Improving Electronic Health Record (EHR) Functionality: Toward the Solution-Oriented Medical Record

James J. Cimino
Chief, Laboratory for Informatics Development
NIH Clinical Center
US National Institutes of Health
Bethesda, Maryland, USA

Outline

- Motivation for better health records
- Creation – the *Problem-Oriented* Health Record
- Evolution – the *Solution-Oriented* Health Record
  - How did we get here?
  - Where we are going?
  - Where we will be?

Florence Nightengale

In attempting to arrive at the truth, I have applied everywhere for information, but in scarcely an instance have I been able to obtain hospital records fit for any purposes of comparison. If they could be obtained they would show subscribers how their money was being spent, what amount of good was really being done with it, or whether the money was not doing mischief rather than good

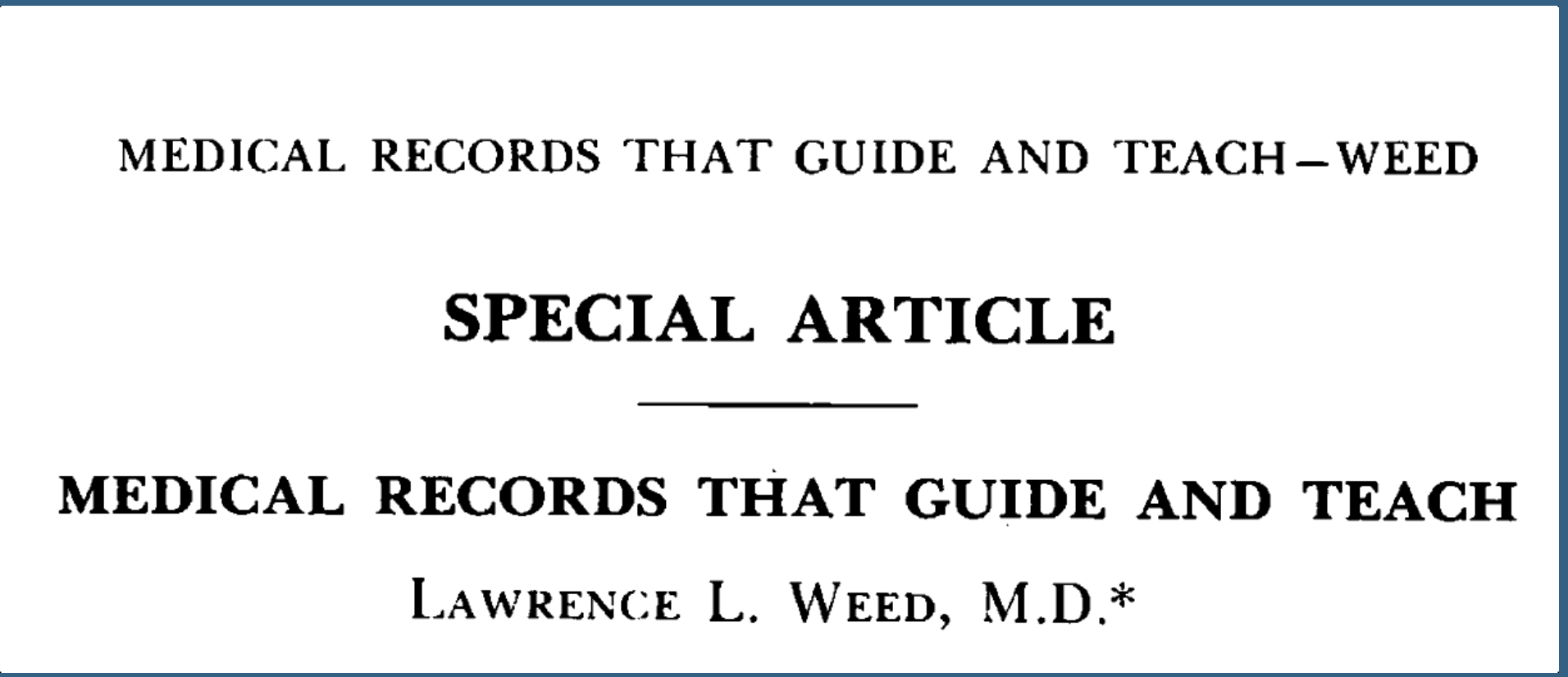
Nightingale F. Notes on Hospitals. London: Longmans, Green and Company; 1863:176

Barnett GO, Jenders RA, Chueh HC. The computer-based clinical record--where do we stand? Ann Intern Med. 1993 Nov 15;119(10):1046-8

“A general purpose [health] record system would serve to improve the quality, planning and administration of health services, to help in the evaluation of comparative therapies, and to forward research on epidemiology and human genetics, and problems of diagnosis and especially on the natural history of disease.”

“We recommend the establishment of a special standing committee…to guide the development of a general purpose health record system…”

- President’s Science Advisory Committee Life Sciences Panel , 1963



MEDICAL RECORDS THAT GUIDE AND TEACH—WEED

SPECIAL ARTICLE

MEDICAL RECORDS THAT GUIDE AND TEACH

LAWRENCE L. WEED, M.D.*

Weed LL. Medical records that guide and teach. *N Engl J Med*. 1968 278(11):593-600 and 278(12):652-657.

9/10

Pt. received 40 units of regular insulin yest. because of B & 4+ urine sugars. Got 2000 cc Amigen yest. & 500 cc D_5W. Was febrile all night up to 40 at 8 PM this gradually came down to 39. 8 PM yest. suctioned & coughed up c̄ return of ½ cup of thick white sputum – cultured also blood cultures. Was in must. tent c̄ mucomist overnight. At 4 PM yest had B-R base. Sputum smear unremarkable – WBC's but no bacteria.

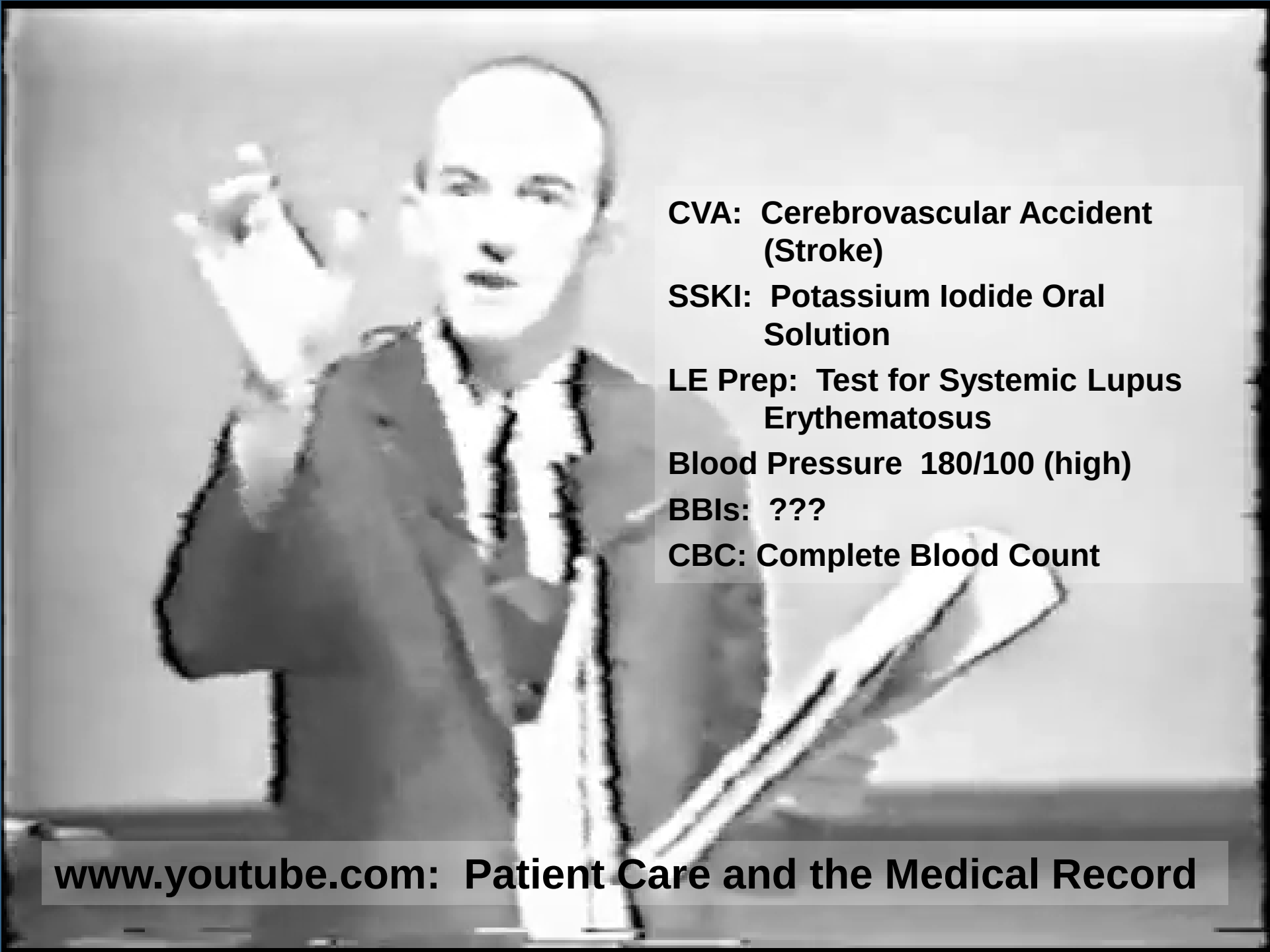
9/10-12:30

10 o'clock urine 2-3+/0. Given 10 U. reg. ins. at 12:30 PM. Temp. down to 38? Suctioned N.T. ō little return. However during suctioning pt. vomited 100-150 cc green fluid. Proximal jejunostomy tube draining well now.

9/11-9 AM

Urine 3+ given 10 U reg. insulin. Pt. was hiccuping all night & this AM. Levine tube passed c̄ 900-1000 cc bileous fluid removed. Jejunostomy tubes have been draining minimally. Will have Levine tube down.

(THREE PAGES OF SIMILAR NOTES FOLLOW UNTIL **9/26/67**)


CVA: Cerebrovascular Accident (Stroke)
SSKI: Potassium Iodide Oral Solution
LE Prep: Test for Systemic Lupus Erythematosus
Blood Pressure 180/100 (high)
BBIs: ???
CBC: Complete Blood Count
www.youtube.com: Patient Care and the Medical Record

#1 *Rheumatoid Arthritis* — maintained on Aspirin gram 15 q.4.h. and Prednisone 5 milligrams twice a day.

#2 *Anemia* — probably related to blood loss by G.I. tract but also rule out persistent folic acid deficiency and hypothyroidism. R/O myxedema & folic acid def.

#3 *Peripheral neuritis* — uncertain etiology

#4 *Peripheral edema* — uncertain etiology — malnutrition

#5 *Depression and memory impairment or slowing up of thought processes* — uncertain etiology — myxedema.

PLANS:

#1 Continue same regime although would suggest elevating head of bed, addition of Belladonna and Maalox PC and HS.

#2* Serum Iron, folic acid, total protein AG ratio. PBI.

#3 Continue multiple vitamin possibly should add folic acid. Folic acid level to be checked.

#4 Evaluate serum protein level as well as PBI.

#5 Probably I am overly impressed by her skin texture suggesting myxedema and her voice changes which may be due to the Thorazine. If the PBI is normal, then perhaps a more vigorous or intensive trial on antidepressants, more rapidly acting such as Pertofrane or Aventyl should be given or possibly shock therapy employed.

What Did Weed Want?

- Each medical record should have a complete list of all the patient's problems, including both clearly established diagnoses and all other unexplained findings that are not yet clear manifestations of a specific diagnosis, such as abnormal physical findings or symptoms
- Careful analysis and follow-through on each problem as revealed in the titled progress notes, requiring that the proper data be collected and that the conclusions drawn from this data are logical and relevant

The Problem-Oriented Medical Records: (SOAP)

- **Subjective**
- **Objective**
- **Assessment**
- **Plan**

In the beginning, there was….

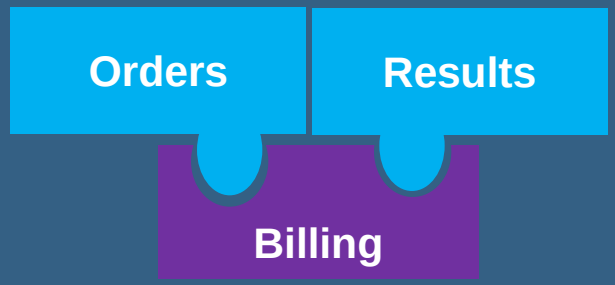
Ancilliay Systems Make their Contribution

Results

Billing

The Beancounters Triumph!

Can you say: Return on Investment?



A Digital Shift on Health Data Swells Profits in an Industry

Jeff Swensen for The New York Times

Dr. Vivek Reddy, a neurologist at the University of Pittsburgh Medical Center, also works on its digital records effort.

By JULIE CRESWELL

Published: February 19, 2013 | 525 Comments

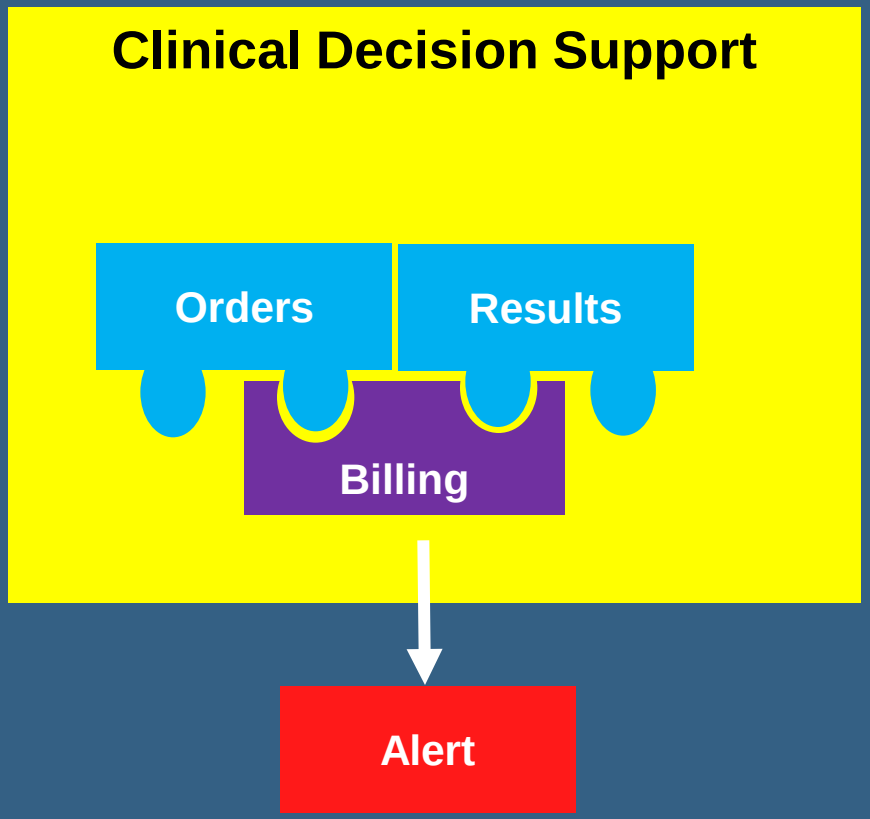
Comments on EHRs Today

“We called it the Sunny von Bülow bill. These companies that should have been dead were being put on machines and kept alive for another few years,” said Jonathan Bush, co-founder of the cloud-based firm Athenahealth and a first cousin to former President George W. Bush

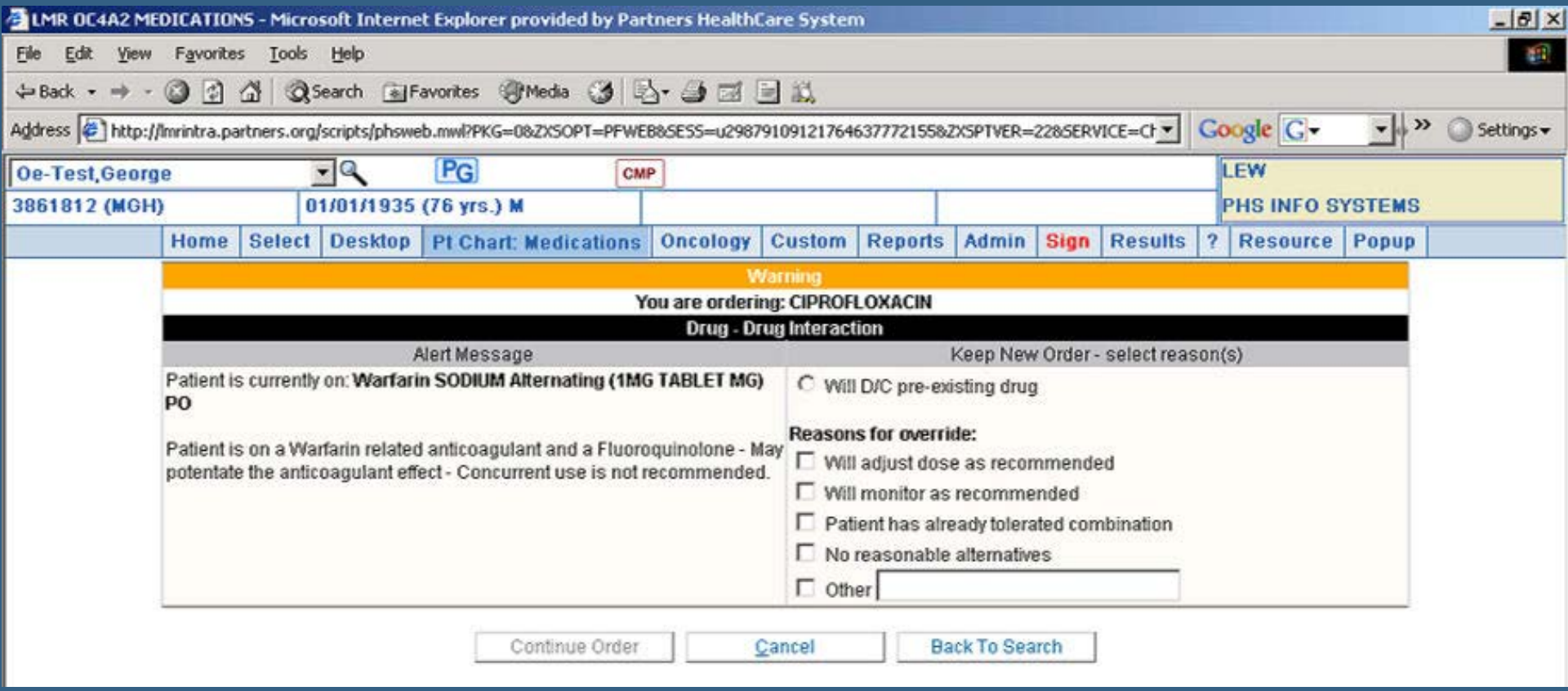
“On a really good day, you might be able to call the system mediocre, but most of the time, it’s lousy,” said Michael Callaham, the chairman of the department of emergency medicine at the University of California, San Francisco Medical Center

“Nothing that these companies did in my eyes was spectacular,” said John Gomez, the former head of technology at Allscripts

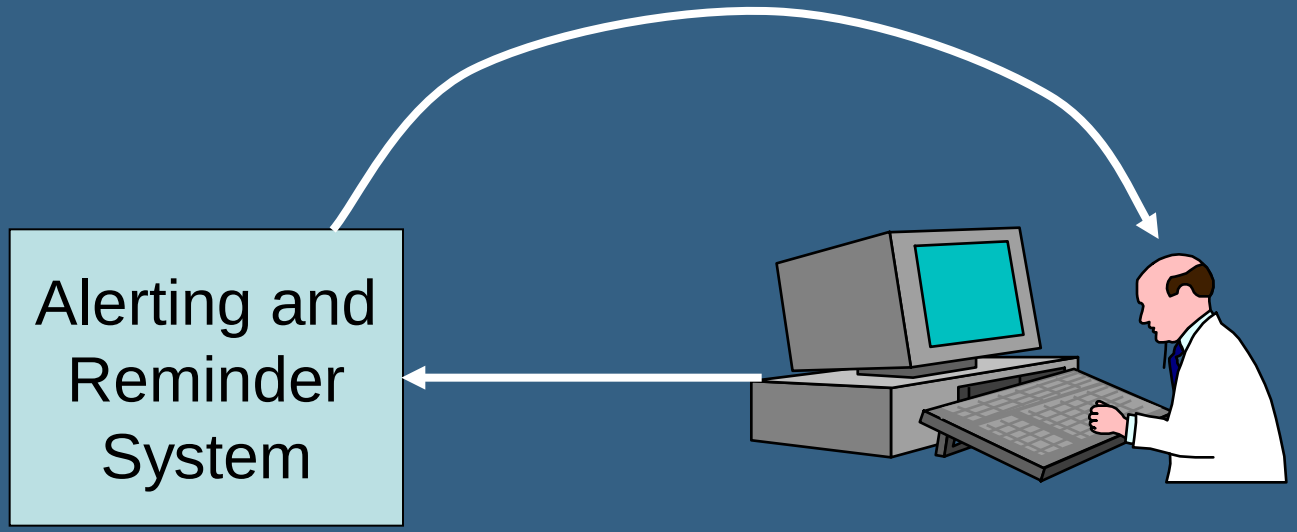
Sometimes, the informaticians get to be in charge



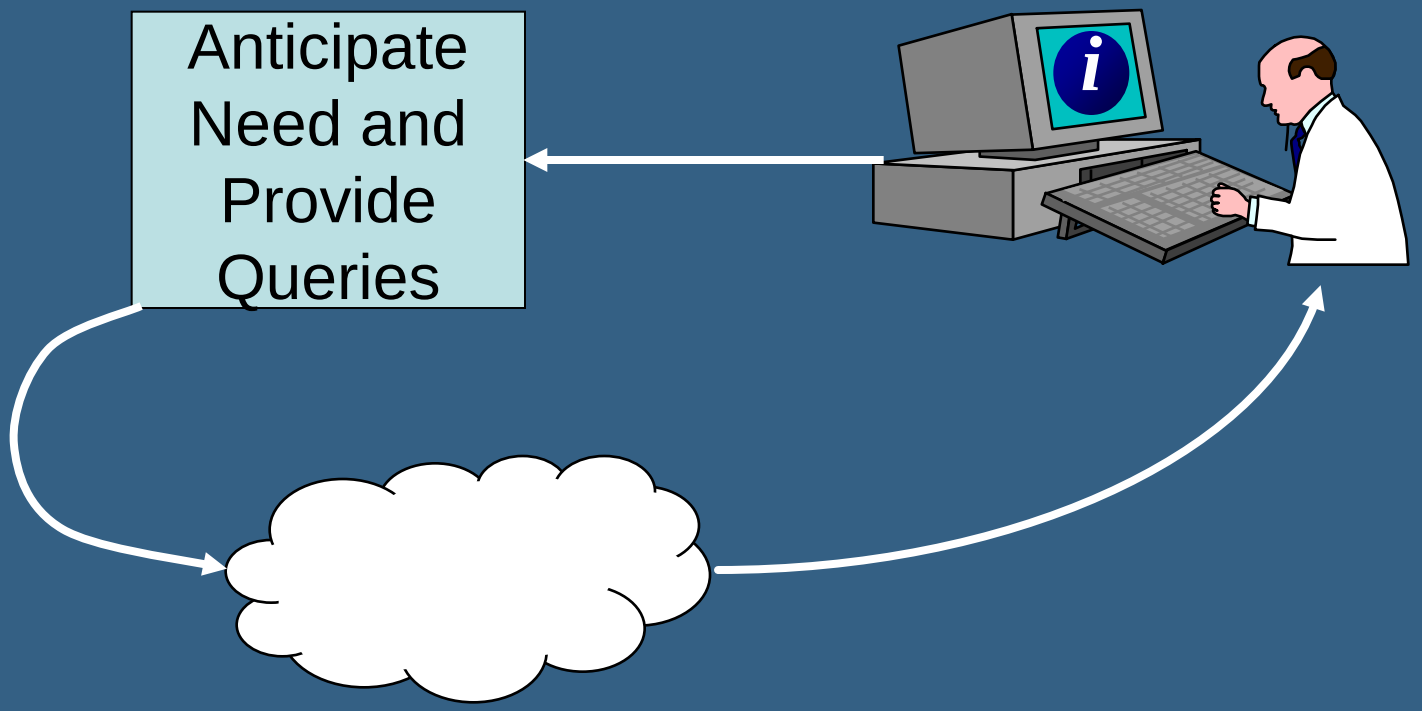
We have been doing these for over 40 years



Automated Clinical Decision Support



Infobuttons



INFOBUTTON MANAGER

Select the Concept of Interest: CPMC Sodiu

Guidelines
- National Guidelines

Lab Info
- Lab Manu

Test
NA-SWEAT TEST
CL-SWEAT TEST
SWEAT WEIGHT
Collection time: 2007-07-26 16:
Last updated: 2008-02-21 14:5
Status: Final, Accno: H47753

Sodium, Sweat

Laboratory Specialty Laboratory

Request Form General

Phone (212) 305-6569

Availability By appointment only

Turnaround Time 1 day

Special Instructions Schedule appointment with laboratory to collect sweat at (212) 305-6569.

Specimen Sweat

Minimum Volume 75 mg

Collection Specimen will be collected by laboratory personnel.

Storage Instructions Refrigerate

Causes for Rejection Insufficient sweat yield

Reference Range Negative: <40 mmol/L; borderline: 40-60 mmol/L; consistent with the diagnosis of cystic fibrosis: >60 mmol/L

Use Establish the diagnosis of cystic fibrosis

Methodology Flame photometry

INFOBUTTON MANAGER

Select the
Concept
Interest:

Drug Info

- Adverse Effects
- Contraindications
- Dosage
- Drug Interactions
- Forms
- Indications
- Precautions
- RxList
- Toxicity

Reference

- Harrisons
- Lab Tests Online
- Micromedex
- PubMed
- UpToDate

Micromedex® 2.0 MICROMEDEX GATEWAY

See entire document

Digoxin

DrugPoint® Summary

View Detailed information in DRUGDEX

Adverse Effects

View Detailed information in DRUGDEX

Common

back to top

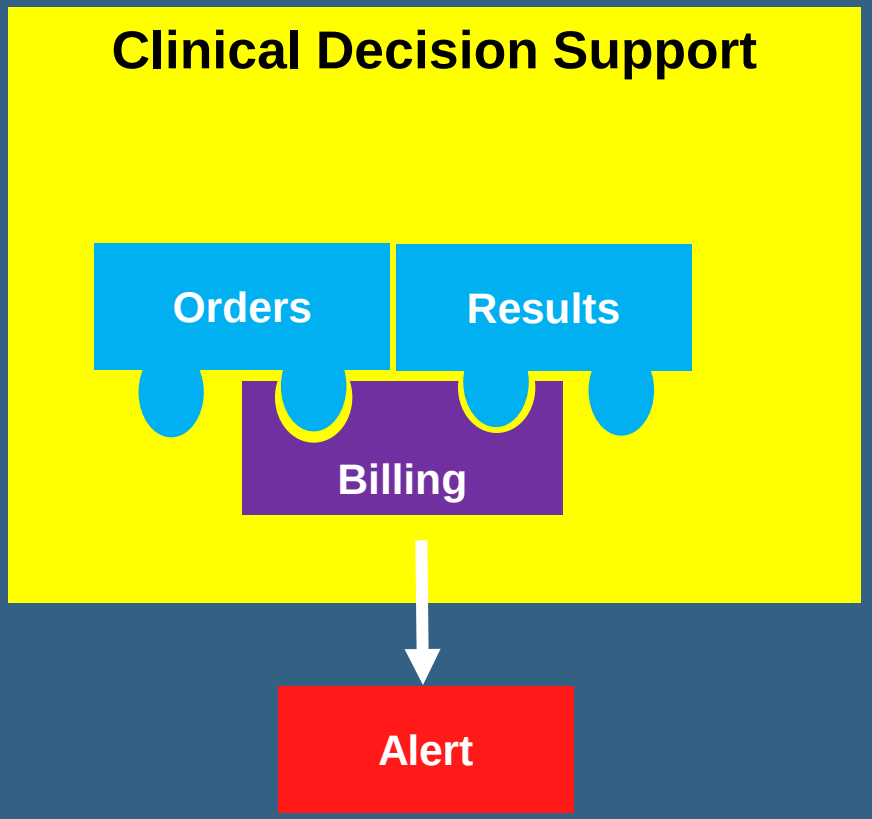
- **Neurologic:** Headache

Serious

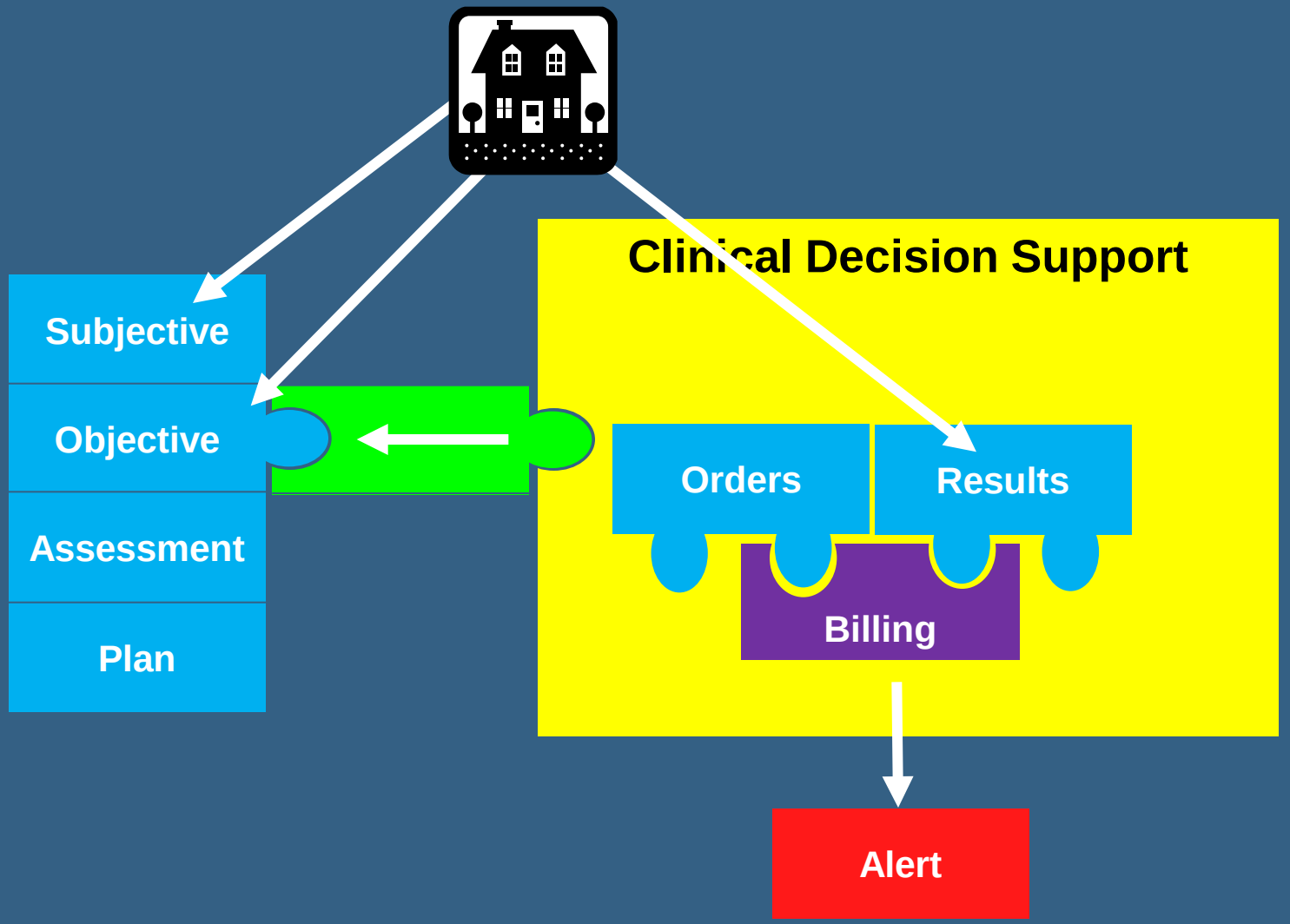
back to top

- **Cardiovascular:** Cardiac dysrhythmia
- **Hematologic:** Thrombocytopenia (rare)

Dawn of Computer-Based Clinical Documentation

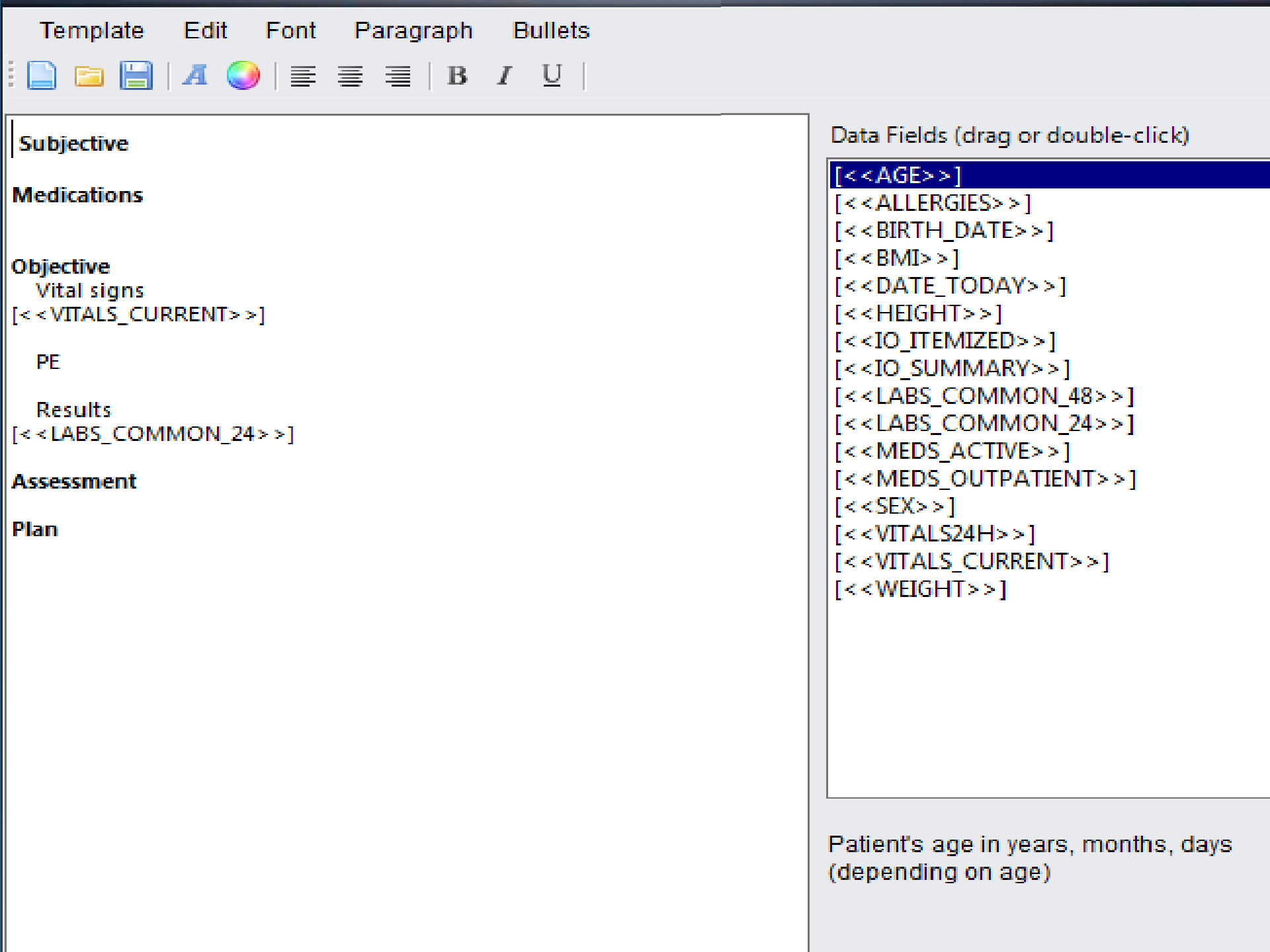


Better Data Capture

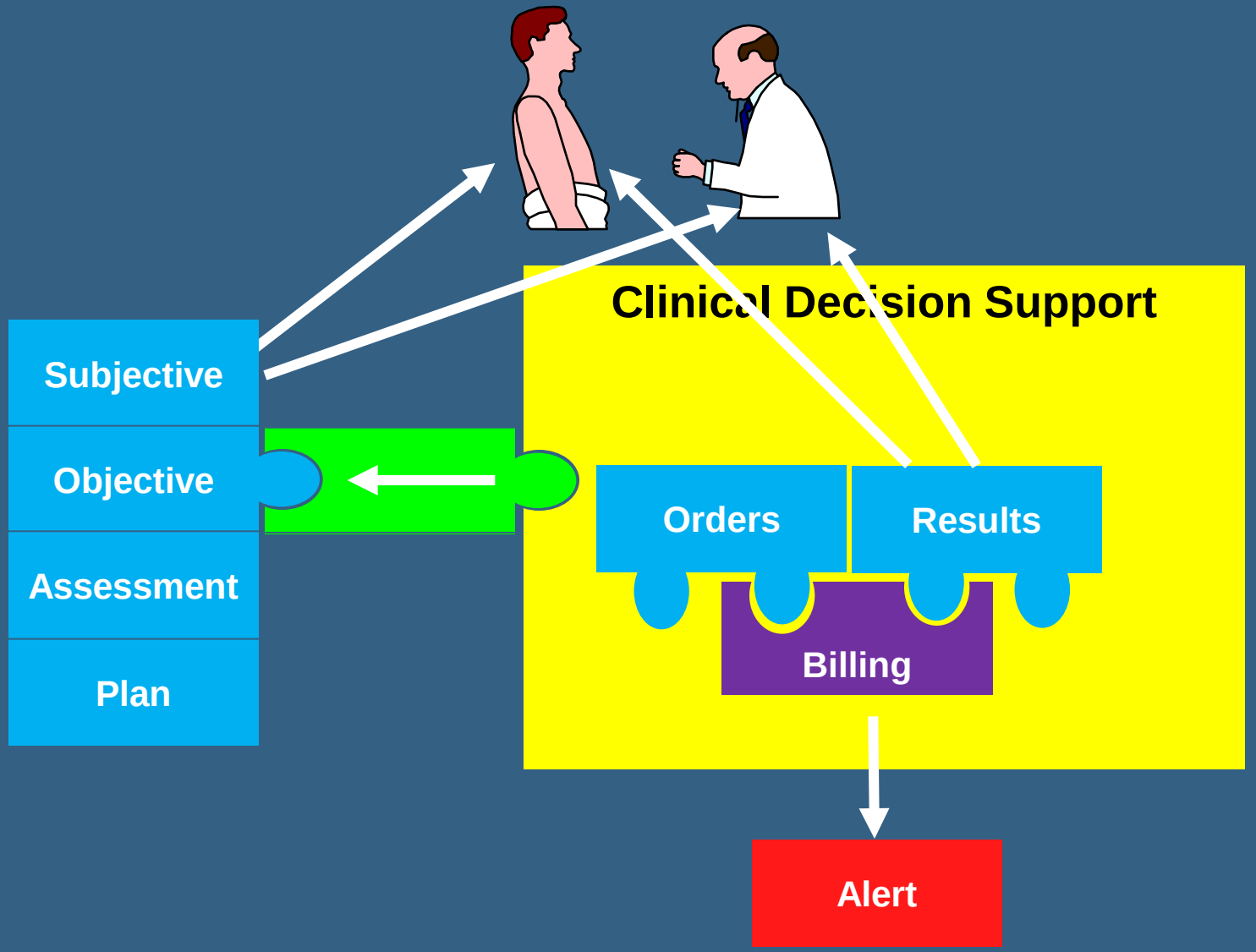


Better Data Capture

- Mobile and home devices
- Systematic, consistent discrete data capture for the purposes of “learning from every patient”
- Smart inclusion of relevant data into notes


Template
Edit
Font
Paragraph
Bullets
Subjective
Medications
Objective
Vital signs
[<<VITALS_CURRENT>>]
PE
Results
[<<LABS_COMMON_24>>]
Assessment
Plan
Data Fields (drag or double-click)
[<<AGE>>]
[<<ALLERGIES>>]
[<<BIRTH_DATE>>]
[<<BMI>>]
[<<DATE_TODAY>>]
[<<HEIGHT>>]
[<<IO_ITEMIZED>>]
[<<IO_SUMMARY>>]
[<<LABS_COMMON_48>>]
[<<LABS_COMMON_24>>]
[<<MEDS_ACTIVE>>]
[<<MEDS_OUTPATIENT>>]
[<<SEX>>]
[<<VITALS24H>>]
[<<VITALS_CURRENT>>]
[<<WEIGHT>>]
Patient's age in years, months, days (depending on age)

Better Views of the Record



Better Views of the Record

- Disease-specific patient-oriented summaries
- Sign-out to support transitions
- Expert systems to render context-sensitive summaries
- Integration of personal genomes into EHRs
- Medication timeline
- Heads-up displays
- Automated communications: discharge summaries, patient letters, etc.

SYSTEMTESTONLY, BARBARA M - 214-17-59 Opened by NIGRIN MD, DANIEL J

Task Edit View Patient Chart Links Notifications Navigation Help

Schedule View | Message Center | Patient List | Patient Sign Out | Patient Access List | Discharge Dashboard | Alice

CHB Home | CH Menu | CHAMPS Help | UpToDate | LexiComp | Indivo | Historical Labs | Radiology Images | SERS

Tear Off | Attach | Exit | Calculator | AdHoc | Patient Product Inquiry | Collections Inquiry | Explorer Menu | Con

SYSTEMTEST...

SYSTEMTESTONL

** ALLERGIES ** Prec

CHB MRN: 214-17

DOB: 4/24/2001

Inpatient [04/30/2012

Menu - Ambulatory

- ViewPoint
- Orders
- Medication List
- MAR
- Allergies
- Problems and Diagnoses
- Outpatient Specialty View
- Ambulatory BP Centiles
- Lab
- Micro
- Lab Followup
- Diagnostic Studies View
- Documents
- Document Viewing

STEMTESTONLY, BARI

SMART App Viewer - Windows Internet Explorer

http://10.36.141.252/token/bdylyKIbzVNugJGNfBThhLLGJVNdte?initial_app=bp_centiles

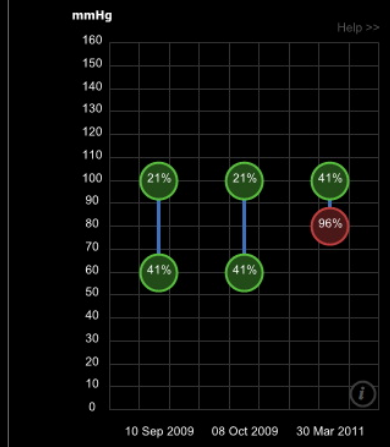
Live Search

Edit View Favorites Tools Help

Favorites | SMART App Viewer

Blood Pressure Centiles BARBARA SYSTEMTESTONLY (female, DOB: 24 Apr 2001, MRN: 2141759) SMART

Short Term View | Long Term View | Table View | Calculator | References



Note: Only ambulatory blood pressures are displayed.

SMART

CAD/DM Smart Form: Graphs

PARTNERS
Clinical Informatics
Research & Development

Lmrsftest,Cadfive

20567889 (BWH) | 01/01/1931 (75 yrs.) M

Log RCT | Select | Desktop | Pt Chart: Smart Form | Oncology | Custom | Reports | Admin | Sign | Results | ? | Resourc

SmartView

Filter by
CAD DM Smoking
Detected: CAD,DM,Smoking

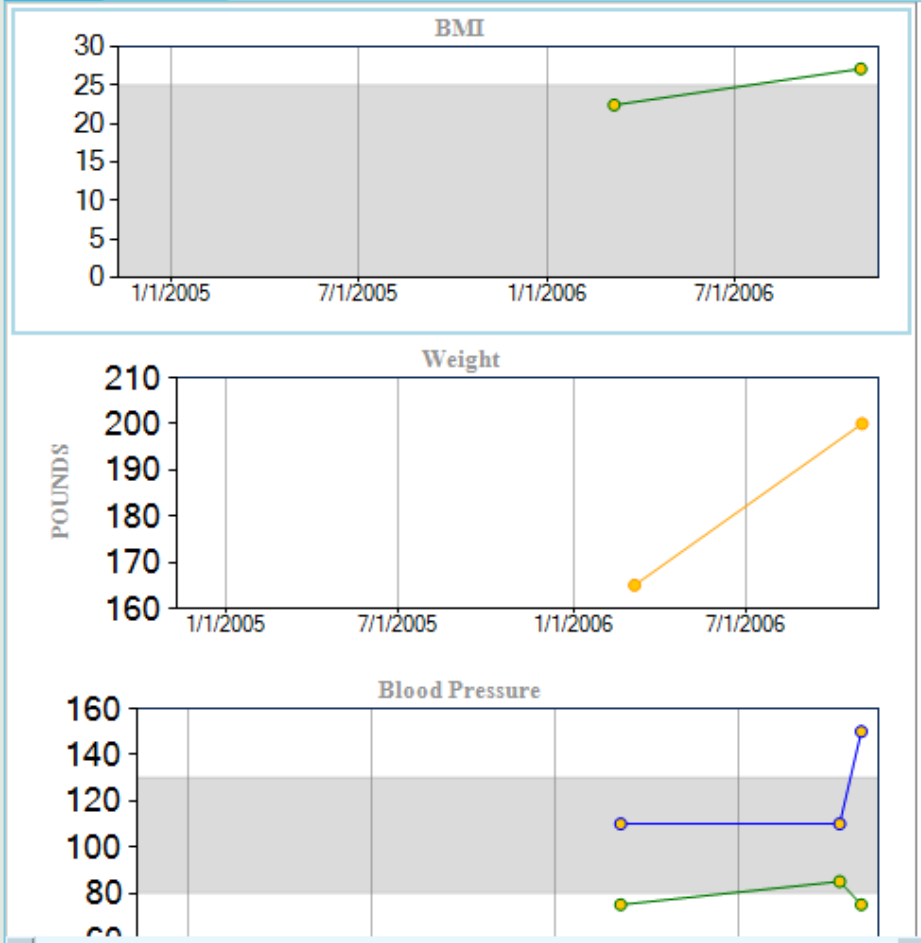
Vital Signs

		10/31/06	10/10/06	03/06/06
T (<98.6)			98.5F	
BP (<130/80)		150/75!	110/85!	110/75
HR (50-100)		70	85	
RR		14		
O2 Sat				
W		200lb		165lb
H		72in		
BMI (<25)		27.1!		22.4

Lab Tests | Last Known

- K
- Creatinine
- BUN
- Glucose
- HbA1c (4.4-6.4)

Note | Graphs | Patient View



Orders, A/P

Execute

Assessment

- No recent LDL measurement
- Patient is on anti-platelet therapy
- Blood Pressure is above goal (avg. over last 2 visits 130/80, goal < 130/80)
- Patient is due for Pneumovax (older than 65, no record of prior vaccination)
- Patient is due for Influenza Vaccine (high risk medical condition)
- Patient may be Current Smoker, not thinking of quitting. Last counsel date is 10/10/06.
- Patient is overweight or obese (BMI 27.1 on 10/31/06, goal < 25)

Lipid Management
Antiplatelet Therapy
Blood Pressure Management
Immunizations
Smoking
Weight/BMI
Follow-ups

Alert **Clinical Trial Participant**

StarTracker Conditions/Diseases: No Tracked Conditions ♦Customize

*** *notation indicates test is due for repeat and value may be outdated.*

Preventive	BP	BMI	eGFR	HCT	FLUVAX	CRC	Mammogram	PAP
	143/72	31.7 (12/30/2010)	52	33	NONE	NONE	UNKNOWN	UNKNOWN
	SMOKE							
	UNKNOWN							

Patient-specific guidelines

MedicationsLog
ICD9 History

Up

General Information:

PCP:
Primary cardiologist:

Significant Medical Diagnoses and Conditions:

1. Coronary atherosclerotic heart disease
a. NonSTMI 01/2010
b. Coronary intervention 1/12/2010
(1) Xience 3x23 drug eluting stent to RCA
c. Coronary intervention 2/17/2010
(1) two 2.5x28 and 2.25x18 Cypher DES to LAD and diagonal
d. Coronary intervention 4/6/2010

Adverse and Allergic Drug Reactions:
penicillin (class) (rash)
cephalexin (rash)

Drug Genome Interactions: *(12/21/10 08:02)*
clopidogrel sensitivity: POOR METABOLIZER, REDUCED
CYP2C19 - gene result: *2/*2

Medications: prepare to print print and give pt.
Drug/Herb Interactions
aspirin 325 mg orally once daily, in the morning
prasugrel (effient) 10 mg orally once daily
carvedilol 6.25 mg orally twice daily with meals
lisinopril 10 mg orally once daily
furosemide 40 mg or

Courtesy: Vanderbilt University

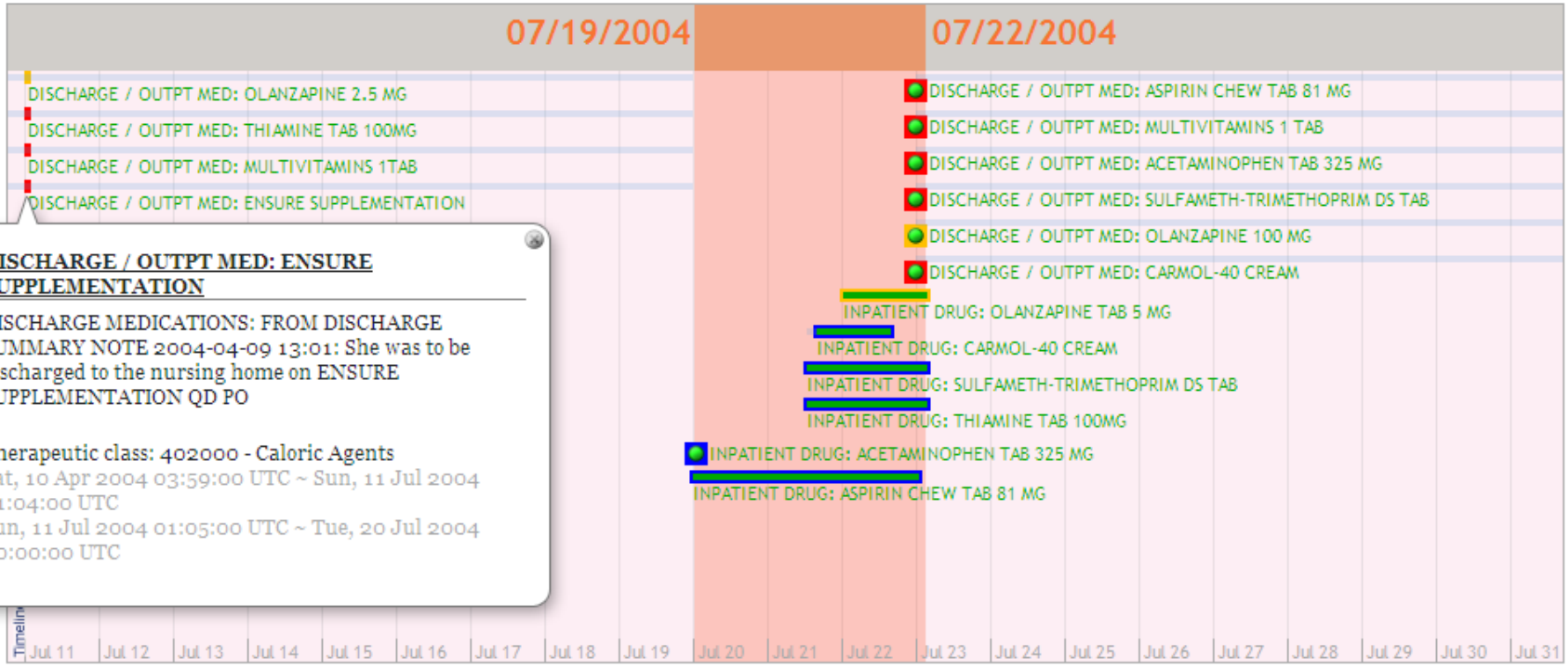
Test of medication timeline - Windows Internet Explorer

http://127.0.0.1:9999/timeline/examples/pt3/pt3.html

File Edit View Favorites Tools Help

Test of medication timeline

PT3 Last Hospital Stay 07/19/2004 - 07/22/2004



DISCHARGE / OUTPT MED: ENSURE SUPPLEMENTATION

DISCHARGE MEDICATIONS: FROM DISCHARGE SUMMARY NOTE 2004-04-09 13:01: She was to be discharged to the nursing home on ENSURE SUPPLEMENTATION QD PO

Therapeutic class: 402000 - Caloric Agents

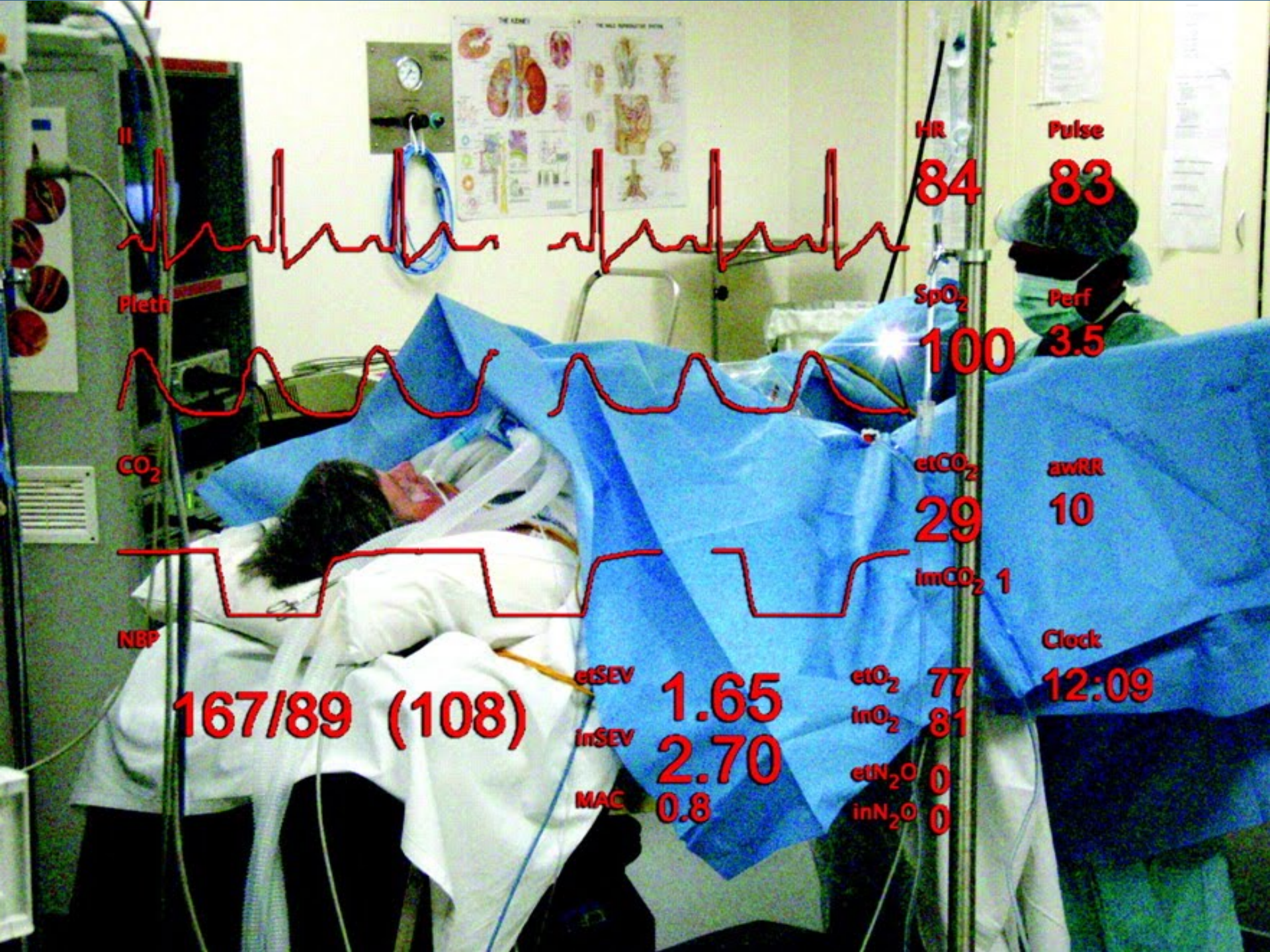
Sat, 10 Apr 2004 03:59:00 UTC ~ Sun, 11 Jul 2004 01:04:00 UTC

Sun, 11 Jul 2004 01:05:00 UTC ~ Tue, 20 Jul 2004 00:00:00 UTC

Filter: Highlight:

DISCHARGE INPATIENT Clear All

Sources: DBMI

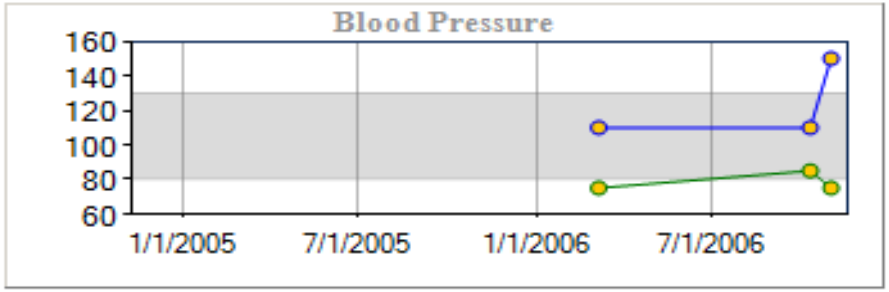

II
HR
84
Pulse
83
Pleth
SpO2
100
Perf
3.5
CO2
etCO2
29
awRR
10
imCO2 1
NBP
167/89 (108)
etSEV
1.65
inSEV
2.70
MAC
0.8
etO2 77
inO2 81
etN2O 0
inN2O 0
Clock
12:09

CAD/DM Smart Form: Patient View

PARTNERS
Clinical Informatics
Research & Development

Blood Pressure

On average, your blood pressure has been running high recently (average of 130/80 from your last two doctor visits). The recommended blood pressure goal is 130/80. You may want to discuss with your doctor about things you can do to help lower your blood pressure.



Immunizations

Most people older than 65 receive a shot to prevent pneumonia at least once. If you have not had a pneumonia shot, you may want to discuss with your doctor whether you should get a pneumonia shot.

Most people with medical conditions such as yours receive a flu shot every year. If you have not had a flu shot this year, you may want to discuss with your doctor's office whether you should get a flu shot.

Smoking

If you are currently a smoker, you may want to talk to your doctor about ways to help you quit.

BRIGHAM AND WOMEN'S HOSPITAL

Mary Jones Room: Phone#: (617) 555-5555

Bigger Smaller

Nurse:
Pozzar, Rachel, R.N.

Attending:
Boxer, Robert, M.D.

Covering:
Barnett, Michael, M.D.

Friday, September 02, 2011

8:19:45 am

Information about your hospital visit

Visiting hours: 1 pm to 9 pm

Call '43663' to order meals

currently 64°F Mostly Cloudy

tomorrow High 81°F Low 67°F

forecast provided by wunderground.com

Scheduled events

7:00-11:00 am	Speech, Blood draw,
11:00 am-3:00 pm	Physical therapy, Blood draw,
3:00-7:00 pm	Family meeting

Daily routine

7:00-8:00 am	Breakfast
7:00-9:30 am	Care team rounds
12:00-1:00 pm	Lunch
5:00-6:00 pm	Dinner

Patient and family notes

PG

- Ask Dr. Boxer about discharge Delete

Add note

Information about your health

Nutrition & Fluids

Care reminders

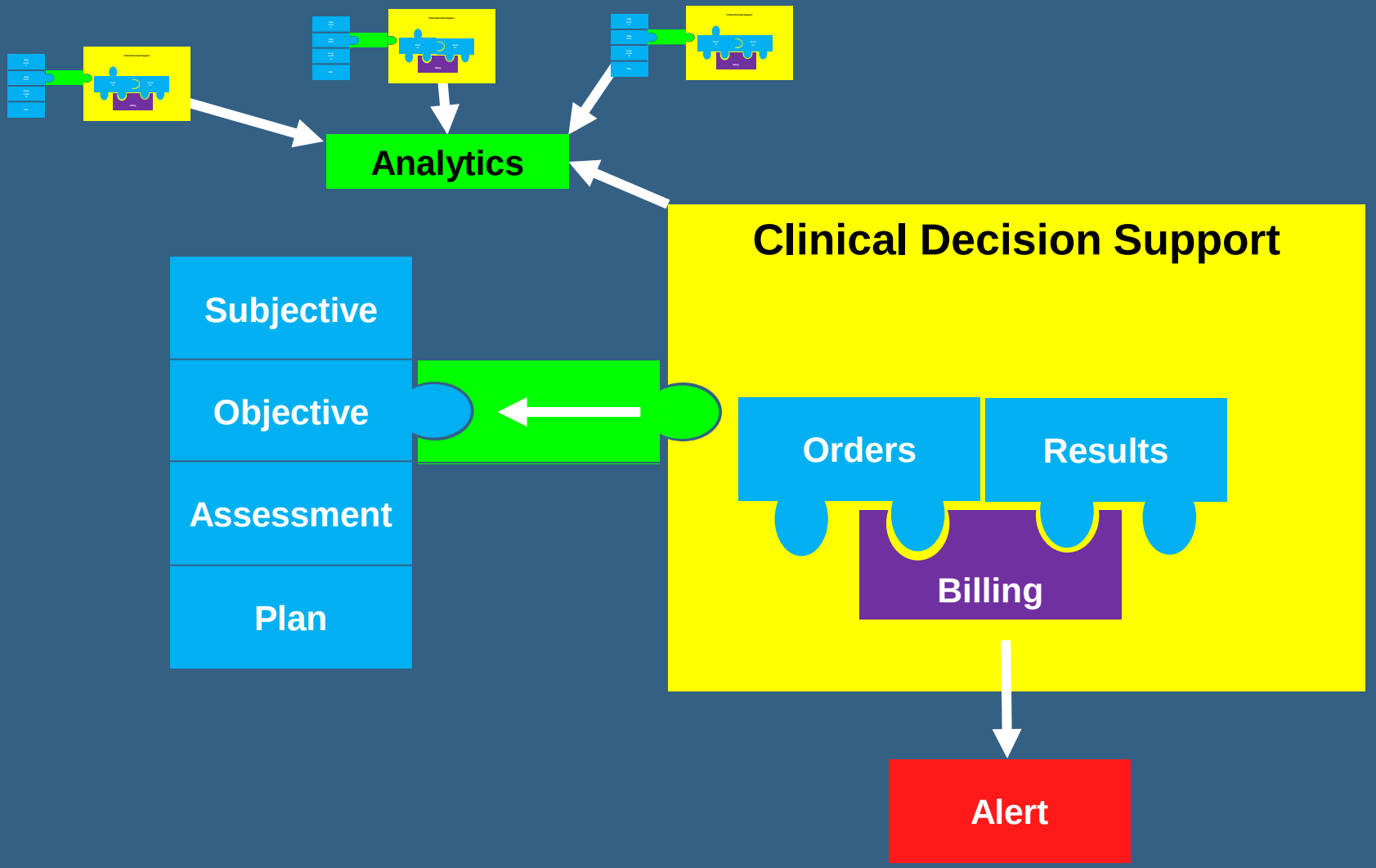
Test results

Medications

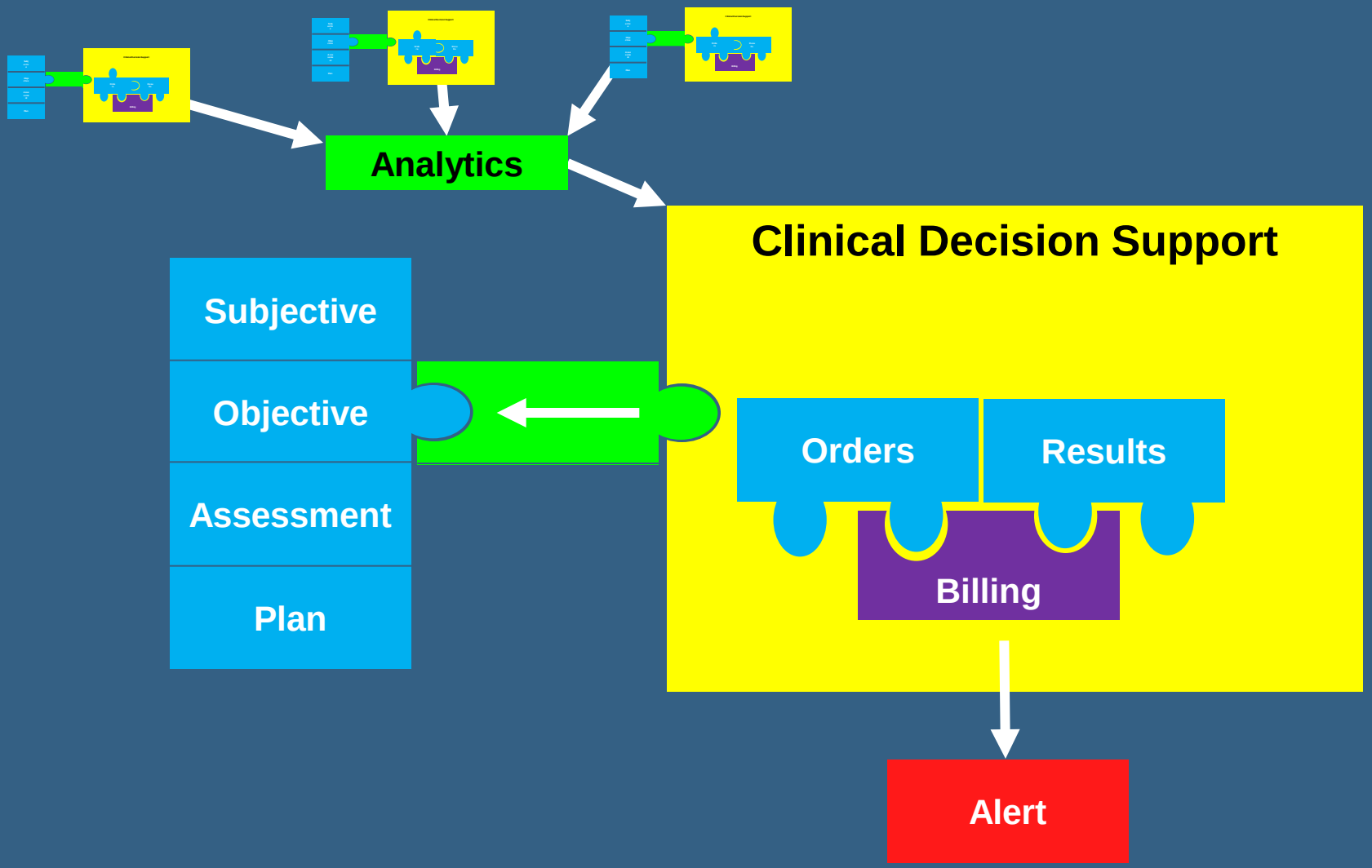
Education/ Self management

Discharge Education

Re-Using EHR Data for Better Evidence



Re-Using EHR Data for Better Decision Support



Re-Using EHR Data for Better Decision Support

- Using a clinical data warehouse to improve alerts
- Risk-stratification with risk-specific plans of care
- Raising clinical alerts based unusual patient care
- Personalized medicine supported by genomic data
- Context-driven dynamic alerts that learn
- NLP to analyze notes in real-time

HEO Popup

Clopidogrel Poor Metabolizer Rules

Genetic testing has been performed and indicates this patient is at risk for inadequate anti-platelet response to clopidogrel (Plavix) therapy

This patient has been tested for CYP2C19 variants, and the presence of the ***2/*2** genotype has identified this patient as a **poor metabolizer** of clopidogrel. Poor metabolizers treated with clopidogrel at normal doses exhibit higher rates of stent thrombosis/other cardiovascular events.

Treatment modification is recommended:

- ○ Prescribe prasugrel (EFFIENT) 10mg daily and stop clopidogrel (PLAVIX) startdate, 10 AM

Due to increased risk of bleeding, prasugrel should not be given to patients:

- that have a history of stroke or transient ischemic attack *** **Not known; please check StarPanel**
- that are greater than 75 years of age
- whose body weight is less than 60 kg

Click here for **more information**

If prasugrel (EFFIENT) not selected, please choose desired action:

- ◉ Increase maintenance dose of clopidogrel (PLAVIX) 150 mg daily, startdate, 10AM
- ○ Maintain requested daily dose of clopidogrel (PLAVIX) 75 mg daily, startdate, 10AM

- ○ Contraindicated
- ○ Expected effects (e.g. nuisance bleeding)
- ○ Patient preference
- ○ Other

Click here for **more information**

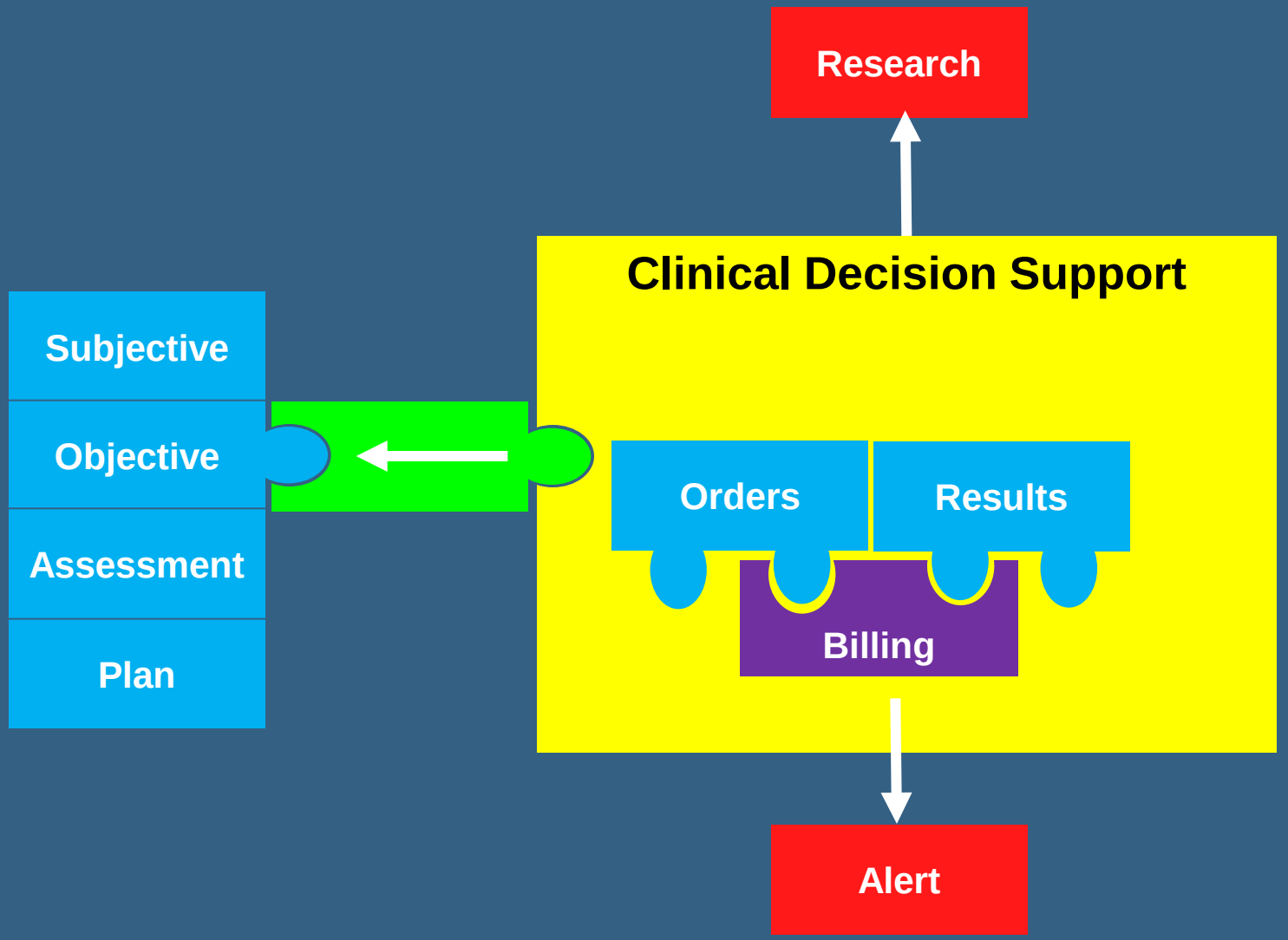
Cancel | Order

NOTE: The Vanderbilt P&T Committee has recommended that prasugrel (if not contraindicated) should replace clopidogrel for poor metabolizers; if this is not possible consider doubling the standard dose of clopidogrel (or, use standard dose clopidogrel). However, there is not a national consensus on drug/dose guidance in this population.

Back | Home | Close

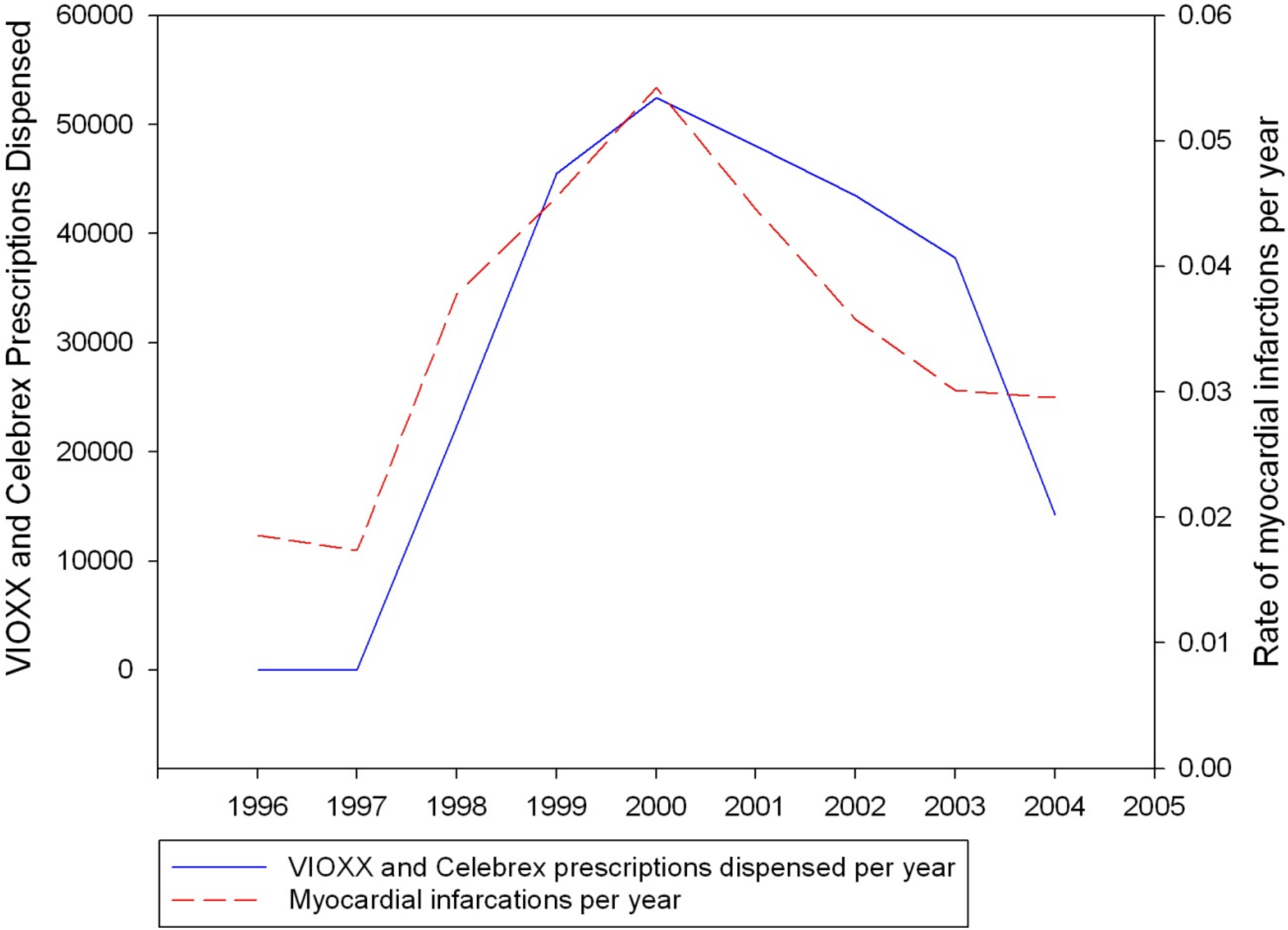
Courtesy: Vanderbilt University

Better Reuse For Research (and Workflow)



Better Reuse for Research (and Workflow)

- Data mining to detect adverse events
- Self-service hypothesis testing
- Alerts for subject recruitment
- Alerts for protocol violation


VIOXX and Celebrex Prescriptions Dispensed
60000
50000
40000
30000
20000
10000
0
Rate of myocardial infarctions per year
0.06
0.05
0.04
0.03
0.02
0.01
0.00
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
VIOXX and Celebrex prescriptions dispensed per year
Myocardial infarcations per year

Allergies: No Known Allergies

Allergy D

● Standing ■ Future Authorizing Provider:

⊟ ACCORD STUDY AGE 40 - 54 - SmartSet # 1410

⊞ THE ACCORD STUDY: Your Patient may be eligible for this Study. PLEASE CLICK

⊞ BELOW TO PROCEED. Thank You.

⊟ Trigger diagnosis

☑ Diabetes Uncompl Adult-Type II [250.00]

⊞ You do not need to explain the trial in detail or obtain consent from your patient.

⊞ Simply consider the following criteria, and select the appropriate response below.

⊞ YES below generates a consult to the study coordinator and Pt info in the After-Visit Summary.

⊞ -

⊞ Does your patient meet the following criteria:

⊞ 1.) Has documented Cardiovascular Disease: CHD, PVD, or Carotid disease

⊞ 2.) Has ONE or BOTH of these diagnoses: HTN and/or Dyslipidemia

⊞ 3.) Patient will allow limited chart review to determine eligibility

⊞ 4.) Patient is willing to be contacted by a research coordinator if eligible.

⊟ -

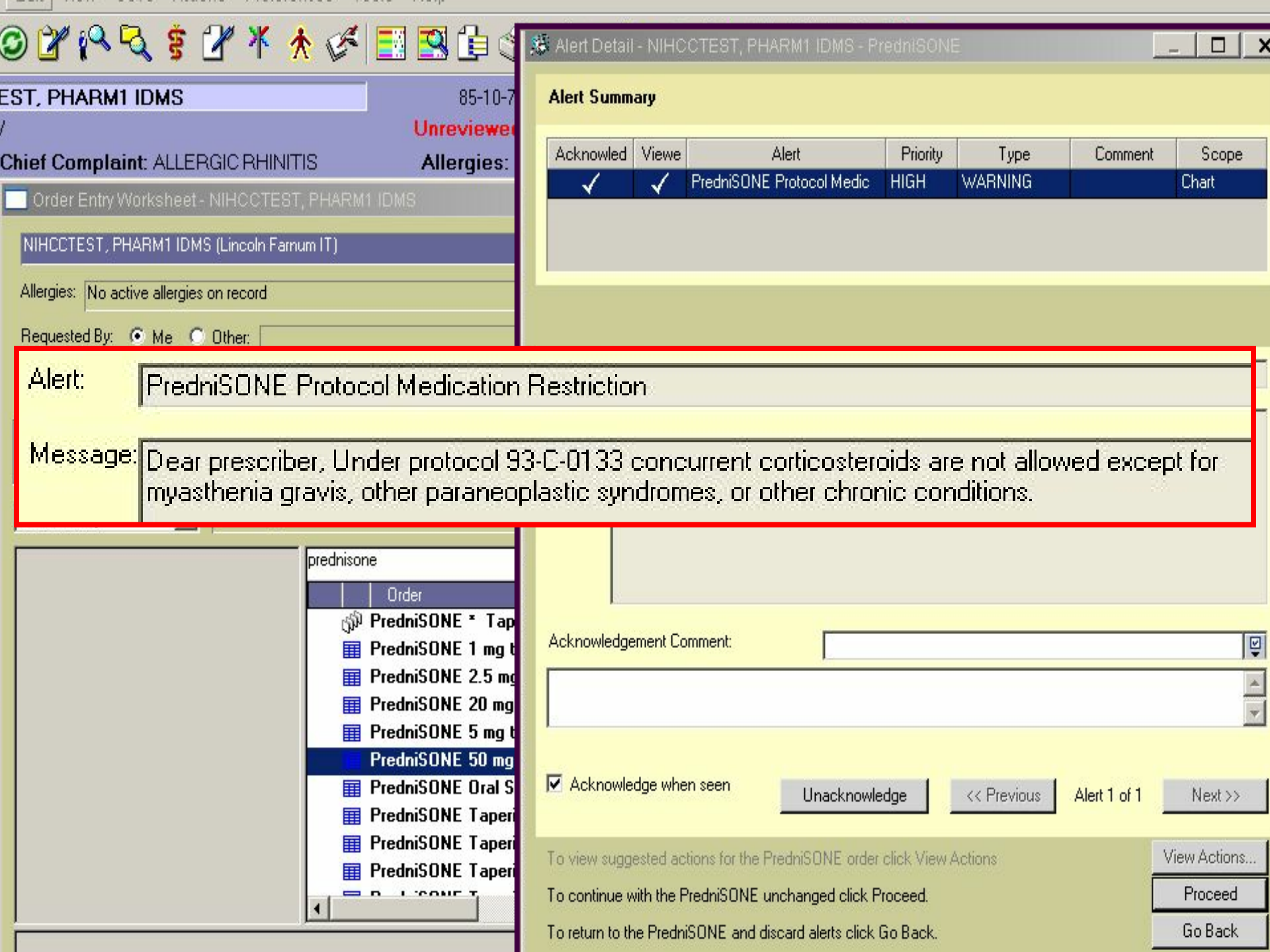
⊟ Please select one of the following, then click ACCEPT (single)

☐ YES, patient meets above criteria (Study Coordinator Consult-Right Click for Details)

☐ NO, Patient Does Not currently meet study Criteria listed in 1.) and 2.) above.

☐ NO, Patient meets these criteria but is not interested

Courtesy: University of Cincinnati


Alert Detail - NIHCCTEST, PHARM1 IDMS - PredniSONE
Alert Summary
Acknowled
Viewe
Alert
Priority
Type
Comment
Scope
PredniSONE Protocol Medic
HIGH
WARNING
Chart
Chief Complaint: ALLERGIC RHINITIS
Allergies:
Order Entry Worksheet - NIHCCTEST, PHARM1 IDMS
NIHCCTEST, PHARM1 IDMS (Lincoln Farnum IT)
Allergies: No active allergies on record
Requested By: Me Other:
Alert: PredniSONE Protocol Medication Restriction
Message: Dear prescriber, Under protocol 93-C-0133 concurrent corticosteroids are not allowed except for myasthenia gravis, other paraneoplastic syndromes, or other chronic conditions.
prednisone
Order
PredniSONE 50 mg
Acknowledgement Comment:
Acknowledge when seen
Unacknowledge
<< Previous
Alert 1 of 1
Next >>
To view suggested actions for the PredniSONE order click View Actions
To continue with the PredniSONE unchanged click Proceed.
To return to the PredniSONE and discard alerts click Go Back.
View Actions...
Proceed
Go Back

BIOMEDICAL TRANSLATIONAL RESEARCH INFORMATION SYSTEM

National Institutes of Health

ne

H BTRIS

BTRIS Presentations

BTRIS Lecture Podcasts

BTRIS In The News

» The Catalyst (3 MB)

» The Record

» CC News Articles

Staff Only

Welcome to BTRIS

The Biomedical Translational Research Information System (BTRIS) is a resource available to the NIH intramural community that brings together clinical research data from the Clinical Center and other NIH Institutes and Centers. BTRIS provides clinical investigators with access to identifiable data for the subjects on their own active protocols, while providing all NIH investigators with access to de-identified data across all protocols. BTRIS provides users with advanced search, filtering, and aggregation methods to create data sets to support ongoing studies and stimulate ideas for new research. BTRIS contains subject data from CRIS/MIS (the Clinical Center Medical Information Systems) and research data from NIAID (Crimson), NIAAA, and NCI. Data are available from 1976 to the present.

BTRIS comprises two distinct but interrelated Web-based applications, BTRIS Data Access and BTRIS Preferences. (Refer to the graphic below)

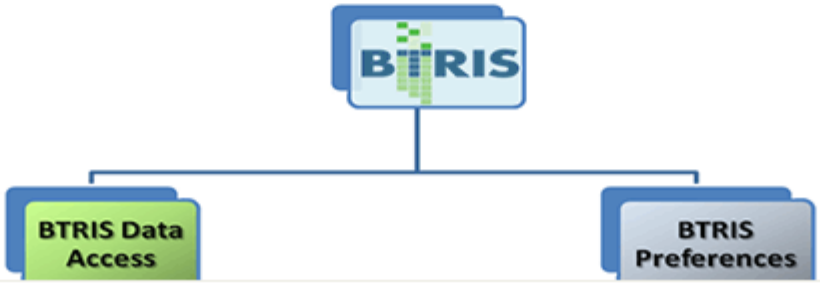
BTRIS Data Access is the data repository where principal investigators or their designees create reports on their active protocols with identified subject data. Multiple reports are available in BTRIS and can easily be run by researchers through a series of prompts. Reports include the IRB Inclusion Enrollment Report, demographics, patient lists, laboratory and microbiology results, vital signs, medication orders and administration, diagnoses, and radiology reports (with links to images in the CC PACS system).

BTRIS Preferences allows principal investigators or their designees to verify subject enrollment in their protocol(s). This ensures that reports created in BTRIS Data Access include all subjects. It also allows the principal investigator to designate associate investigators, and other members of the research team, to manage subject enrollment and create reports in BTRIS Data Access.

For questions or comment about BTRIS contact Dr. Jim Cimino, Chief, Laboratory for Informatics Development, NIH Clinical Center, National Institutes of Health, Bethesda, MD

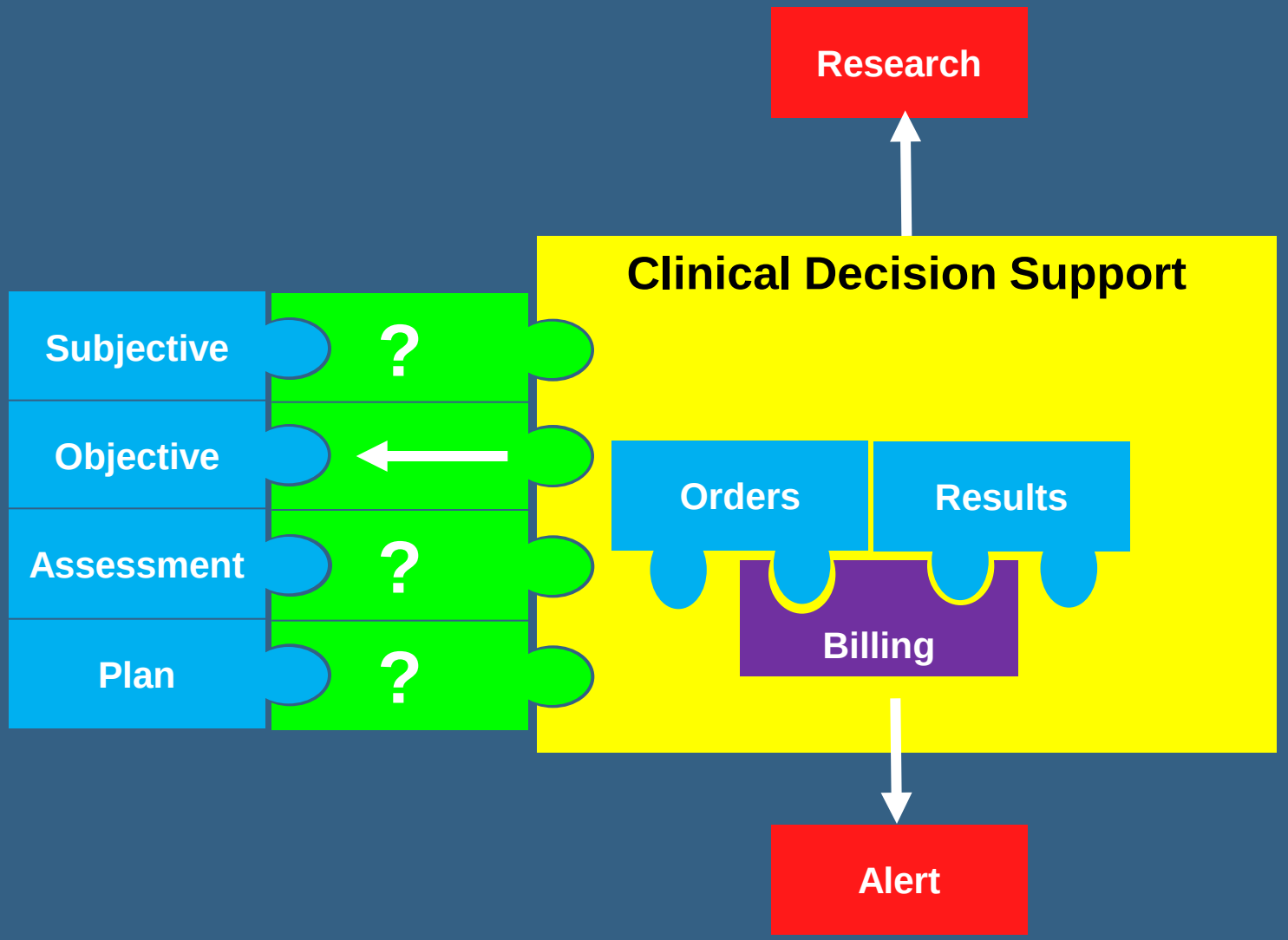
Latest News

» BTRIS Town Hall - October 2011



	A	B	C	D	E	F	G	H	I	J	K	L	M
1	Data Type	Subject	Event	Observation	Date	Medication Admin Da	Value	Unit of M	Range	Comment	Protocol	PI	PI Email
2	Diagnosis	Subject1	NIAID Problem	Chronic Granulomatous Disease (CGD)	5/1/1984 12:00		829			288.1			
3	Medications	Subject1		Bactrim DS	5/15/1984 12:00	No Admin Date Available							
4	Labs	Subject1	ALKALINE PHOSPHATASE	ALKALINE PHOSPHATASE	2/8/1985 10:38		124	U/L					
5	Labs	Subject1	BILIRUBIN TOTAL	BILIRUBIN TOTAL	2/8/1985 10:38		0.2	MG/DL		N			
6	Labs	Subject1	ALT/GPT	ALT/GPT	2/9/1985 12:42		18	U/L		N			
7	Labs	Subject1	AST/GOT	AST/GOT	2/9/1985 12:42		18	U/L		N			
8	Labs	Subject1	ALBUMIN	ALBUMIN	2/9/1985 12:42		4.1	G/DL		N			
9	Labs	Subject1	LDH	LDH	2/9/1985 12:42		231	U/L		N			
10	Labs	Subject1	BILIRUBIN	BILIRUBIN	2/10/1985 11:56		NEG						
11	Labs	Subject1	BILIRUBIN	BILIRUBIN	2/14/1985 12:16		NEG						
12	Diagnosis	Subject1	Discharge Diagnosis	Primary Tuberculous Infection, Unspecifie	2/27/1985 0:00		10.9			PRIMARY TUBERCULOSIS			
13	Diagnosis	Subject1	NIAID Problem	Pulmonary tuberculosis	6/1/1985 12:00		314			11.9			
14	Medications	Subject1		Streptomycin	6/1/1985 12:00	No Admin Date Available							
15	Medications	Subject1		Rifampin	6/15/1985 12:00	No Admin Date Available							
16	Medications	Subject1		INH	8/1/1985 12:00	No Admin Date Available							
17	Labs	Subject1	ALBUMIN	ALBUMIN	7/30/1986 11:44		4.1	G/DL		N			
18	Labs	Subject1	LDH	LDH	7/30/1986 11:44		317	U/L		H			
19	Diagnosis	Subject1	Discharge Diagnosis	Primary Tuberculous Infection, Unspecifie	8/4/1986 0:00		10.9			PRIMARY PULMONARY TUBERCULOSIS ON			
20	Labs	Subject1	ALKALINE PHOSPHATASE	ALKALINE PHOSPHATASE	8/4/1986 11:18		168	U/L					
21	Medications	Subject1		INH	9/1/1988 12:00	No Admin Date Available							
22	Medications	Subject1		Pyrazinamide	9/15/1988 12:00	No Admin Date Available							
23	Labs	Subject1	ALKALINE PHOSPHATASE	ALKALINE PHOSPHATASE	9/16/1988 14:32		162	U/L					
24	Diagnosis	Subject1	Discharge Diagnosis	Unspecified Pulmonary Tuberculosis, Uns	9/20/1988 0:00		11.9			R/O REACTIVATION TUBERCULOSIS			
25	Labs	Subject1	ALKALINE PHOSPHATASE	ALKALINE PHOSPHATASE	2/2/1993 10:40		208	U/L					
26	Labs	Subject1	ALKALINE PHOSPHATASE	ALKALINE PHOSPHATASE	6/22/1993 10:56		209	U/L			93-I-0119	Steven H	sholland@r
27	Medications	Subject1		RIFAMPIN 300MG CAPSULE	11/27/1998 12:00	No Admin Date Available					93-I-0119	Steven H	sholland@r
28	Medications	Subject1		LEVOFLOXACIN 500MG TAB	11/27/1998 12:00	No Admin Date Available					93-I-0119	Steven H	sholland@r
29	Medications	Subject1		SODIUM SULFACETAMIDE 10%, SULFUR 5%	11/27/1998 12:01	No Admin Date Available					93-I-0119	Steven H	sholland@r
30	Medications	Subject1		LEVOFLOXACIN 500MG TAB	12/3/1998 17:33	No Admin Date Available					93-I-0119	Steven H	sholland@r
31	Medications	Subject1		RIFAMPIN 300MG CAPSULE	12/3/1998 17:33	No Admin Date Available					93-I-0119	Steven H	sholland@r
32	Labs	Subject1	Hepatic Panel	ALT/GPT(Alanine Trans)	9/13/1999 5:59		19	U/L	Jun-41		93-I-0119	Steven H	sholland@r

There Are Still Pieces Missing

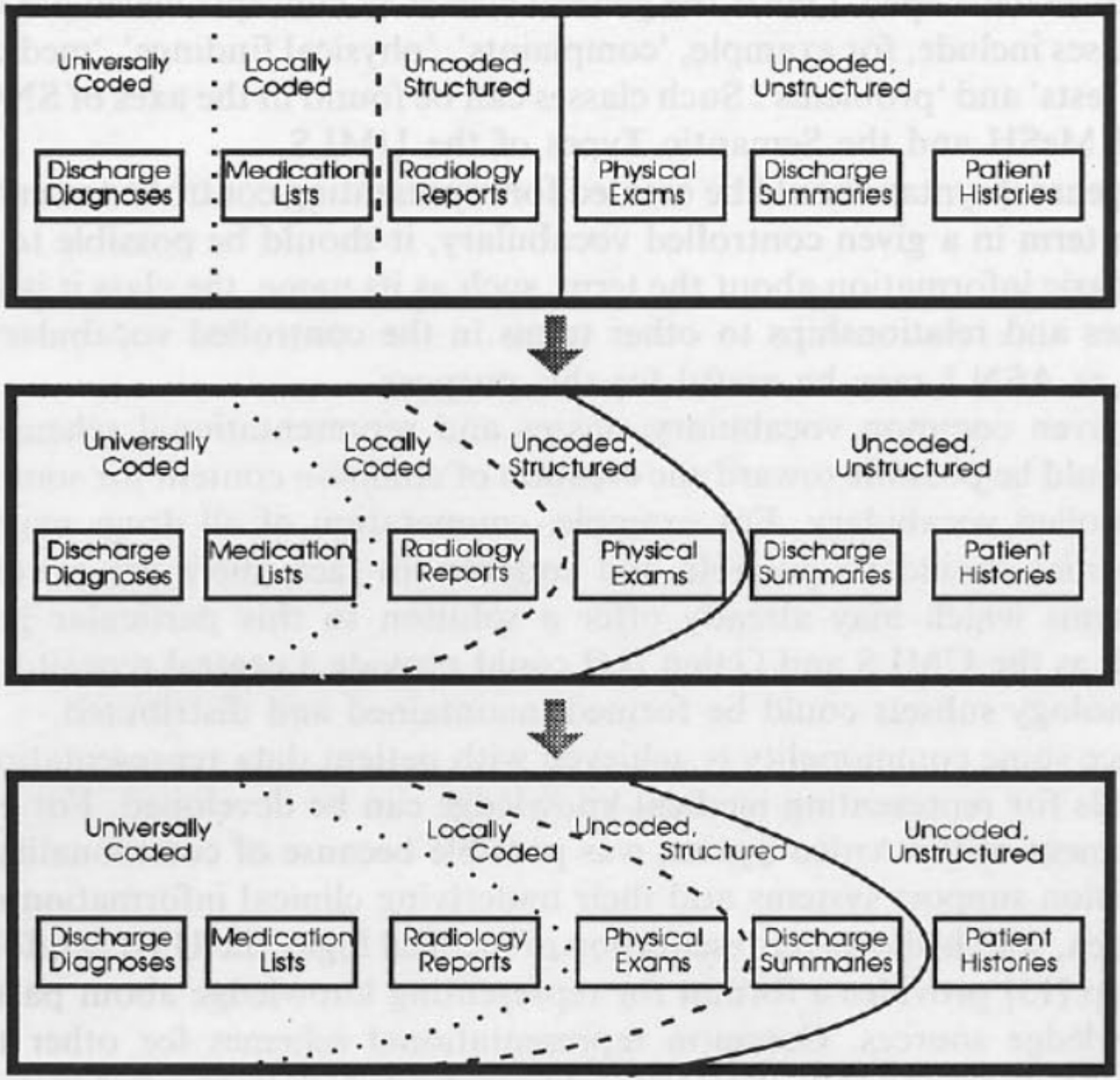


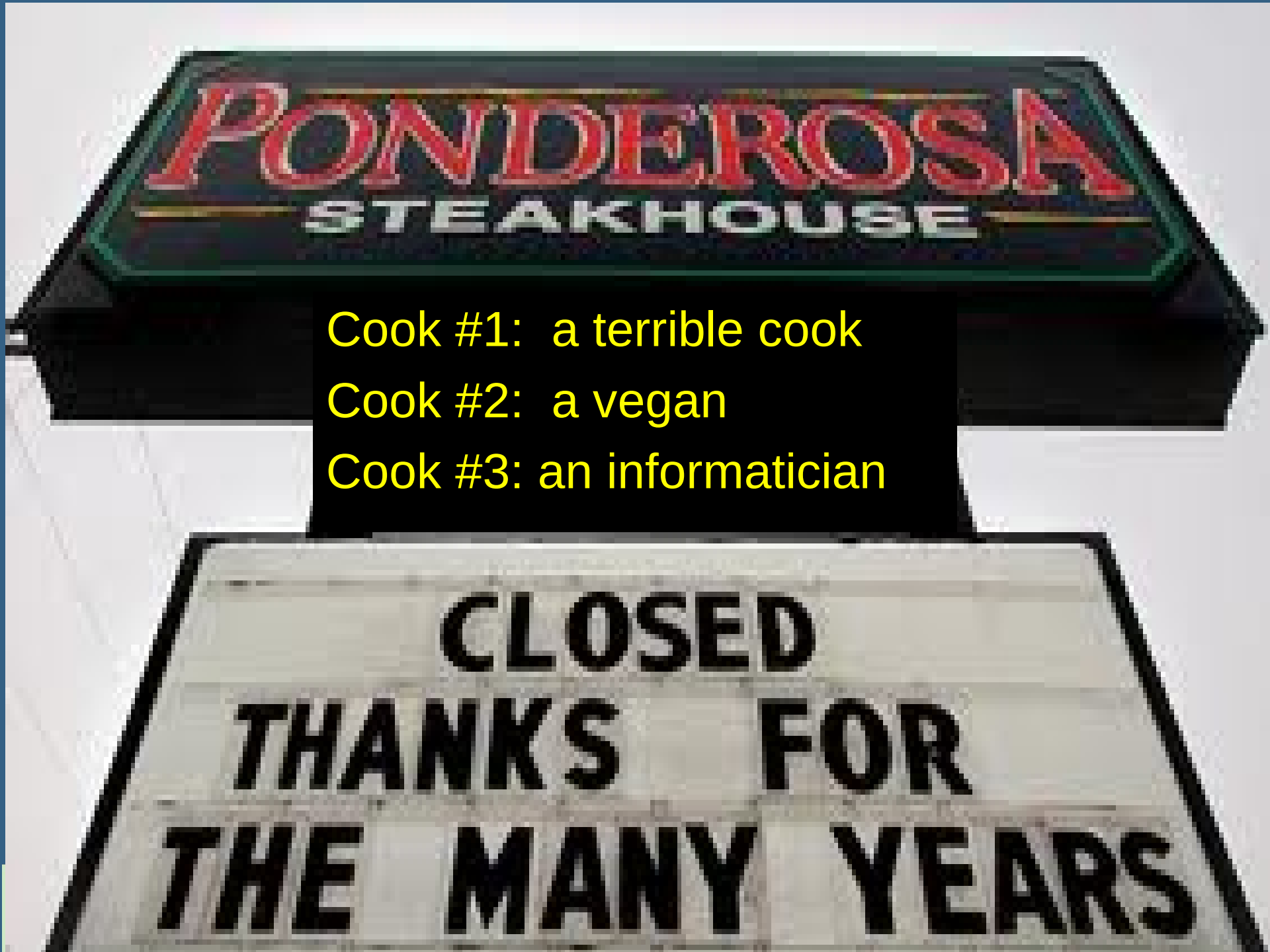
Tactics versus Strategy

Medical Records the Guide and Teach

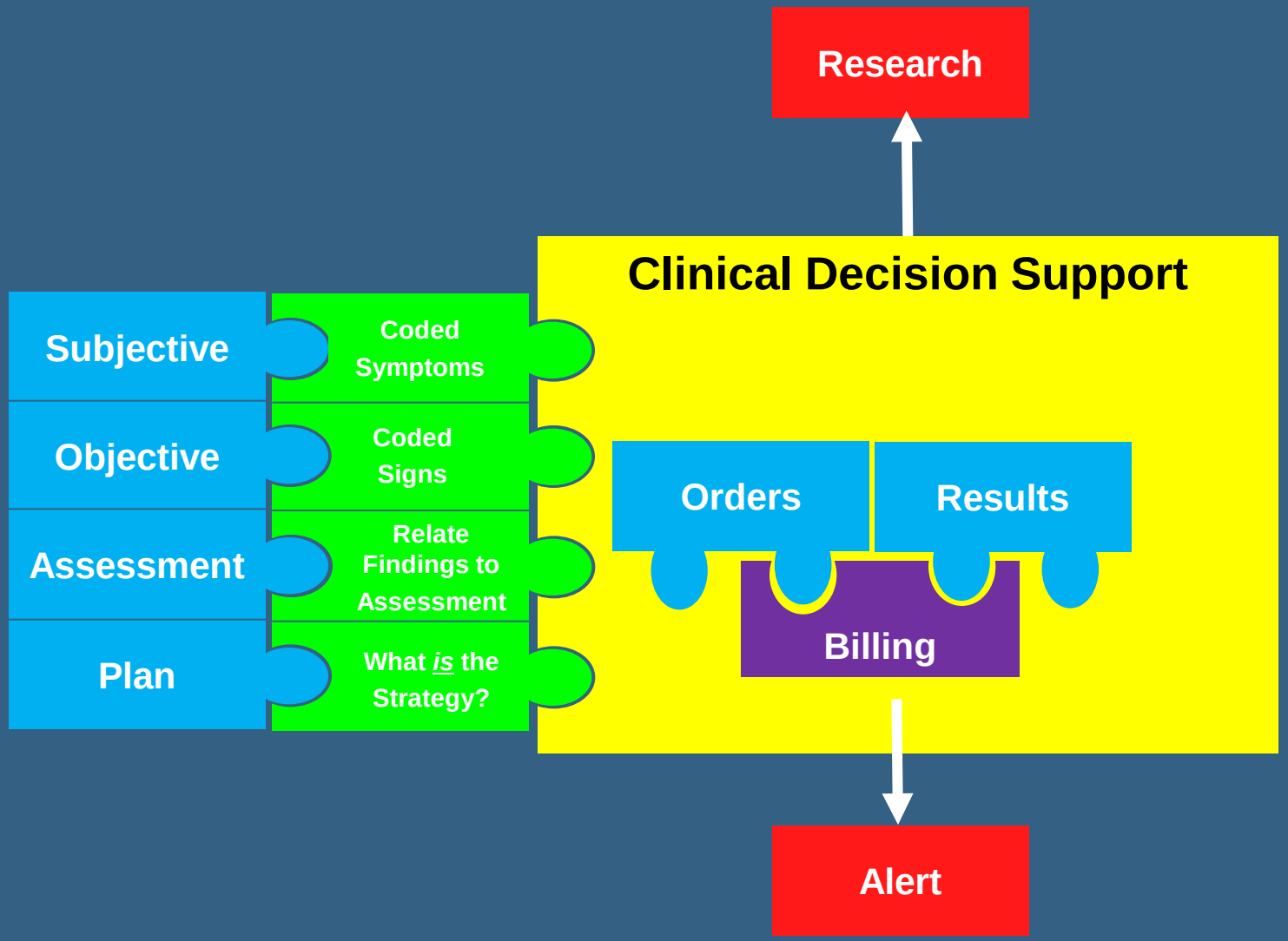
- Larry Weed mentions computers 24 times

"If we accept the limits of discipline and form as we keep data in the medical records the physician's task will be better defined, the role of paramedical personnel and the computer will be clarified, and the art of medicine will gain freedom at the level of interpretation and be released from the constraints that disorder and confusion always impose."


Universally Coded
Locally Coded
Uncoded, Structured
Uncoded, Unstructured
Discharge Diagnoses
Medication Lists
Radiology Reports
Physical Exams
Discharge Summaries
Patient Histories
Universally Coded
Locally Coded
Uncoded, Structured
Uncoded, Unstructured
Discharge Diagnoses
Medication Lists
Radiology Reports
Physical Exams
Discharge Summaries
Patient Histories
Universally Coded
Locally Coded
Uncoded, Structured
Uncoded, Unstructured
Discharge Diagnoses
Medication Lists
Radiology Reports
Physical Exams
Discharge Summaries
Patient Histories


PONDEROSA
STEAKHOUSE
Cook #1: a terrible cook
Cook #2: a vegan
Cook #3: an informatician
CLOSED
THANKS FOR
THE MANY YEARS

We Need to Make the Computer a Full Partner



CAD/DM Smart Form

PARTNERS
Clinical Informatics
Research & Development

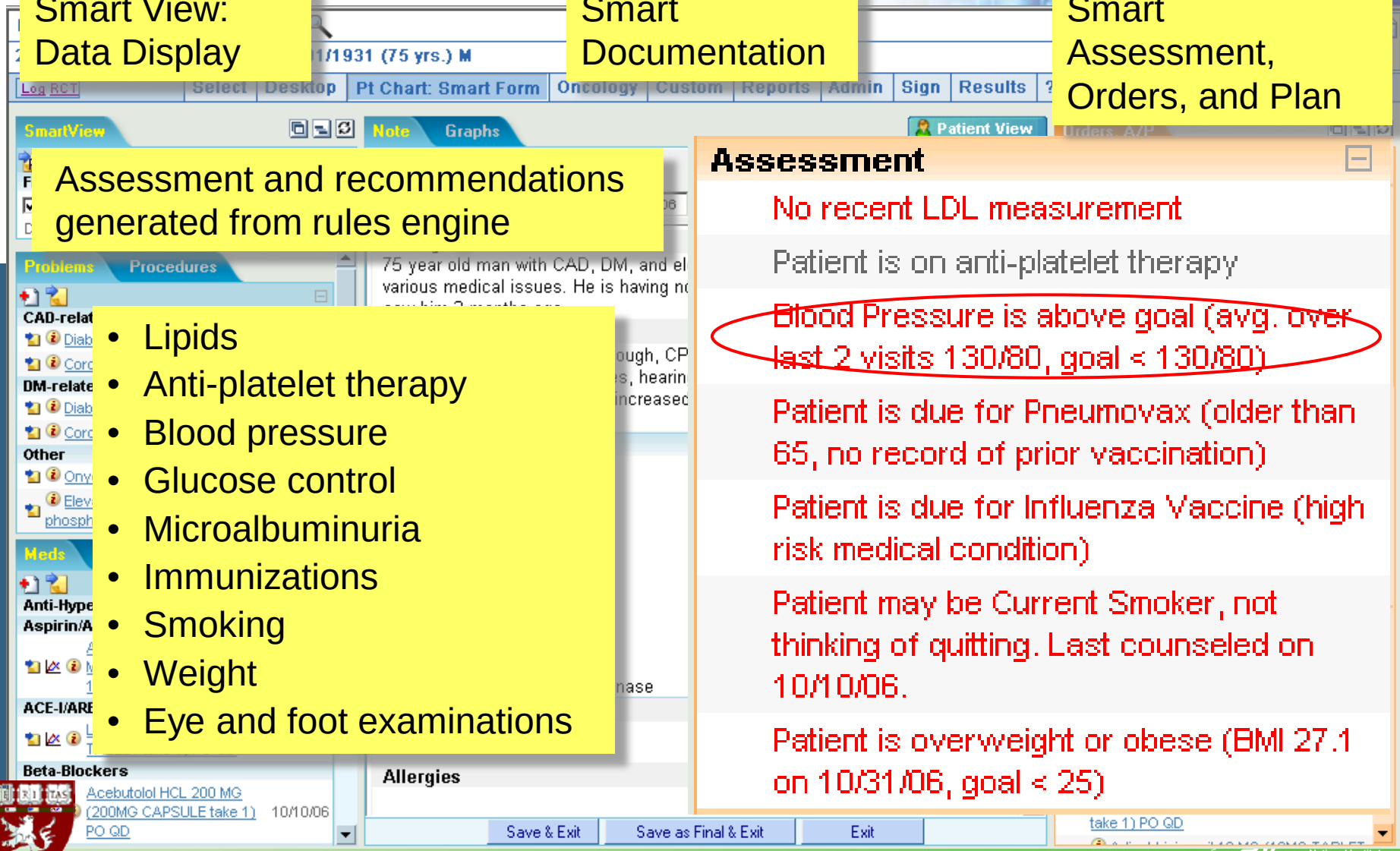
Smart View: Data Display

Smart Documentation

Smart Assessment, Orders, and Plan

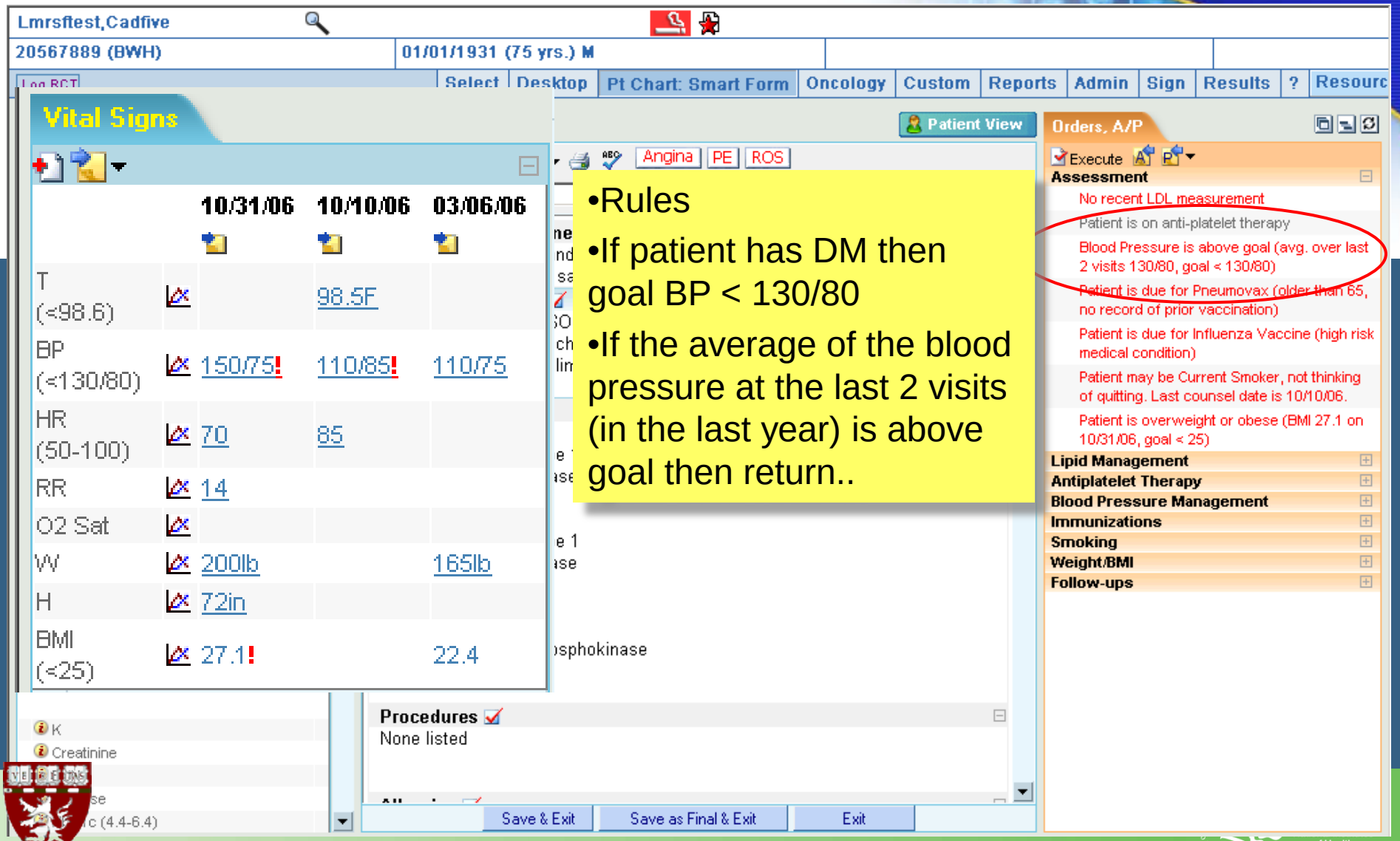
Assessment and recommendations generated from rules engine

- Lipids
- Anti-platelet therapy
- Blood pressure
- Glucose control
- Microalbuminuria
- Immunizations
- Smoking
- Weight
- Eye and foot examinations



National Institutes of Health
Clinical Center

CAD/DM Smart Form\



- Rules
- If patient has DM then goal BP < 130/80
- If the average of the blood pressure at the last 2 visits (in the last year) is above goal then return..

CAD/DM Smart Form

PARTNERS
Clinical Informatics
Research & Development

- Medication Orders
- Lab Orders
- Referrals
- Handouts/Education

Blood Pressure Management

Blood Pressure is above goal (avg. over last 2 visits 130/80, goal < 130/80)

Start an Other Anti-Hypertensives (Help Me Choose)

Adjust Oretic 25 MG (25MG TABLET take 1) PO QD

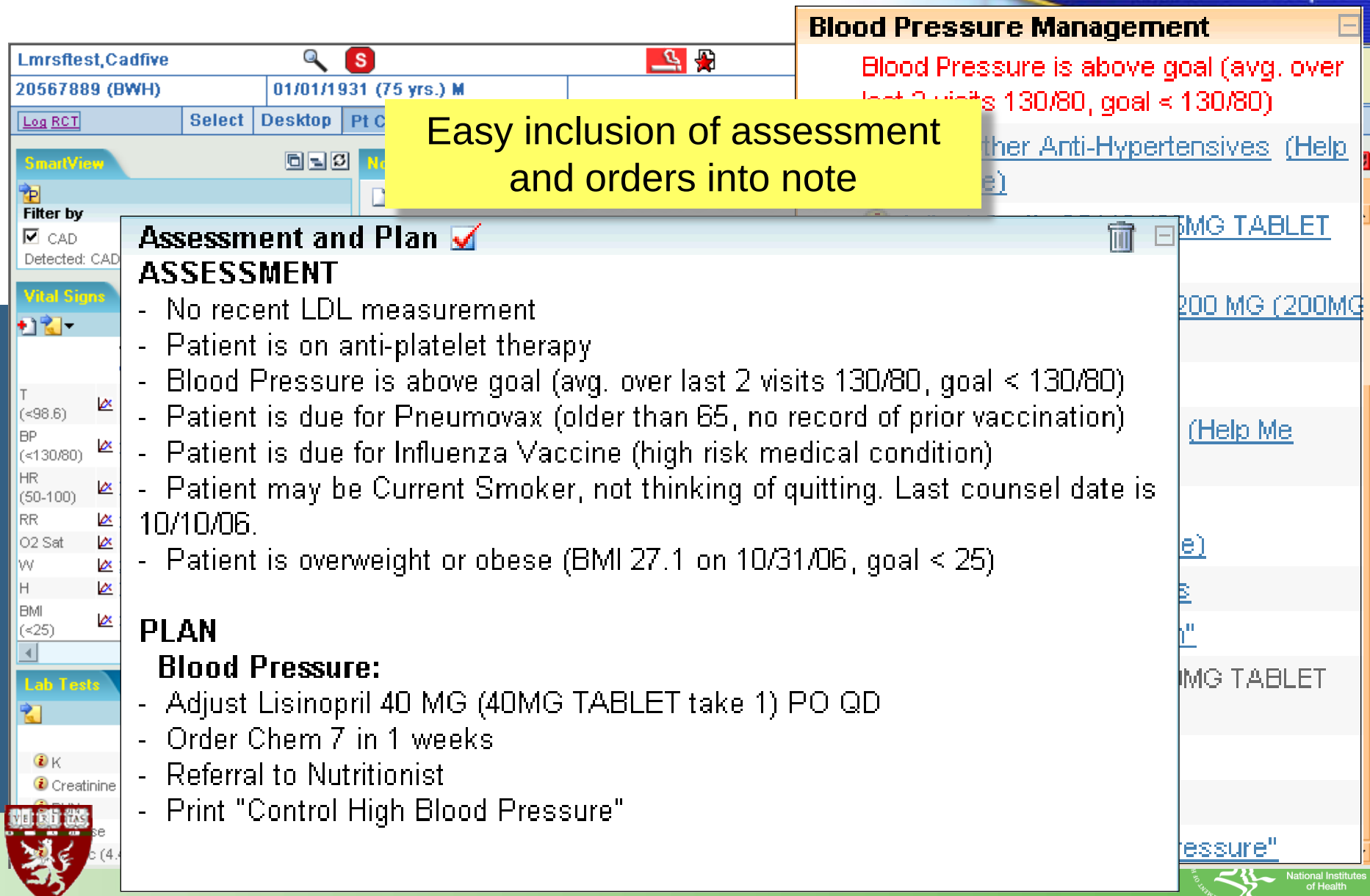
Adjust Lisinopril 20 MG (20MG TABLET take 1) PO QD

Adjust Acebutolol HCL 200 MG (200MG CAPSULE take 1) PO QD

- [ ] Order Chem 7 now
- [ ] Order Chem 7 in 4 Weeks
- [ ] Referral to Nutritionist
- [ ] Referral to Cardiac Rehab (Help Me Choose)
- [ ] Referral to Blood Pressure Specialist (Help Me Choose)
- [ ] Print "Control High Blood Pressure"
- [ ] Print DASH diet instructions
- [ ] Print exercise "prescription"

CAD/DM Smart Form

PARTNERS
Clinical Informatics
Research & Development



Easy inclusion of assessment and orders into note

Assessment and Plan

ASSESSMENT

- No recent LDL measurement
- Patient is on anti-platelet therapy
- Blood Pressure is above goal (avg. over last 2 visits 130/80, goal < 130/80)
- Patient is due for Pneumovax (older than 65, no record of prior vaccination)
- Patient is due for Influenza Vaccine (high risk medical condition)
- Patient may be Current Smoker, not thinking of quitting. Last counsel date is 10/10/06.
- Patient is overweight or obese (BMI 27.1 on 10/31/06, goal < 25)

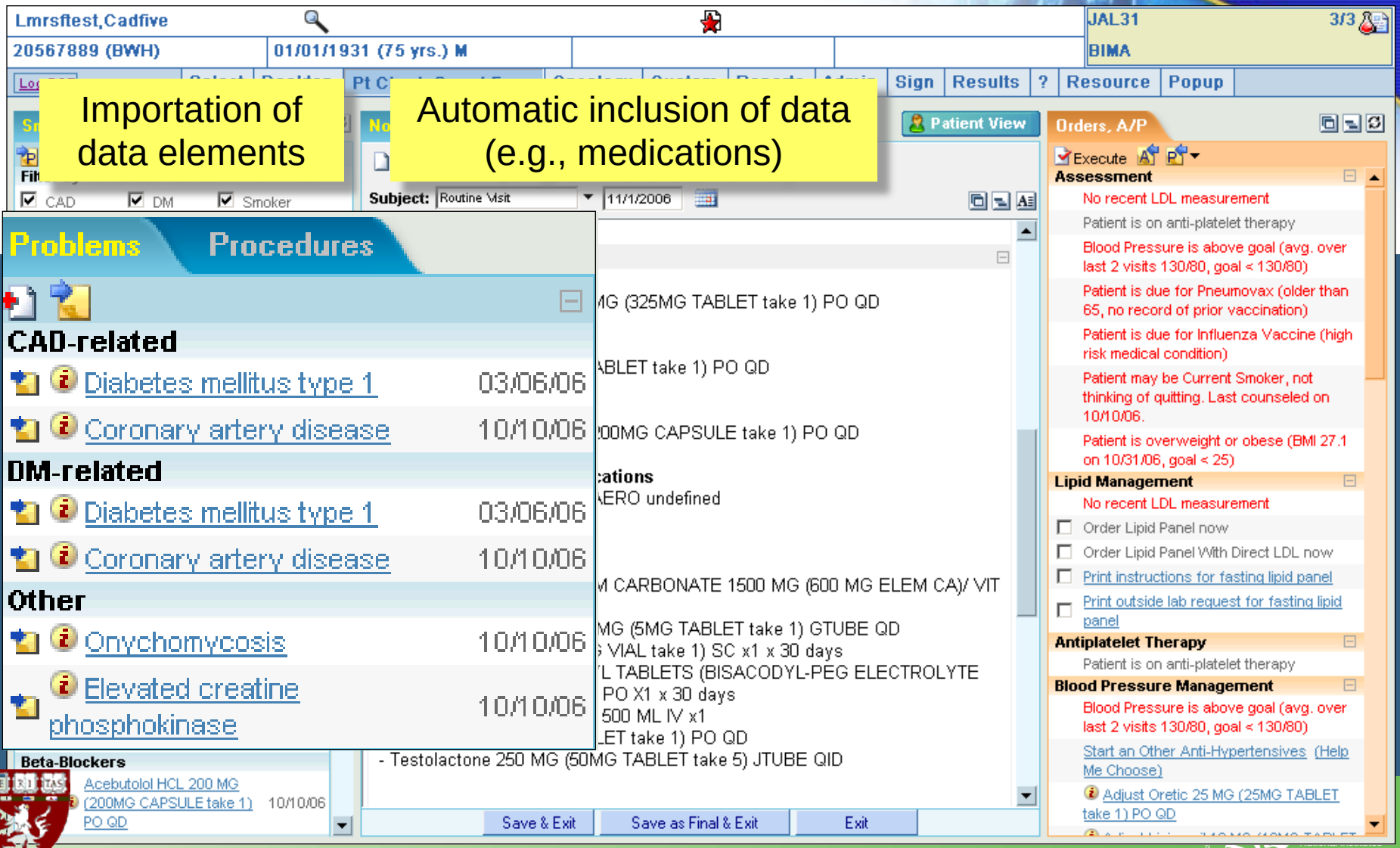
PLAN

Blood Pressure:

- Adjust Lisinopril 40 MG (40MG TABLET take 1) PO QD
- Order Chem 7 in 1 weeks
- Referral to Nutritionist
- Print "Control High Blood Pressure"

National Institutes of Health
Clinical Center

CAD/DM Smart Form: Workflow



Automated Inclusion of Data in Notes

- Adverse effects:
  - Leads to note bloat
  - Discrepancies in the record
- Alternative therapy:
  - Annotate non-note data
  - Create relevant views while composing notes
  - Link observations to assessments - evidence
  - Link observations to plan – monitoring strategy

Future Partnerships

- Evidence-based care
- Quality care
- Cost containment
- Genomics: diagnosis, treatment, prognosis
- Pharmacogenomics: patient, tumor, microorganism
- Meaningful use of electronic health records

Larry Weed, Again

It has been said that preoccupation with the medical record and the computer leads to neglect of the "humanitarian" side and the "art" of medical practice.

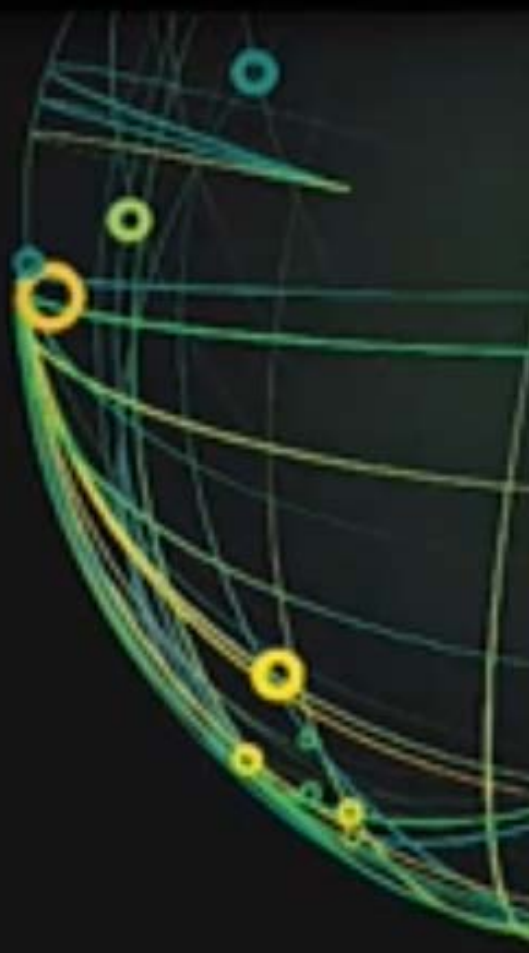
The most humanitarian thing a physician can do is to precisely know what he is doing, and make the patient as comfortable as he can in the face of problems that he cannot yet solve.

Where Do We Go from Here?

- EHRs are less problem-oriented than paper ones
- Current EHRs are victims of their history
- Those who don't study history are doomed to repeat it
- We need to stop thinking of the EHR as a diary
- We need to tell the EHR why we are doing things

Putting IBM Watson to Work in Healthcare

A New Class of Industry Specific Analytical Solutions.



IBM

Memorial Sloan-Kettering Cancer Center

Where Do We Go from Here?

- EHRs are less problem-oriented than paper ones
- Current EHRs are victims of their history
- Those who don't study history are doomed to repeat it
- We need to stop thinking of the EHR as a diary
- We need to tell the EHR why we are doing things
- Then it can evolve to a solution-oriented health record
- Extinction is part of the evolutionary process
- IBM has tried to build EHRs before…
- Partners Healthcare purchased a commercial EHR

Acknowledgements

- Blackford Middleton: Partners Healthcare/Harvard
- Ken Mandl: Intelligent Health Lab (Harvard)
- Patti Dykes: Electronic Bedside Communication Center (eBCC; Harvard)
- David Vawdrey: SmartNotes (Columbia University)
- Dan Masys: Vanderbilt University
- Bill Tierney: Regenstrief Institute