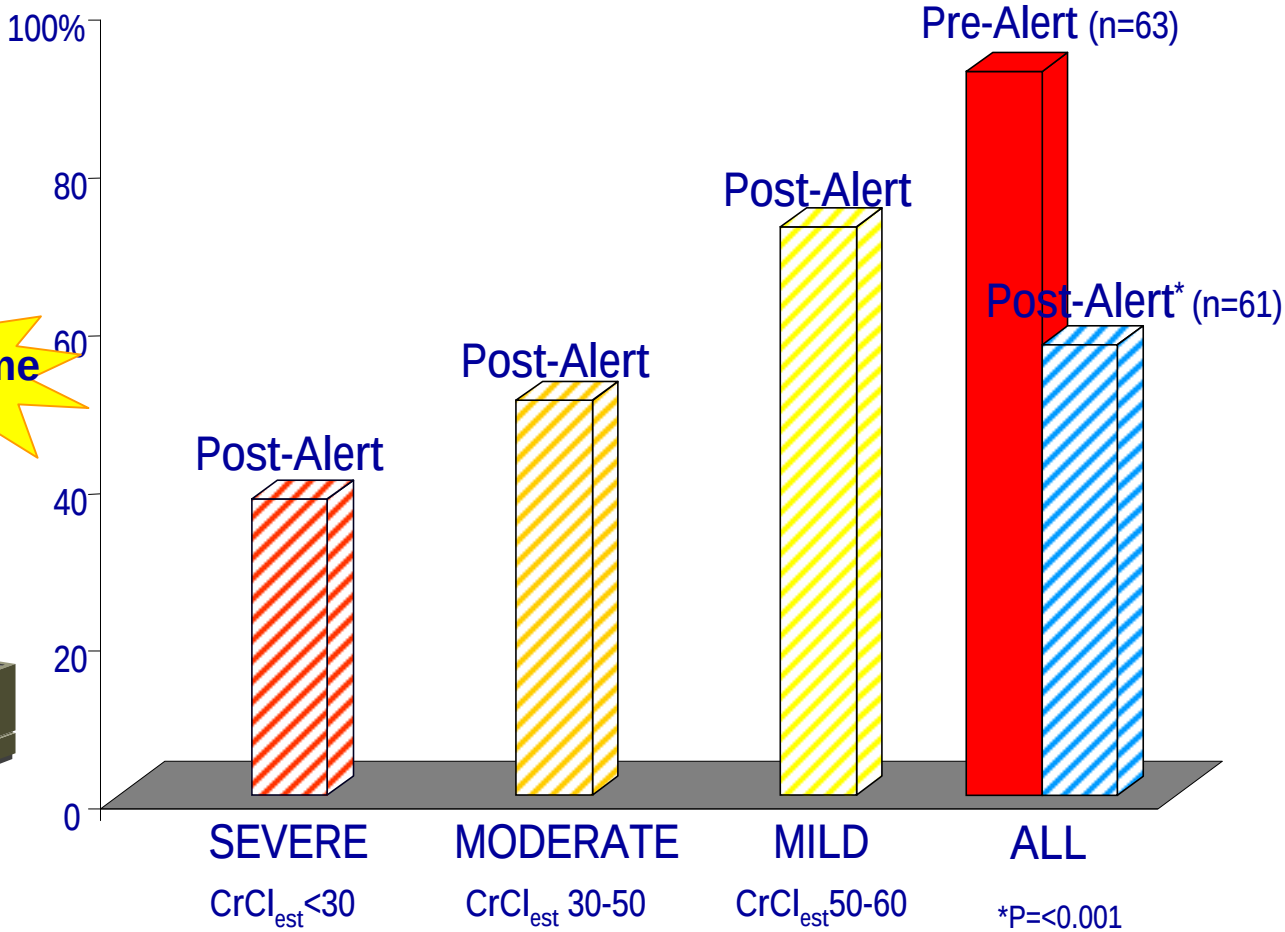
4-months pre-alert vs. 4-months post-alert

Provider

Real-Time Alert



EMR



Galanter et al. J Am Med Inform Assoc. 2005 May-Jun;12(3):269-74

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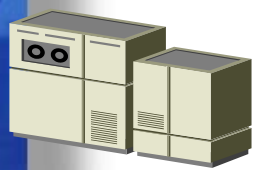
Alerts for Contrast Studies in patients with Renal Insufficiency

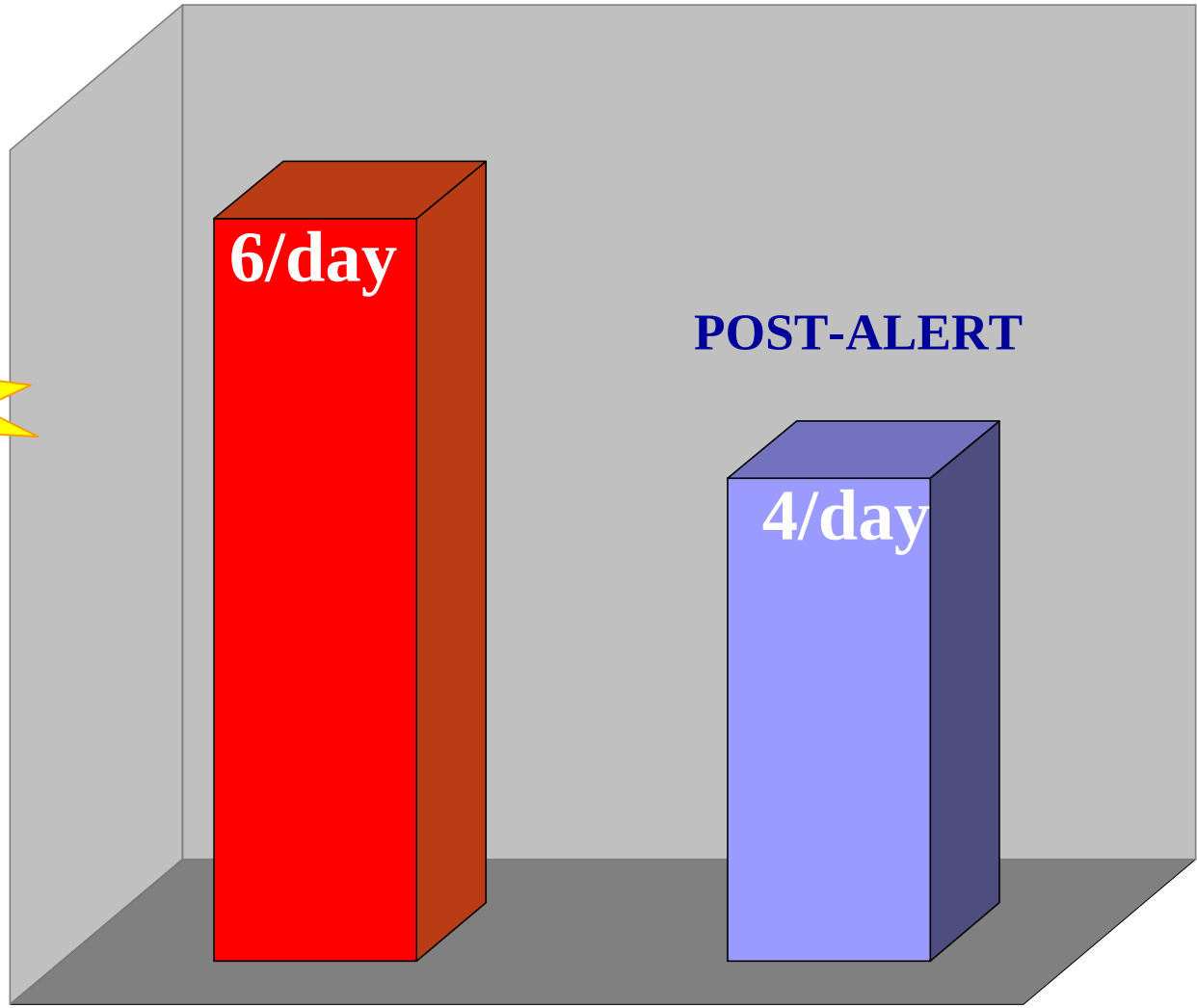
Provider

Real-Time Alert



EMR

Orders for IV contrast in patients with CrCL < 50 ml/min.



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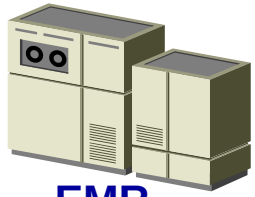
Asynchronous Alerts

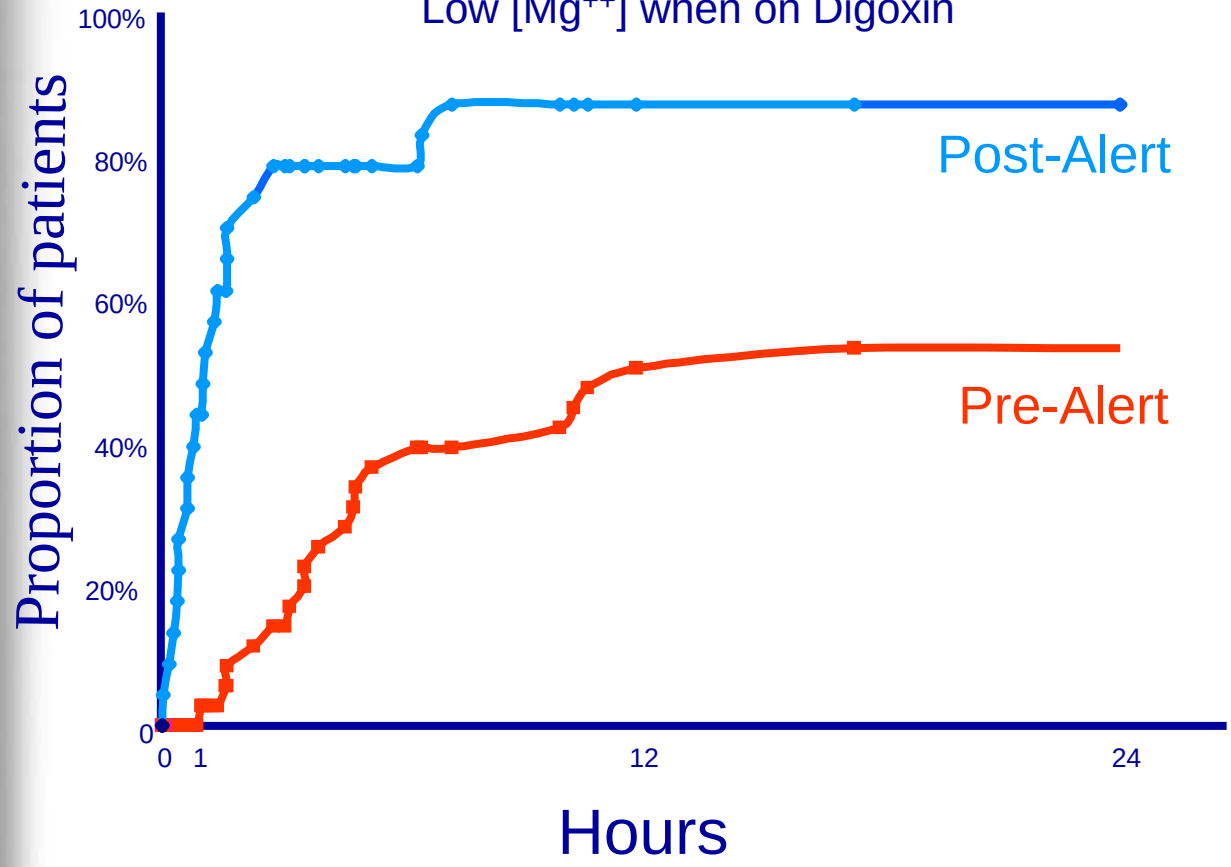
Lab results



EMR

Compliance with alert recommendations

Low [Mg^{++}] when on Digoxin



Provider

Galanter et al. J Am Med Inform Assoc. 2004 Jul-Aug;11(4):270-7.

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VTE prophylaxis at UIH

Stakeholders:
-Risk Management, VTE prophylaxis committee

Objectives:
-Increase risk assessments, increase use of prophylaxis & prevent events

Challenges:
-Making an accepted mandatory intervention.

Interventions:
-Real time alerts
-Risk assessment forms
-Order sets with pushed results
-Active surveillance with reminders.

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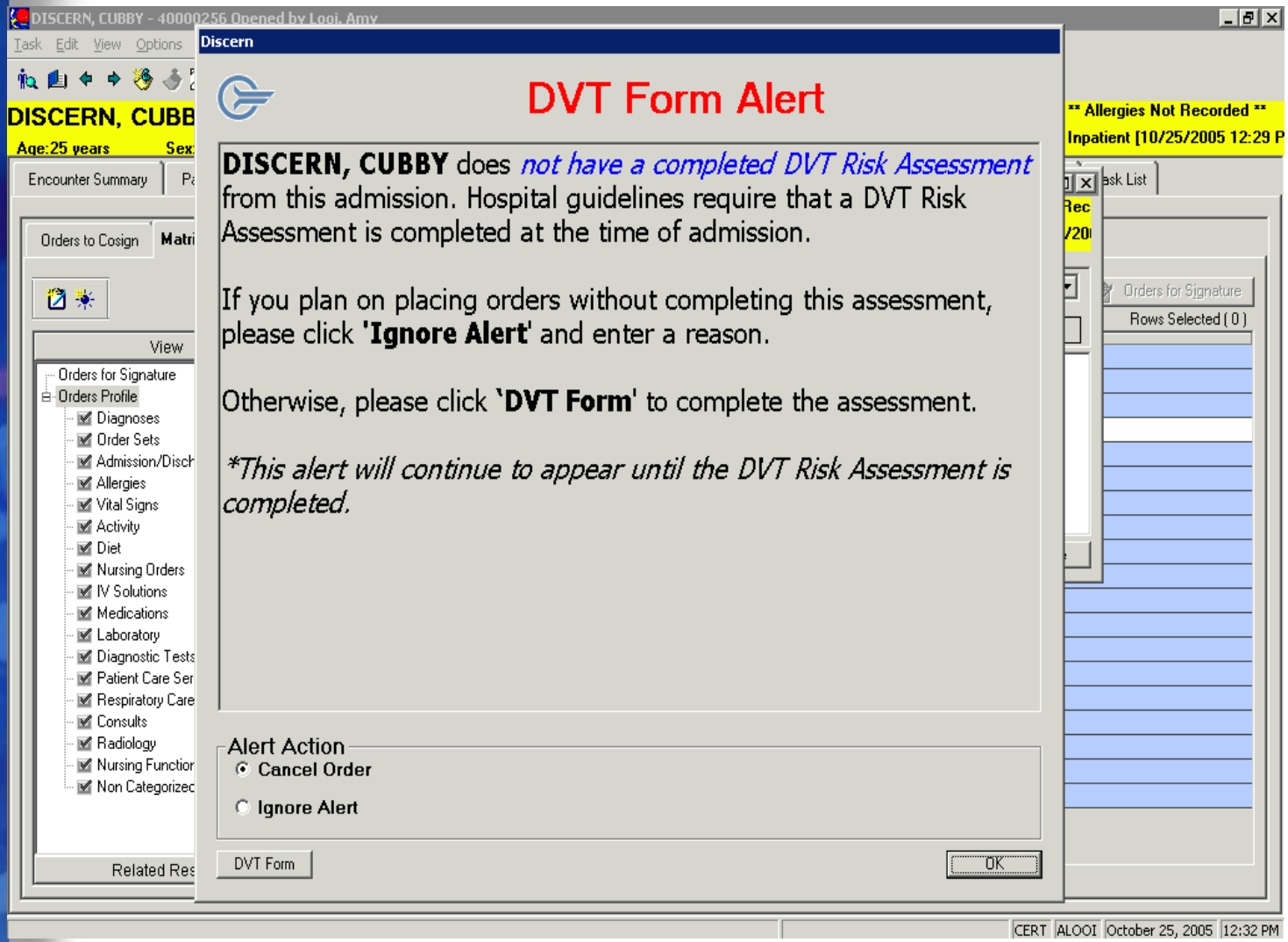
VTE risk assessment Alerts



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VTE risk assessment

DVT Risk Assessment

Is the intent to fully anticoagulate this patient (warfarin, IV heparin, treatment dose enoxaparin)?

(•) Yes ( ) No

Does the patient have any of the following contraindications to pharmacologic prophylaxis?

- [ ] None
- [ ] Spinal tap or epidural removal within last 2 hours
- [ ] High risk of or current major bleeding

Has the patient undergone or suffered any of the following?

- [ ] None
- [ ] Hip arthroplasty
- [ ] Knee arthroplasty
- [ ] Major trauma (multiple organ system injuries, multiple extremity fractures or pelvic fractures)
- [ ] Acute spinal cord injury resulting in lower extremity paralysis

If hip arthroplasty is checked, use one of the following:

warfarin (goal INR 2-3) starting the evening of surgery
enoxaparin 30 mg SC Q12 hr starting 12-24 hr post-op
enoxaparin 40 mg SC Q24 hr starting 2 hr pre-op

fondaparinux 2.5 mg SC Q24 hr starting 6-8 hr post-op

If knee arthroplasty is checked, use one of the following:

warfarin (goal INR 2-3) starting the evening of surgery
enoxaparin 30 mg SC Q12 hr starting 12-24 hr post-op
fondaparinux 2.5 mg SC Q24 hr starting 6-8 hr post-op

If "Major trauma" or "Acute spinal cord injury..." is checked, use enoxaparin 30 mg SC Q12 hr once primary hemostatis is ensured.

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VTE risk assessment

WARNINGS

Warfarin is absolutely contraindicated during pregnancy.
Enoxaparin dose in patients with creatinine clearance <30 ml/min is 30 mg SC Q24 hr.
Enoxaparin dose in extremely obese patients (BMI >50 kg/m2) is 40 mg SC Q12 hr.

Fondaparinux is contraindicated in patients with creatinine clearance <30 ml/min.
Enoxaparin and heparin are absolutely contraindicated in patients with a history of being heparin-induced-thrombocytopenia antibody positive (HIT+).

Does the patient have any of the following risk factors for DVT?

- ☐ None
- ☐ Acute ischemic stroke
- ☐ Age >60 years
- ☐ Cancer or brain tumor
- ☐ Congestive Heart Failure
- ☐ Current estrogen or estrogen receptor modulator (tamoxifen) use
- ☐ Expected or current immobility >24 hours
- ☐ History of DVT or PE
- ☐ Hypercoagulable state (e. g., protein C deficiency, protein S deficiency, antithrombin deficiency, antiphospholipid syndrome, prothrombin G20210A, etc.)
- ☐ Lung disease requiring oxygen or inability to walk >1 block
- ☐ Obesity (BMI >30 kg/m2)
- ☐ Surgery requiring full admission

If anything other than "None" is checked, use heparin 5,000 Units SC Q8-12 hr.

WARNING

Enoxaparin and heparin are absolutely contraindicated in patients with a history of being heparin-induced-thrombocytopenia antibody positive (HIT+).

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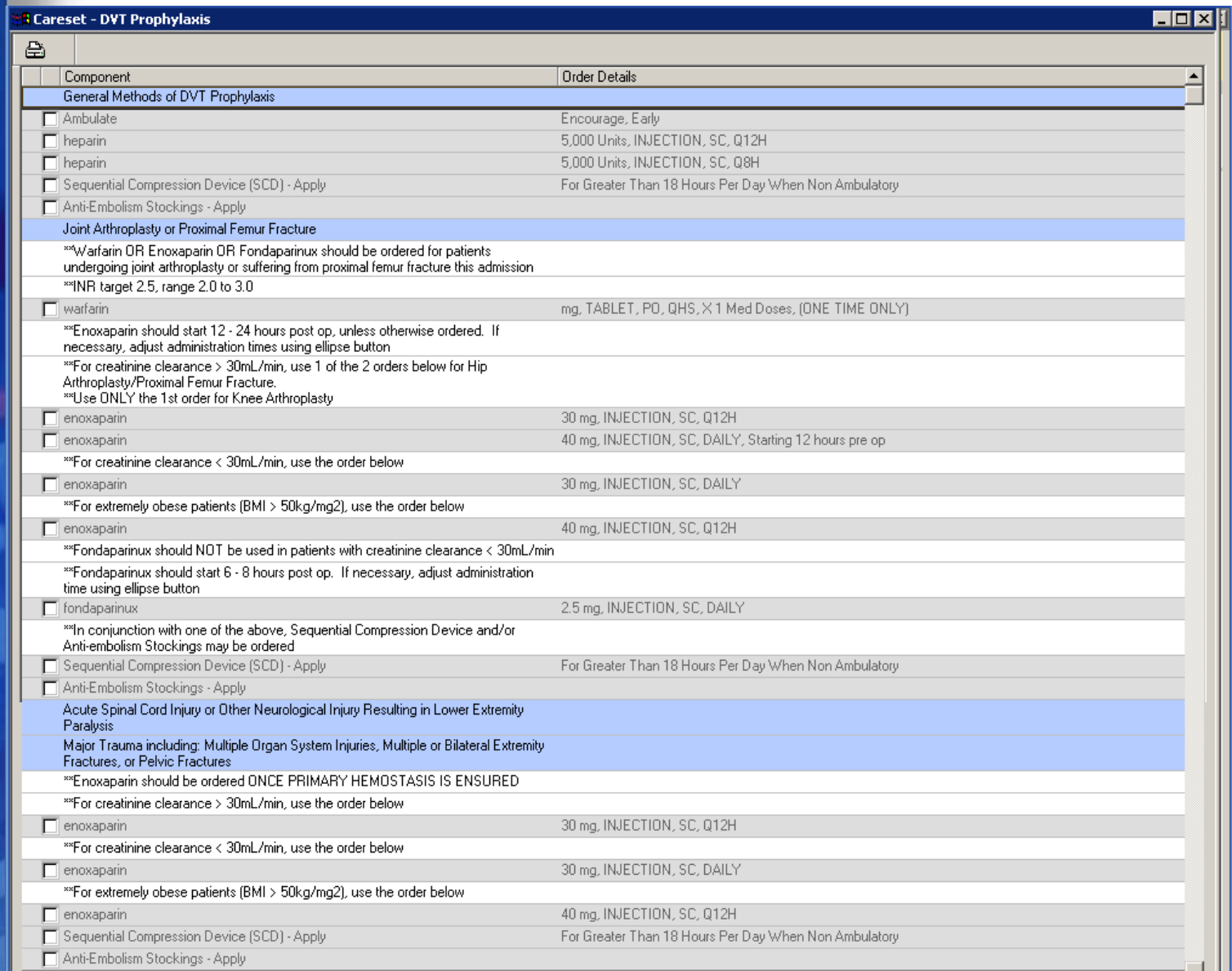
Order sets for VTE



Careset - DVT Prophylaxis

Component	Order Details
General Methods of DVT Prophylaxis	
Ambulate	Encourage, Early
heparin	5,000 Units, INJECTION, SC, Q12H
heparin	5,000 Units, INJECTION, SC, Q8H
Sequential Compression Device (SCD) - Apply	For Greater Than 18 Hours Per Day When Non Ambulatory
Anti-Embolism Stockings - Apply	
Joint Arthroplasty or Proximal Femur Fracture	
**Warfarin OR Enoxaparin OR Fondaparinux should be ordered for patients undergoing joint arthroplasty or suffering from proximal femur fracture this admission	
**INR target 2.5, range 2.0 to 3.0	
warfarin	mg, TABLET, PO, QHS, X 1 Med Doses, (ONE TIME ONLY)
**Enoxaparin should start 12 - 24 hours post op, unless otherwise ordered. If necessary, adjust administration times using ellipse button	
**For creatinine clearance > 30mL/min, use 1 of the 2 orders below for Hip Arthroplasty/Proximal Femur Fracture. **Use ONLY the 1st order for Knee Arthroplasty	
enoxaparin	30 mg, INJECTION, SC, Q12H
enoxaparin	40 mg, INJECTION, SC, DAILY, Starting 12 hours pre op
**For creatinine clearance < 30mL/min, use the order below	
enoxaparin	30 mg, INJECTION, SC, DAILY
**For extremely obese patients (BMI > 50kg/mg2), use the order below	
enoxaparin	40 mg, INJECTION, SC, Q12H
**Fondaparinux should NOT be used in patients with creatinine clearance < 30mL/min	
**Fondaparinux should start 6 - 8 hours post op. If necessary, adjust administration time using ellipse button	
fondaparinux	2.5 mg, INJECTION, SC, DAILY
**In conjunction with one of the above, Sequential Compression Device and/or Anti-embolism Stockings may be ordered	
Sequential Compression Device (SCD) - Apply	For Greater Than 18 Hours Per Day When Non Ambulatory
Anti-Embolism Stockings - Apply	
Acute Spinal Cord Injury or Other Neurological Injury Resulting in Lower Extremity Paralysis	
Major Trauma including: Multiple Organ System Injuries, Multiple or Bilateral Extremity Fractures, or Pelvic Fractures	
**Enoxaparin should be ordered ONCE PRIMARY HEMOSTASIS IS ENSURED	
**For creatinine clearance > 30mL/min, use the order below	
enoxaparin	30 mg, INJECTION, SC, Q12H
**For creatinine clearance < 30mL/min, use the order below	
enoxaparin	30 mg, INJECTION, SC, DAILY
**For extremely obese patients (BMI > 50kg/mg2), use the order below	
enoxaparin	40 mg, INJECTION, SC, Q12H
Sequential Compression Device (SCD) - Apply	For Greater Than 18 Hours Per Day When Non Ambulatory
Anti-Embolism Stockings - Apply	

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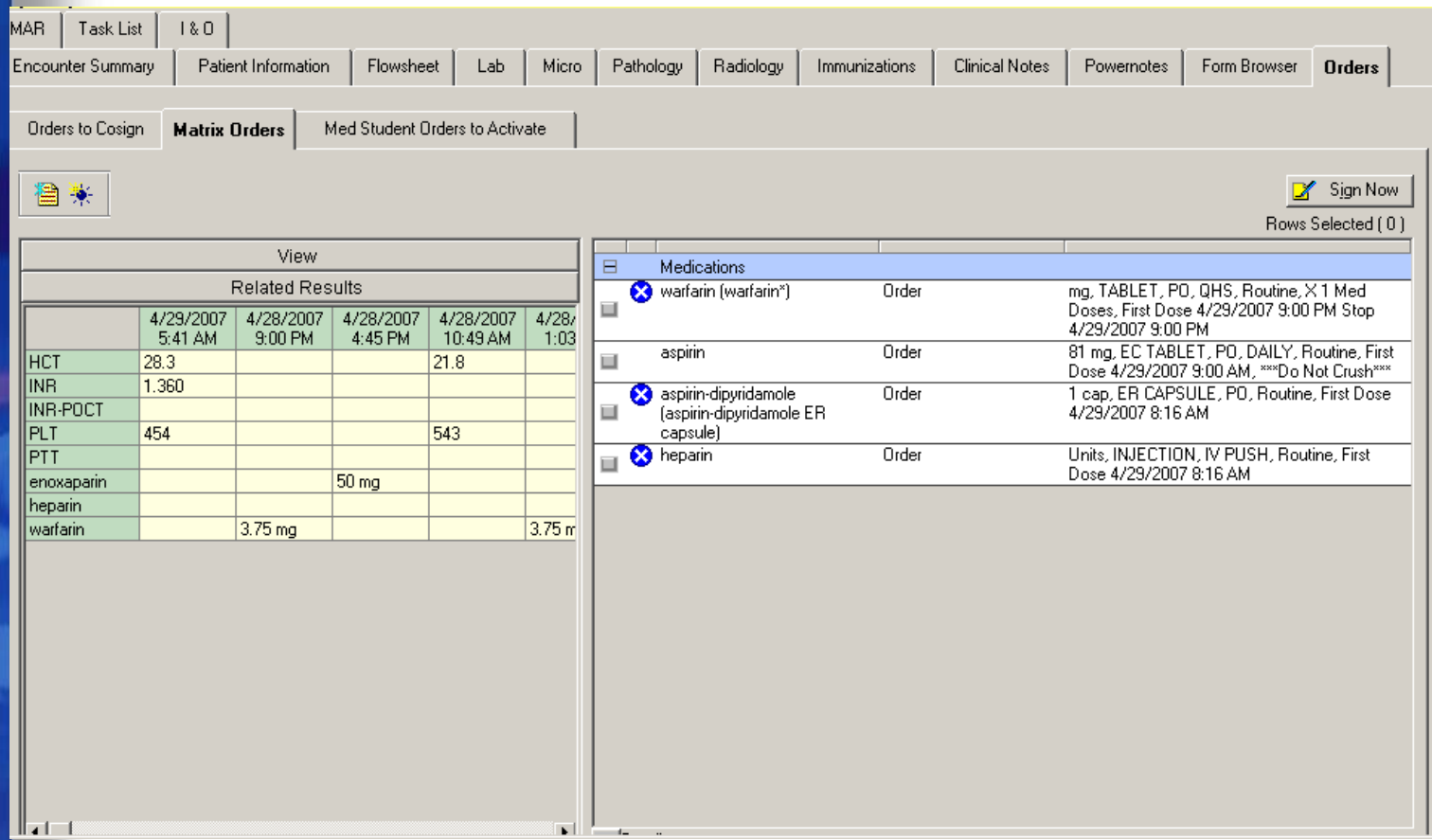
Pushed labs for VTE orders



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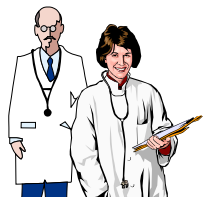
Nightly active surveillance

CDS
Engine



Physician
team

data
risk form

Med
Orders

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What Happened

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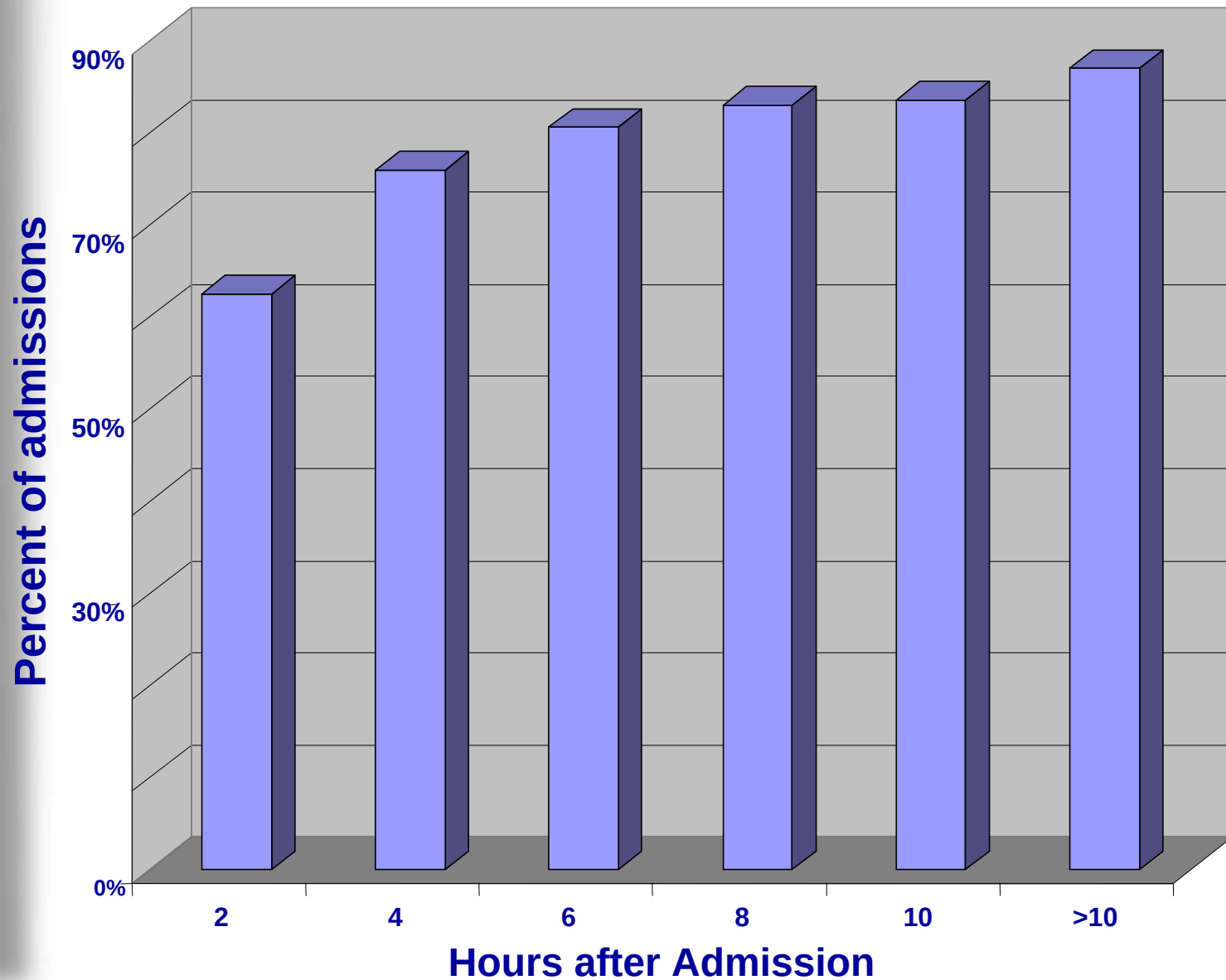
VTE risk assessment

Assessment completion vs. Time



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VTE prophylaxis CDS at UIH

Results of a 5-month trial on prophylaxis rates

	Historical Control	Trial	
Number of patients	5,505	4,598	
Average age	46.4 +/-18.3 years	47.1+/-18.5 years	NS
% Female	64.9%	64.8%	NS
RESULTS			
Type of prophylaxis			
Enoxaparin	2.94%	2.65%	NS
Fondaparinux	0.16%	0.20%	NS
Heparin sub-cutaneous	24.7%	33.7%	P<0.001
Warfarin for total knee or hip arthroplasty	0.25%	0.24%	NS
Total pharmacologic	27.6%	36.5%	P<0.001
Mechanical	30.0%	29.8%	NS
Any form of prophylaxis	43.1%	50.6%	P<0.001

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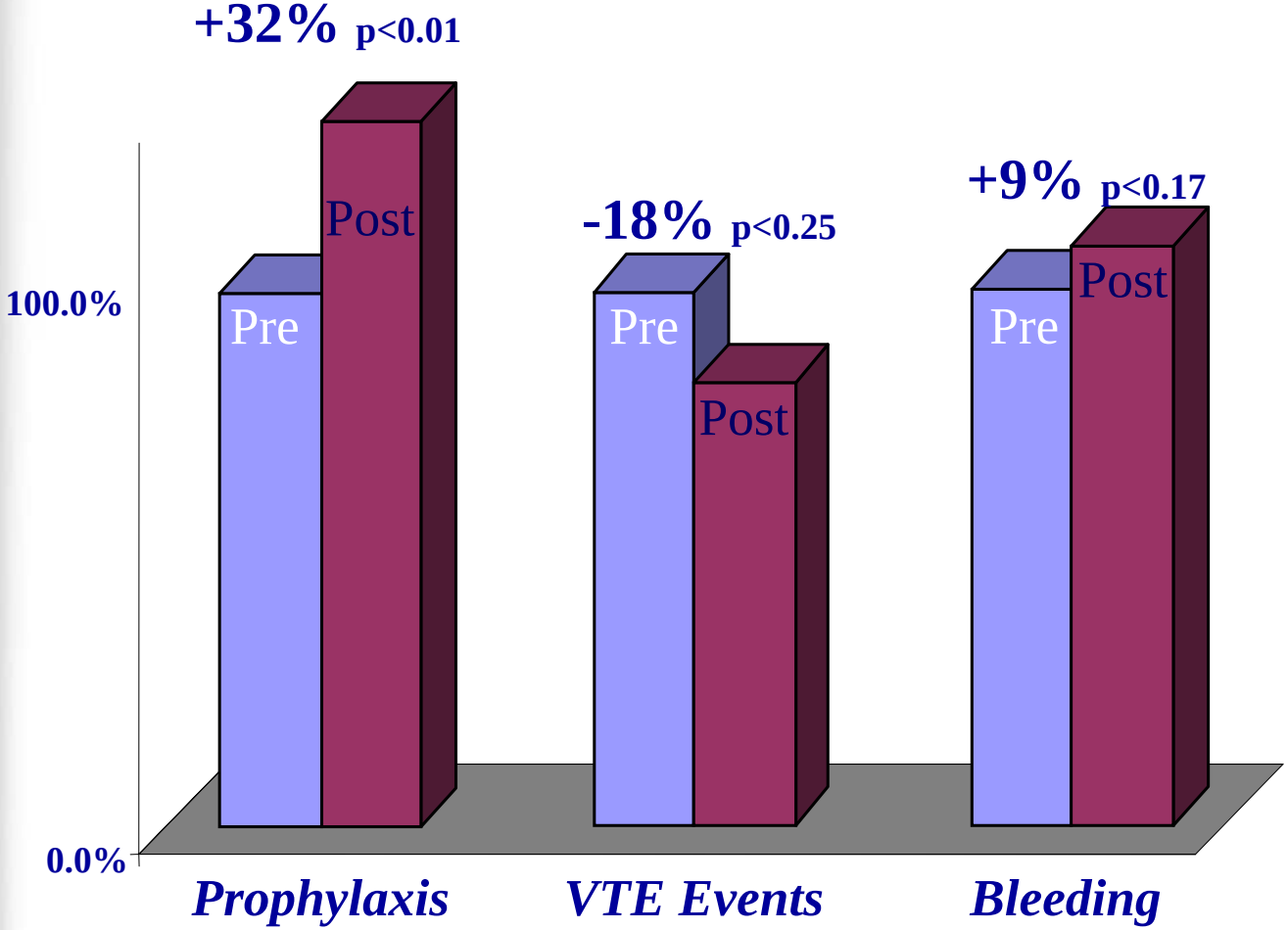
VTE prophylaxis CDS at UIH

Results of a 1 year trial on clinical outcomes



NNT: 1 additional patient on Sub-Q Heparin for every 11 adult admissions

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Acknowledgements

IS: Lisa Canonge, Marla Lax, Amy Looi, Audrius Polikaitis, Jennifer Welch,

Pharmacy: Carson Bording, Rob Didomenico, Kelly Kopek, Jamie Paek, Mat Thambi

Medical Staff: Dan Hier, Mark Kushner, Holly Rosencranz, David Sarne, David Williams

History of the EHR in VHA

CPRS - Computerized Patient Record System

Mark Graber, MD

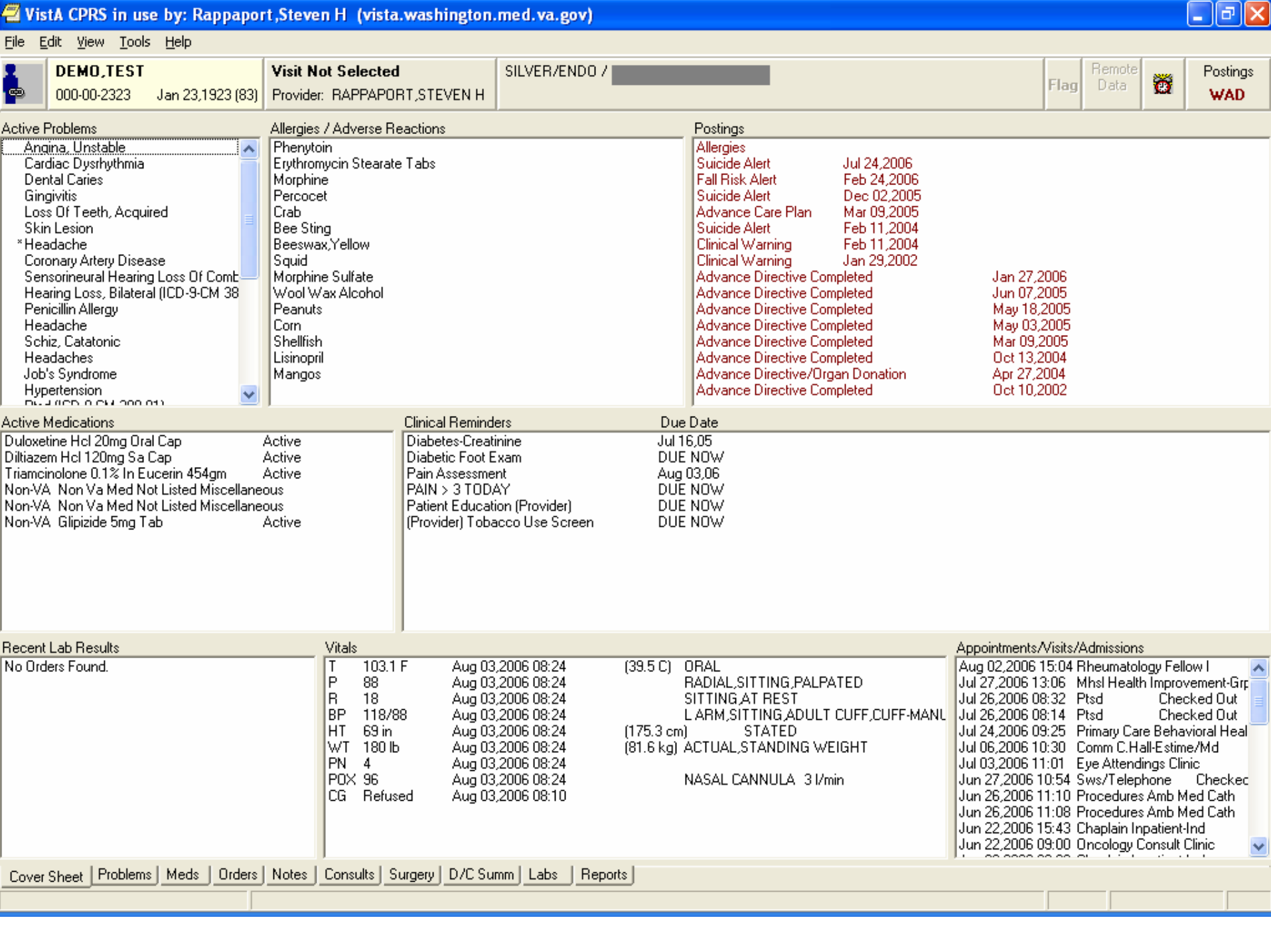
- Official deployment in 1982
  - Lab, pharmacy, scheduling
- Imaging - 1992
- Order Entry / Results Reporting 1994
- GUI 1998
- BCMA 2000

CPRS Usage

- 1.1B orders, 1M/day
- 200M Images, 350k/day
- 500M Notes & Documents, 500k/day
- 500M Meds admin via BCMA, 500k/day
- 1M lab results /day
- 200M Outpatient Rx’s dispensed/year

Integrated Packages – Clinical

- CPRS - Order Entry / Results Reporting
- Pharmacy, Laboratory, Radiology / Imaging
- Surgery, Medicine, Procedures
- Nursing, Social Work,
- Nutrition & Food Service
- Audiology and Speech Pathology
- Billing, , Scheduling, Registries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File Edit View Tools Help
DEMO,TEST
000-00-2323 Jan 23,1923 (83)
Visit Not Selected
Provider: RAPPAPORT,STEVEN H
SILVER/ENDO /
Flag
Remote Data
Postings
WAD
Active Problems
Angina, Unstable
Cardiac Dysrhythmia
Dental Caries
Gingivitis
Loss Of Teeth, Acquired
Skin Lesion
*Headache
Coronary Artery Disease
Sensorineural Hearing Loss Of Comb
Hearing Loss, Bilateral (ICD-9-CM 38
Penicillin Allergy
Headache
Schiz, Catatonic
Headaches
Job's Syndrome
Hypertension
Allergies / Adverse Reactions
Phenytoin
Erythromycin Stearate Tabs
Morphine
Percocet
Crab
Bee Sting
Beeswax,Yellow
Squid
Morphine Sulfate
Wool Wax Alcohol
Peanuts
Corn
Shellfish
Lisinopril
Mangos
Postings
Allergies
Suicide Alert Jul 24,2006
Fall Risk Alert Feb 24,2006
Suicide Alert Dec 02,2005
Advance Care Plan Mar 09,2005
Suicide Alert Feb 11,2004
Clinical Warning Feb 11,2004
Clinical Warning Jan 29,2002
Advance Directive Completed Jan 27,2006
Advance Directive Completed Jun 07,2005
Advance Directive Completed May 18,2005
Advance Directive Completed May 03,2005
Advance Directive Completed Mar 09,2005
Advance Directive Completed Oct 13,2004
Advance Directive/Organ Donation Apr 27,2004
Advance Directive Completed Oct 10,2002
Active Medications
Duloxetine Hcl 20mg Oral Cap Active
Diltiazem Hcl 120mg Sa Cap Active
Triamcinolone 0.1% In Eucerin 454gm Active
Non-VA Non Va Med Not Listed Miscellaneous
Non-VA Non Va Med Not Listed Miscellaneous
Non-VA Glipizide 5mg Tab Active
Clinical Reminders Due Date
Diabetes-Creatinine Jul 16,05
Diabetic Foot Exam DUE NOW
Pain Assessment Aug 03,06
PAIN > 3 TODAY DUE NOW
Patient Education (Provider) DUE NOW
(Provider) Tobacco Use Screen DUE NOW
Recent Lab Results
No Orders Found.
Vitals
T 103.1 F Aug 03,2006 08:24 (39.5 C) ORAL
P 88 Aug 03,2006 08:24 RADIAL,SITTING,PALPATED
R 18 Aug 03,2006 08:24 SITTING,AT REST
BP 118/88 Aug 03,2006 08:24 L ARM,SITTING,ADULT CUFF,CUFF-MANU
HT 69 in Aug 03,2006 08:24 (175.3 cm) STATED
WT 180 lb Aug 03,2006 08:24 (81.6 kg) ACTUAL,STANDING WEIGHT
PN 4 Aug 03,2006 08:24
POX 96 Aug 03,2006 08:24 NASAL CANNULA 3 l/min
CG Refused Aug 03,2006 08:10
Appointments/Visits/Admissions
Aug 02,2006 15:04 Rheumatology Fellow I
Jul 27,2006 13:06 Mhsl Health Improvement-Grp
Jul 26,2006 08:32 Ptsd Checked Out
Jul 26,2006 08:14 Ptsd Checked Out
Jul 24,2006 09:25 Primary Care Behavioral Heal
Jul 06,2006 10:30 Comm C.Hall-Estime/Md
Jul 03,2006 11:01 Eye Attendings Clinic
Jun 27,2006 10:54 Sws/Telephone Checkec
Jun 26,2006 11:10 Procedures Amb Med Cath
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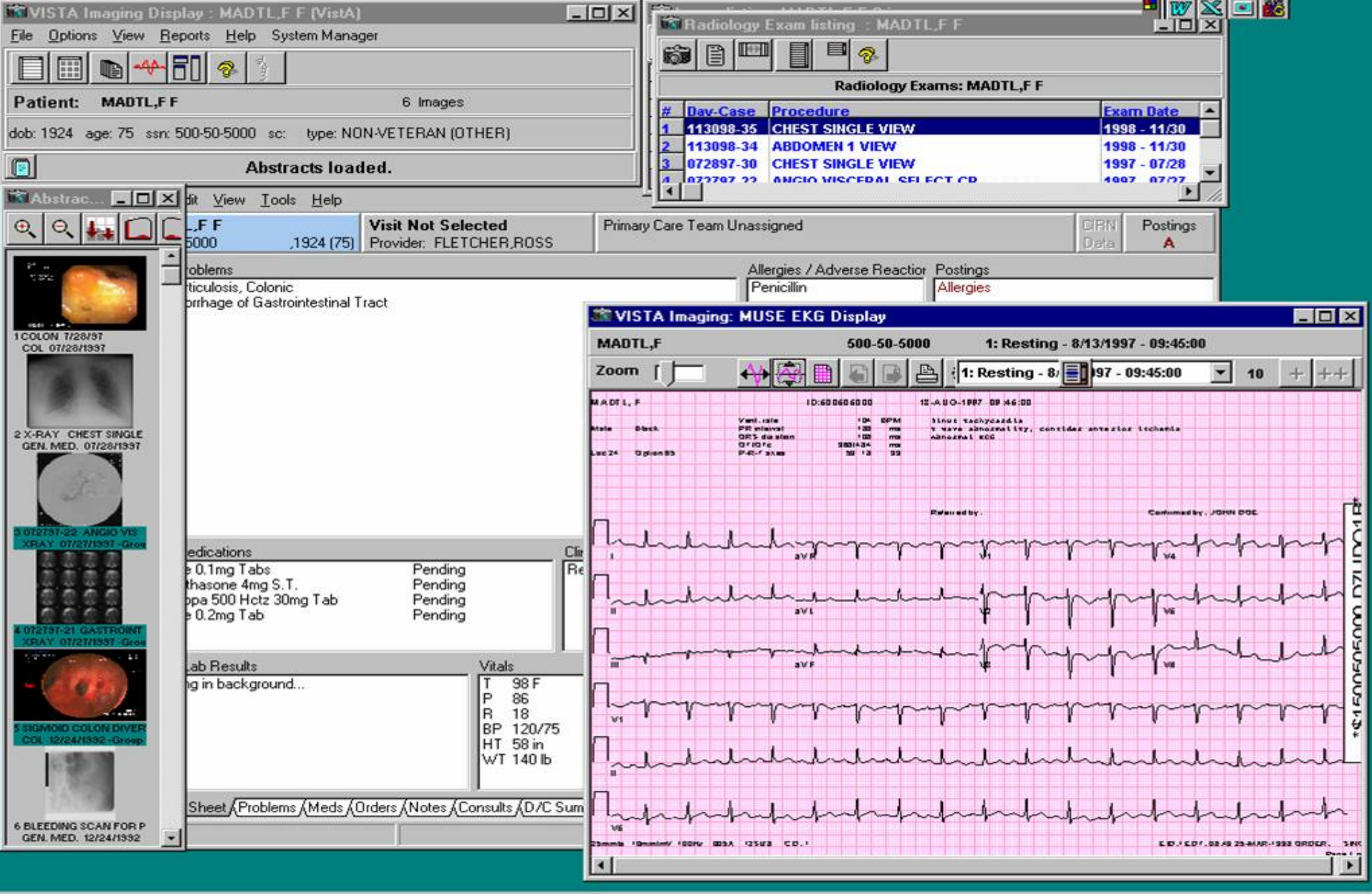
Orders
Notes
Consults
Surgery
D/C Summ
Labs
Reports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File Options View Reports Help System Manager
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6 Images
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Abstracts loaded.
Radiology Exam listing : MADTL,F F
Radiology Exams: MADTL,F F
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1 113098-35 CHEST SINGLE VIEW 1998 - 11/30
2 113098-34 ABDOMEN 1 VIEW 1998 - 11/30
3 072897-30 CHEST SINGLE VIEW 1997 - 07/28
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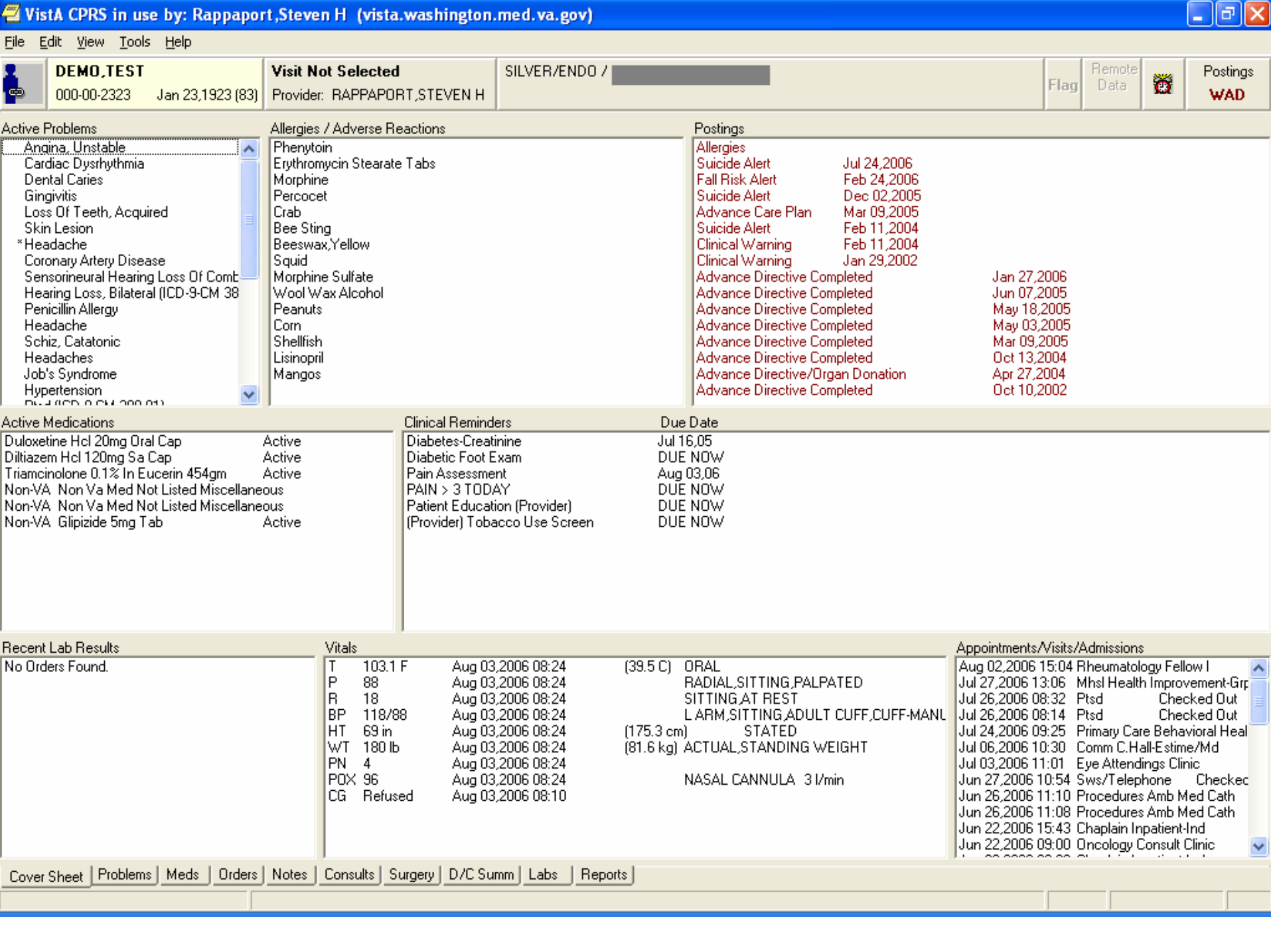
Provider: FLETCHER,ROSS
Primary Care Team Unassigned
CPRS Data
Postings A
Problems
Allergies / Adverse Reactior
Penicillin
Postings
Allergies
Medications
0.1mg Tabs Pending
Pending
Pending
0.2mg Tab Pending
Lab Results
in background...
Vitals
T 98 F
P 86
R 18
BP 120/75
HT 58 in
WT 140 lb
Sheet Problems Meds Orders Notes Consults D/C Sum
1 COLON 7/28/97
COL 07/28/1997
2 X-RAY CHEST SINGLE
GEN. MED. 07/28/1997
3 072797-22 ANGIO VIS
XRAY 07/27/1997 -Grou
4 072797-21 GASTROINT
XRAY 07/27/1997 -Grou
5 SIGMOID COLON DIVER
COL 12/24/1992 -Group
6 BLEEDING SCAN FOR P
GEN. MED. 12/24/1992
VISTA Imaging: MUSE EKG Display
MADTL,F
500-50-5000
1: Resting - 8/13/1997 - 09:45:00
Zoom
Sinus tachycardia
T wave abnormality, consider anterior ischemia
Abnormal ECG

Decision Support in CPRS

- Alerts (Order checking, allergies, meds)
- Reminders
- Smart orders
- Dialogue notes with embedded links
- Online access to books, journals, e-tools

Using “Reminders”

- VHA has set national goals for providing preventive health services
- These goals are communicated to the field, CDS provided in the form of “Reminders”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Morphine
Percocet
Crab
Bee Sting
Beeswax,Yellow
Squid
Morphine Sulfate
Wool Wax Alcohol
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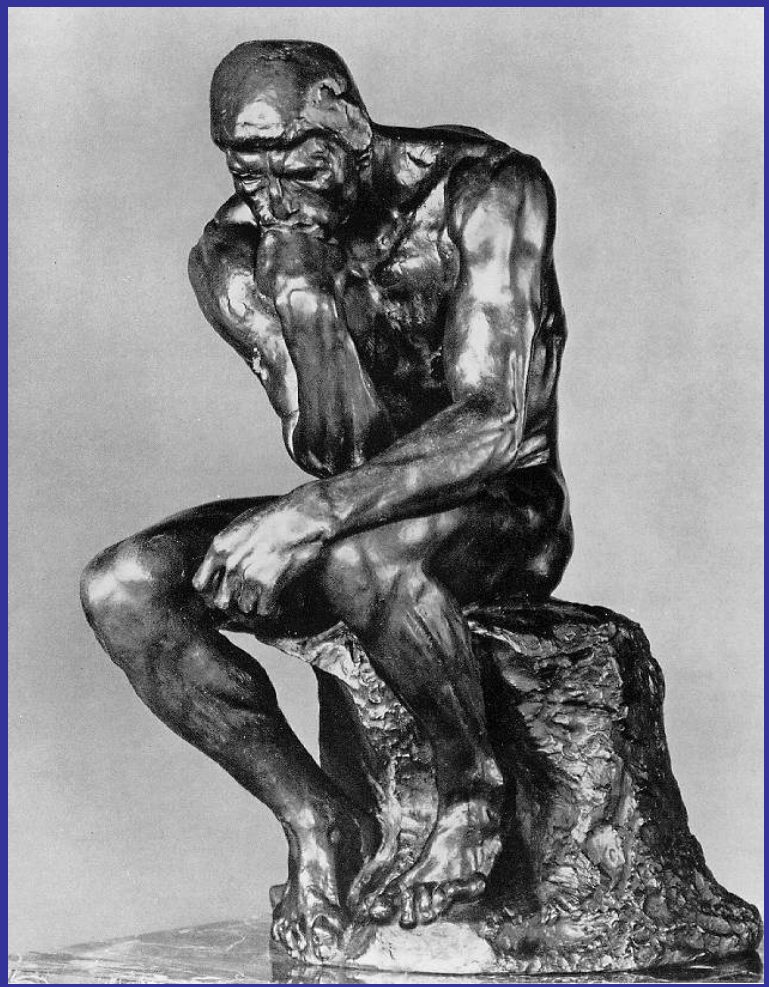


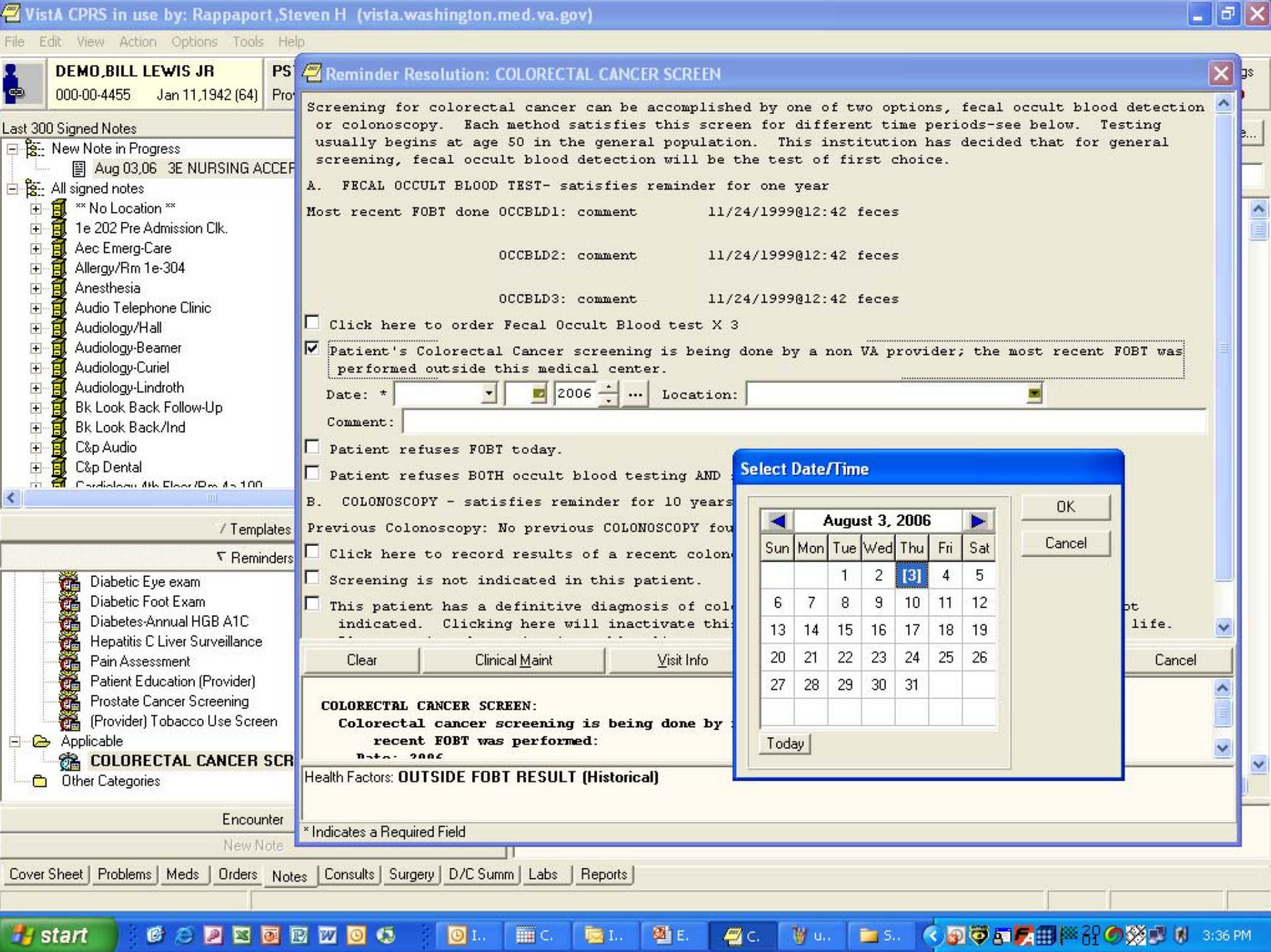
DECISION SUPPORT

How do you get people to use it ??

Give them the Beef !

The carrot: Performance bonus;

The stick: Constant humiliation & threats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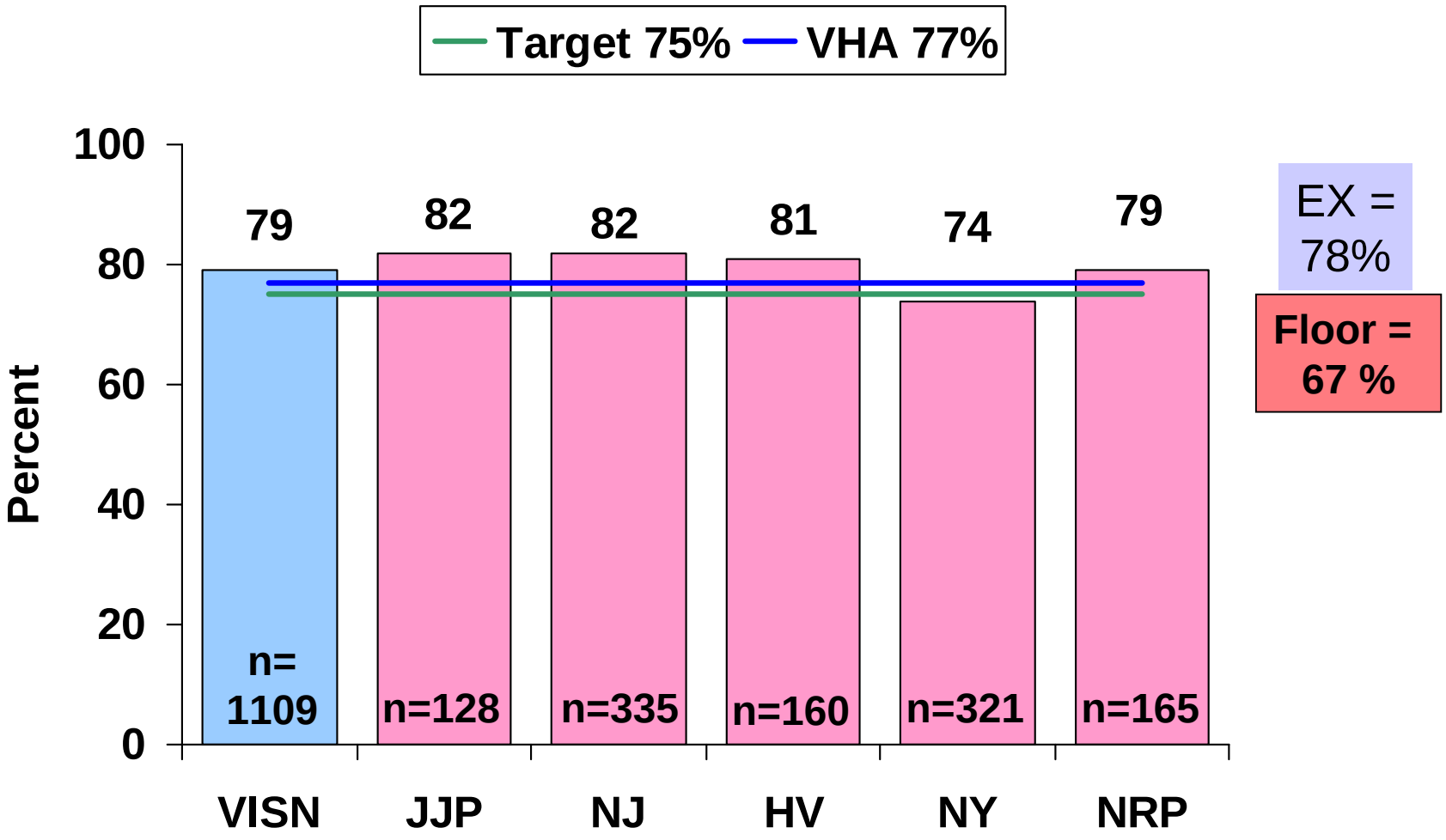
000-00-4455 Jan 11,1942 (64)
Last 300 Signed Notes
New Note in Progress
Aug 03,06 3E NURSING ACCEF
All signed notes
** No Location **
1e 202 Pre Admission Clk.
Aec Emerg-Care
Allergy/Rm 1e-304
Anesthesia
Audio Telephone Clinic
Audiology/Hall
Audiology-Beamer
Audiology-Curiel
Audiology-Lindroth
Bk Look Back Follow-Up
Bk Look Back/Ind
C&p Audio
C&p Dental
/ Templates
Reminders
Diabetic Eye exam
Diabetic Foot Exam
Diabetes-Annual HGB A1C
Hepatitis C Liver Surveillance
Pain Assessment
Patient Education (Provider)
Prostate Cancer Screening
(Provider) Tobacco Use Screen
Applicable
COLORECTAL CANCER SCR
Other Categories
Encounter
New Note
Cover Sheet Problems Meds Orders Notes Consults Surgery D/C Summ Labs Reports
Reminder Resolution: COLORECTAL CANCER SCREEN
Screening for colorectal cancer can be accomplished by one of two options, fecal occult blood detection or colonoscopy. Each method satisfies this screen for different time periods-see below. Testing usually begins at age 50 in the general population. This institution has decided that for general screening, fecal occult blood detection will be the test of first choice.
A. FECAL OCCULT BLOOD TEST- satisfies reminder for one year
Most recent FOBT done OCCBLD1: comment 11/24/1999@12:42 feces
OCCBLD2: comment 11/24/1999@12:42 feces
OCCBLD3: comment 11/24/1999@12:42 feces
Click here to order Fecal Occult Blood test X 3
Patient's Colorectal Cancer screening is being done by a non VA provider; the most recent FOBT was performed outside this medical center.
Date: * 2006 Location:
Comment:
Patient refuses FOBT today.
Patient refuses BOTH occult blood testing AND
B. COLONOSCOPY - satisfies reminder for 10 years
Previous Colonoscopy: No previous COLONOSCOPY fou
Click here to record results of a recent colon
Screening is not indicated in this patient.
This patient has a definitive diagnosis of col
indicated. Clicking here will inactivate thi
life.
Clear Clinical Maint Visit Info Cancel
COLORECTAL CANCER SCREEN:
Colorectal cancer screening is being done by
recent FOBT was performed:
Health Factors: OUTSIDE FOBT RESULT (Historical)
* Indicates a Required Field
Select Date/Time
August 3, 2006
Sun Mon Tue Wed Thu Fri Sat
1 2 [3] 4 5
6 7 8 9 10 11 12
13 14 15 16 17 18 19
20 21 22 23 24 25 26
27 28 29 30 31
Today
OK
Cancel
start
3:36 PM

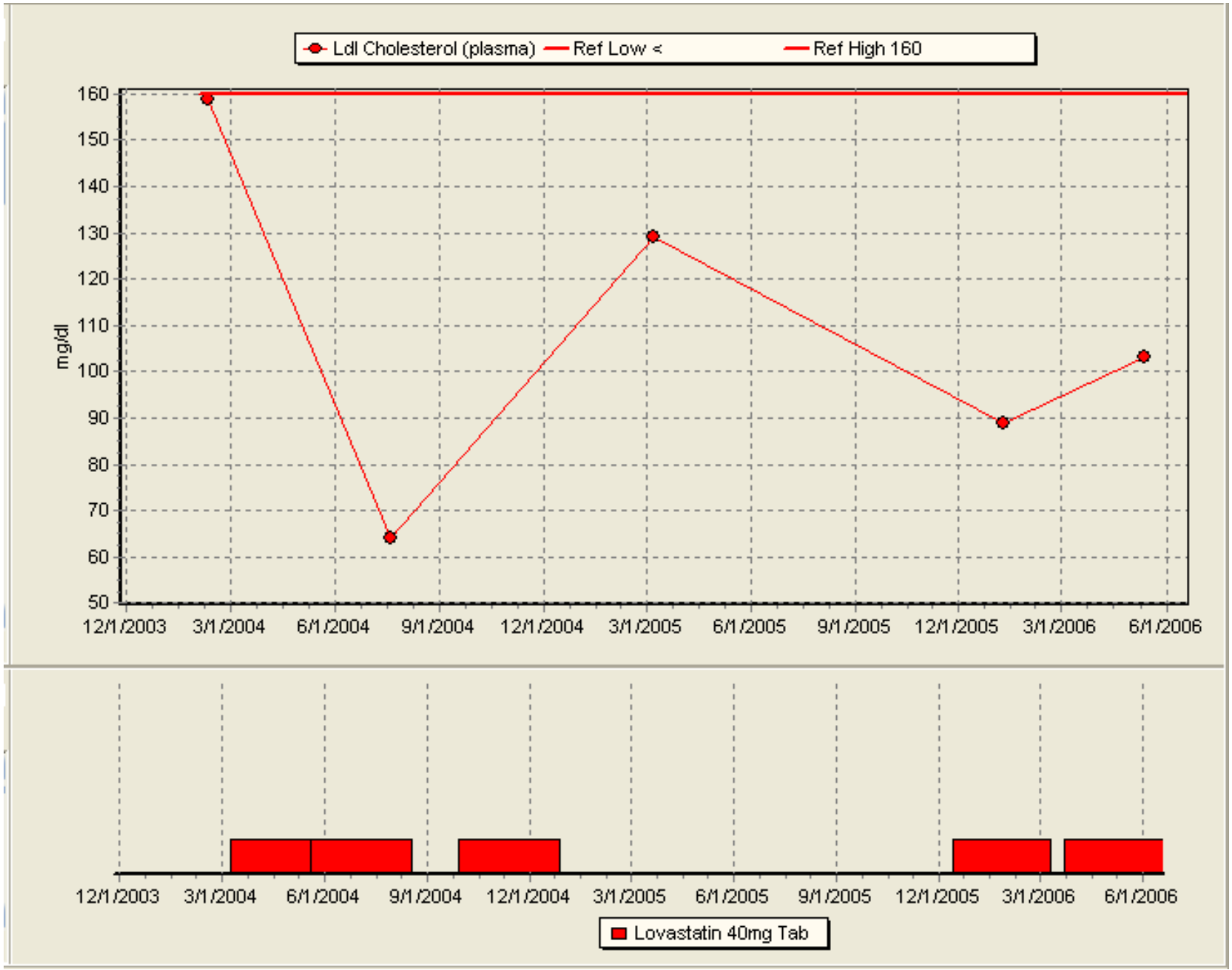
Cancer Measure
Screening for Colorectal Cancer – 52-80yrs



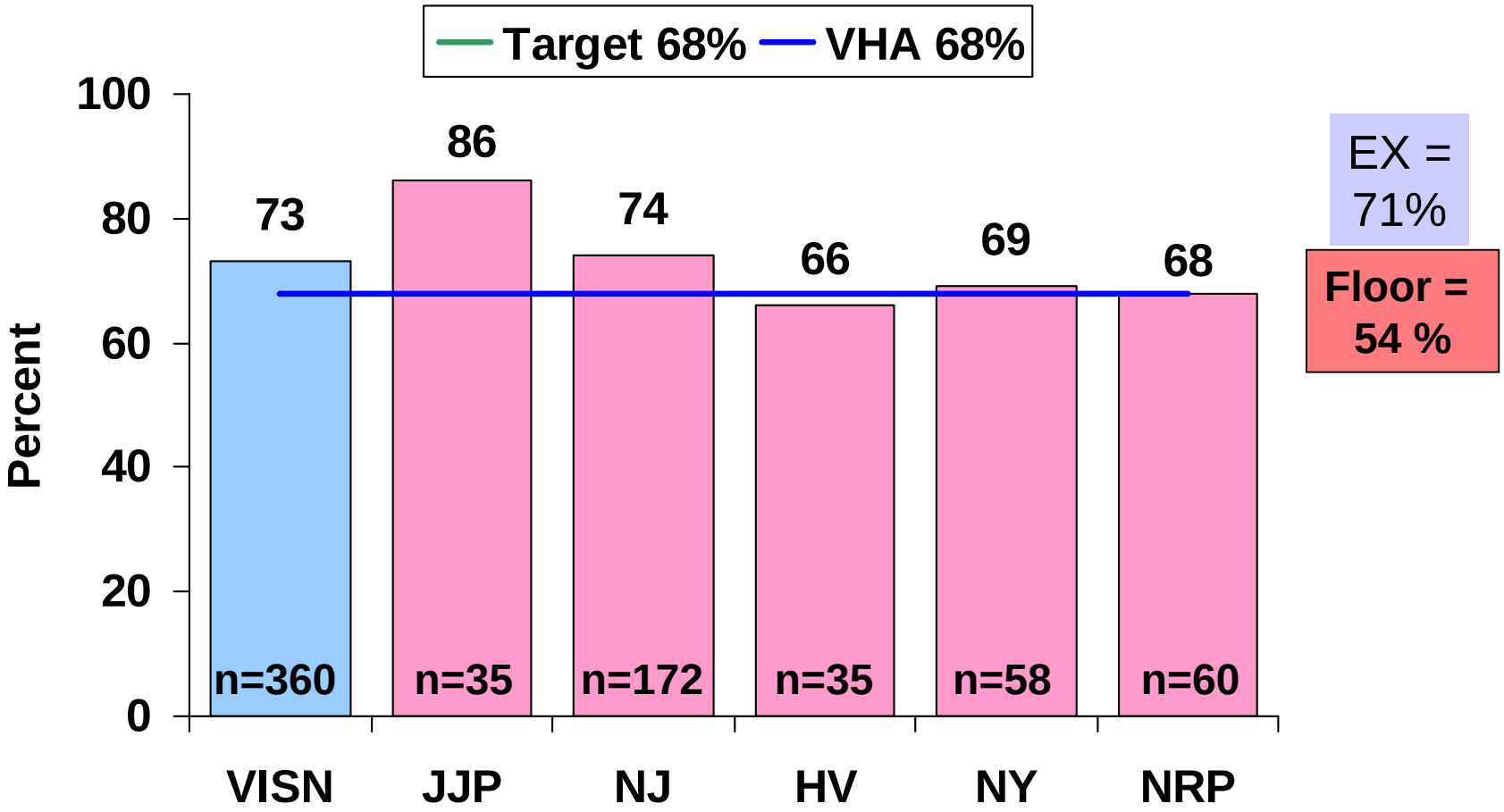
Measure 8c – Perf. Period 10/06 – 8/07

Quality Measures

CLINICAL PERFORMANCE INDICATOR	VA FY 05	HEDIS (2) Commercial 2004	HEDIS (2) Medicare 2004	HEDIS (2) Medicaid 2004
Breast cancer screening	86%	73%	74%	54%
Cervical cancer screening	92%	81%	Not Reported	65%
Colorectal cancer screening	76%	49%	53%	Not Reported
LDL Cholesterol < 100 after AMI, PTCA, CABG	Not Reported (3)	51%	54%	29%
LDL Cholesterol < 130 after AMI, PTCA, CABG	Not Reported (3)	68%	70%	41%
Beta blocker on discharge after AMI	98%	96%	94%	85%
Diabetes: HgbA1c done past year	96%	87%	89%	76%
Diabetes: Poor control HbA1c > 9.0% (lower is better)	17%	31%	23%	49%
Diabetes: Cholesterol (LDL-C) Screening	95%	91%	94%	80%
Diabetes: Cholesterol (LDL-C) controlled (<100)	60%	40%	48%	31%
Diabetes: Cholesterol (LDL-C) controlled (<130)	82%	65%	71%	51%
Diabetes: Eye Exam	79%	51%	67%	45%
Diabetes: Renal Exam	66%	52%	59%	47%
Hypertension: BP <= 140/90 most recent visit	77%	67%	65%	61%
Follow-up after Hospitalization for Mental Illness (30 days)	70%(4)	76%	61%	55%
Immunizations: influenza, (note patients age groups) (6) (7)	75% (65 and older or high risk)	39% (50-64)	75% (65 and older)	68% (65 and older)
Immunizations: pneumococcal, (note patients age groups) (6)	89% (all ages at risk)	Not Reported	Not Reported	65% (65 and older)


Ldl Cholesterol (plasma)
Ref Low <
Ref High 160
mg/dl
160
150
140
130
120
110
100
90
80
70
60
50
12/1/2003
3/1/2004
6/1/2004
9/1/2004
12/1/2004
3/1/2005
6/1/2005
9/1/2005
12/1/2005
3/1/2006
6/1/2006
Lovastatin 40mg Tab

Cardiovascular Measure- ISHD, % Prior AMI and LDLC<100 on Most Recent Test and Had a Full Lipid Profile in the Past 2 Years



Measure 9c1 – Perf. Period 10/06 -8/07

Quality Measures

CLINICAL PERFORMANCE INDICATOR	VA FY 05	HEDIS (2) Commercial 2004	HEDIS (2) Medicare 2004	HEDIS (2) Medicaid 2004
Breast cancer screening	86%	73%	74%	54%
Cervical cancer screening	92%	81%	Not Reported	65%
Colorectal cancer screening	76%	49%	53%	Not Reported
LDL Cholesterol < 100 after AMI, PTCA, CABG	Not Reported (3)	51%	54%	29%
LDL Cholesterol < 130 after AMI, PTCA, CABG	Not Reported (3)	68%	70%	41%
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Diabetes: Cholesterol (LDL-C) Screening	95%	91%	94%	80%
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Diabetes: Cholesterol (LDL-C) controlled (<130)	82%	65%	71%	51%
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Hypertension: BP <= 140/90 most recent visit	77%	67%	65%	61%
Follow-up after Hospitalization for Mental Illness (30 days)	70%(4)	76%	61%	55%
Immunizations: influenza, (note patients age groups) (6) (7)	75% (65 and older or high risk)	39% (50-64)	75% (65 and older)	68% (65 and older)
Immunizations: pneumococcal, (note patients age groups) (6)	89% (all ages at risk)	Not Reported	Not Reported	65% (65 and older)

Keys to Success

- Clear goals
- LEADERSHIP
- Effective communication
- Appropriate incentives
- Constant feedback – hopefully POSITIVE