

It's 08:14 hrs on 22 Mar 2010.

Dr. Rosman, your beeper is
buzzing.









Chief Resident, Infectious Disease,
The Mayo Clinic, Rochester



imagination at work

Let's watch closely for a short time.

(All days in the week of 21 Mar 2010)

06:34 Mon	ER admission	
07:28 Mon	Labs and Xray	
08:14 Mon	Chief resident, Infectious Disease	
09:27 Mon	Med-Surg Ward 3-West	
09:40 Mon	Chief of Infectious Disease	
15:19 Wed	Director, Performance Improvement and Risk Management	

06:34 Monday, 22 Mar 2010

67 year old male smoker
presents to ER with
2 days of fever,
chills, and
productive cough.



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Meet Roger Dogeman

Quiet time in the ER today. Mr. Dogeman seen almost immediately by resident, Dr. Forseman.

Evaluation: (left lower rales) consistent with pneumonia.

Orders in ER:
CBC, Lytes, BUN, Cr and CXR. Pulse oximetry checked.



Roger Dogeman, DOB 03/04/1938

Vital Signs @ 06:40 hrs

Vitals	Heart Rate	110
	Systolic BP	150
	Diastolic BP	80
	Respiratory Rate	28
	Temperature	38.9
	O2 Sat	88



First Impression:

Poor respiratory function, r/o Pneumonia

Note:

Fever,
Possible infection

07:28 Monday, 22 Mar 2010

Labs and CXRs done. Reports available.



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Summary @ 07:28 hrs

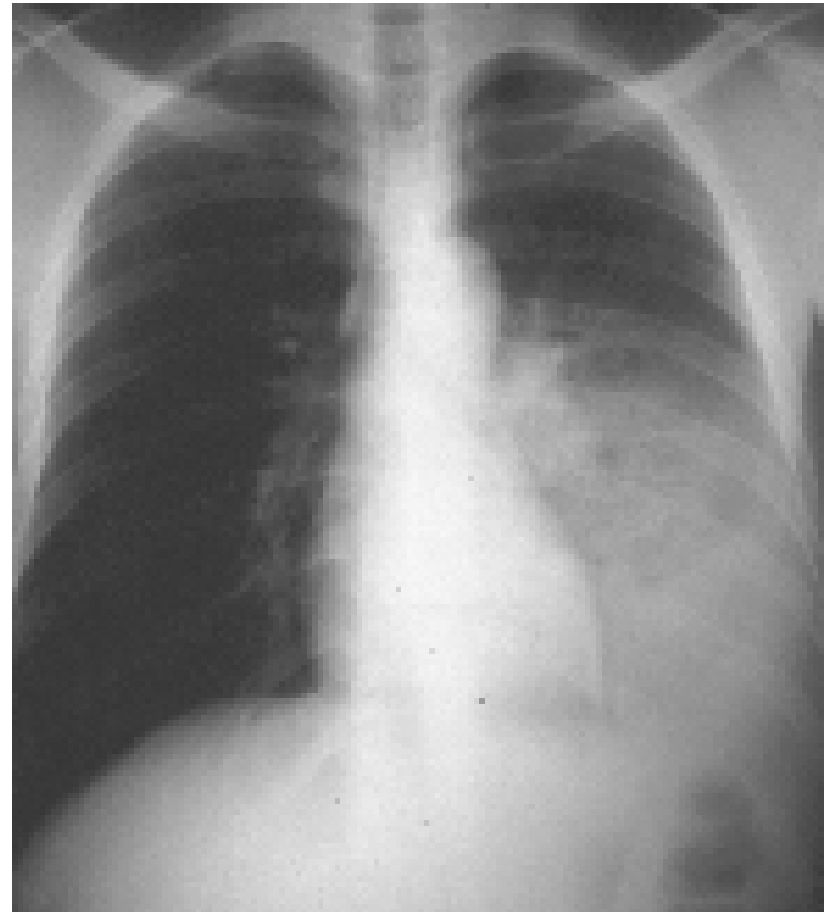
Presentation	Signs	Cough and Fever
Demographics	Age	67
	Sex	M
Vitals	Heart Rate	110 ↑
	Systolic BP	150 ↑
	Diastolic BP	80
	Respiratory Rate	28 ↑
	Temperature	38.9 ↑
	O2 Sat	88 ↓
Past History	Problem List	Renal Insufficiency
		Nicotine Dependence
Allergies		Allergy to b-lactam
Medications		none
New Labs	Hgb	10 ↓
	HCT	30 ↓
	WBC	18000 ↑
	Sodium	133 ↓
	BUN	34 ↑
	Glucose	97
	pH	pending
	Cr	1.9 ↑

Poor respiratory function,
Fever,
Anemia,
r/o infection,
Renal insufficiency

See CXRs ►

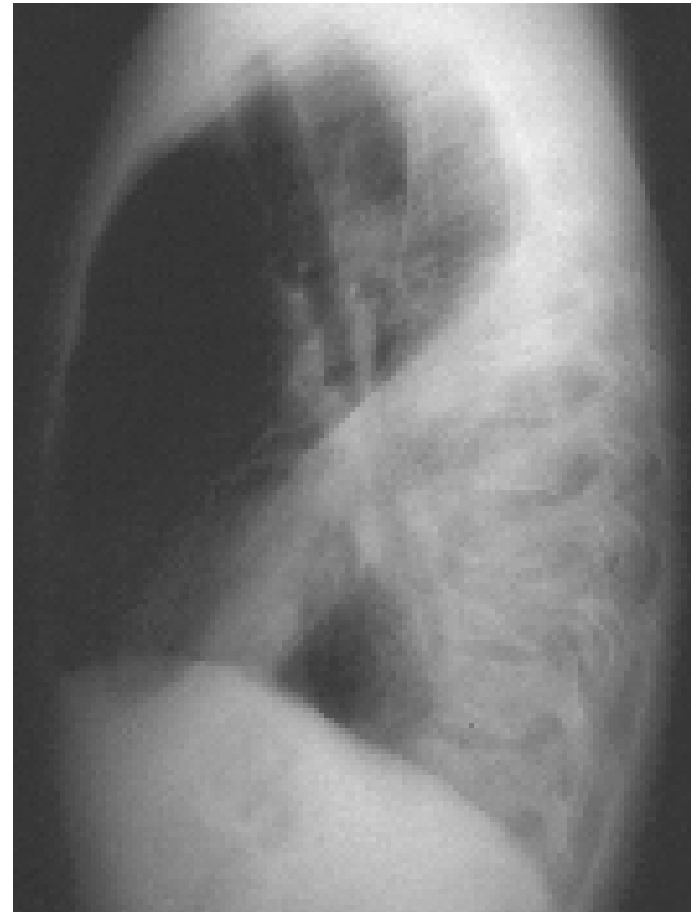
Chest X-rays

PA view of the chest shows dense opacity in the left lower lobe, consistent with pneumonia.



Chest X-rays

The loss of the left hemidiaphragm ("silhouette sign") and preservation of the left heart border, indicates involvement of the left lower lobe and sparing of the lingula of the left upper lobe.



Dr. Forseman records Problem @ 08:13 hrs

John Forseman, MD

Select a patient: **Dogeman, Roger || DOB: 03/04/1938** ▼

Current Problems

Add Problem

Problem Name * **Pneumonia** ▼

Status * **Active** ▼

Submit

The SAGE Engine is triggered by this event.

SAGE?

Shared Active Guideline Environment

2001-2006: An R&D consortium to develop the technology infrastructure to enable computable clinical guidelines, that is shareable and interoperable across multiple clinical information system platforms.

A 5-year, industry-academic research collaboration led by IDX Systems, now GE Healthcare

Partners:

- Apelon, Inc.

The Apelon logo consists of the word "Apelon" in a white, sans-serif font, centered within a solid red rectangular background.

- Intermountain Healthcare



- Mayo Clinic



- Stanford Medical Informatics



- University of Nebraska Medical Center

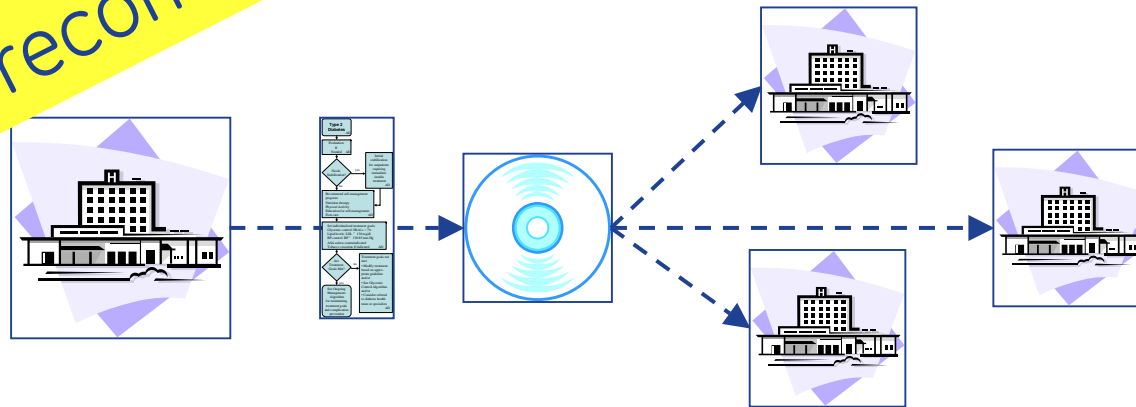


SAGE Project Goals

The primary goal: Develop a Standards-Based Sharable Active Guideline Environment with:

- Health experts can author and encode clinical practice guidelines in a standard computer-readable format, and
- Health care organizations throughout the nation can deploy those guidelines within any standards-conforming clinical information system.

Make recommendations at the point of care!



08:14 Monday, 22 Mar 2010

Dr Rosman, your beeper is buzzing.

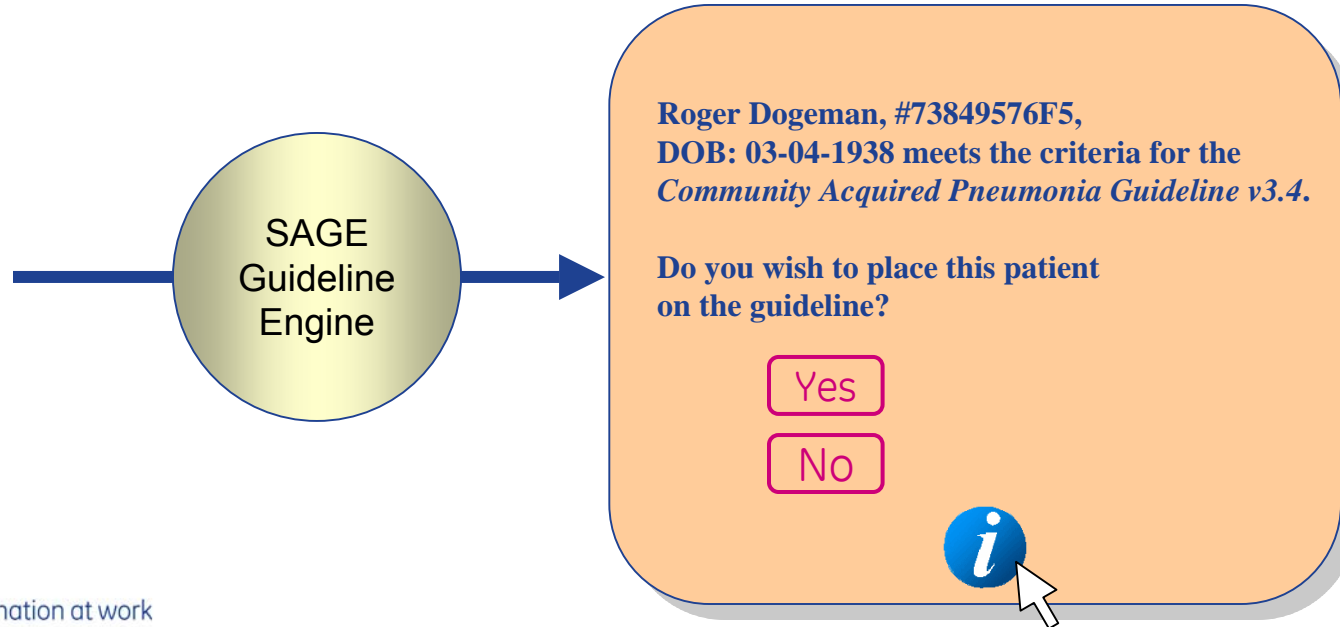


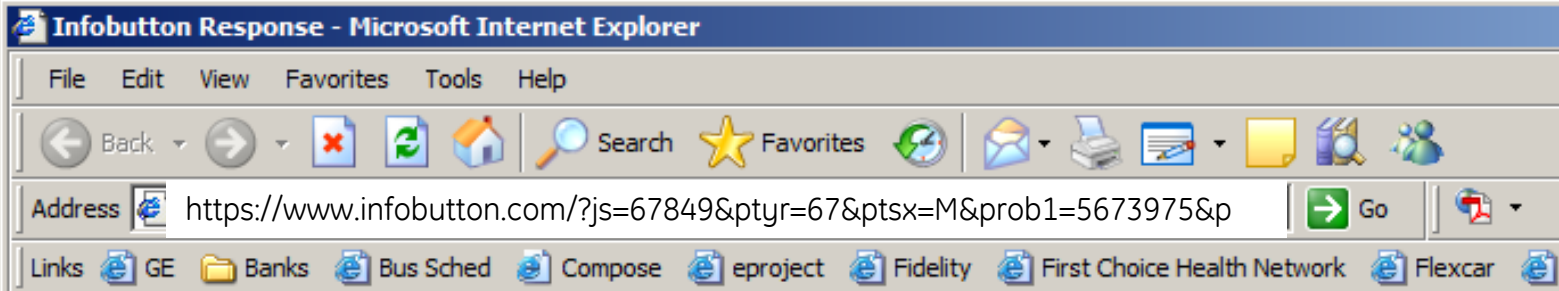
Chief Resident, Infectious Disease,
The Mayo Clinic, Rochester

Collaborating with ER Resident, Dr. Forseman responds to SAGE

SAGE inquires:

After checking for eligibility (not female and pregnant, no HIV, no recent hospitalization), SAGE asks if the physician wants to use the CAP guideline for this patient.





Help from the GE/Intermountain Healthcare Infobutton Manager

Concept of Interest: Community Acquired Pneumonia

Patient: age = 67, sex = male

History: renal insufficiency, smoker

Labs (LOINC specified), CXR (SMOMED-CT specified)

Context: recommendation for use of guideline

Guidelines:

[CAP \(ICSI Feb 2009, v3.4\), available from SAGE](#)

[CAP \(APS Jun 2009, v5.5\)](#)

Frequently asked questions:

[What antibiotics are frequently recommended for CAP?](#)

[What JCAHO measures are required by The Mayo Clinic?](#)

[How is pO₂ monitoring used in Pneumonia?](#)

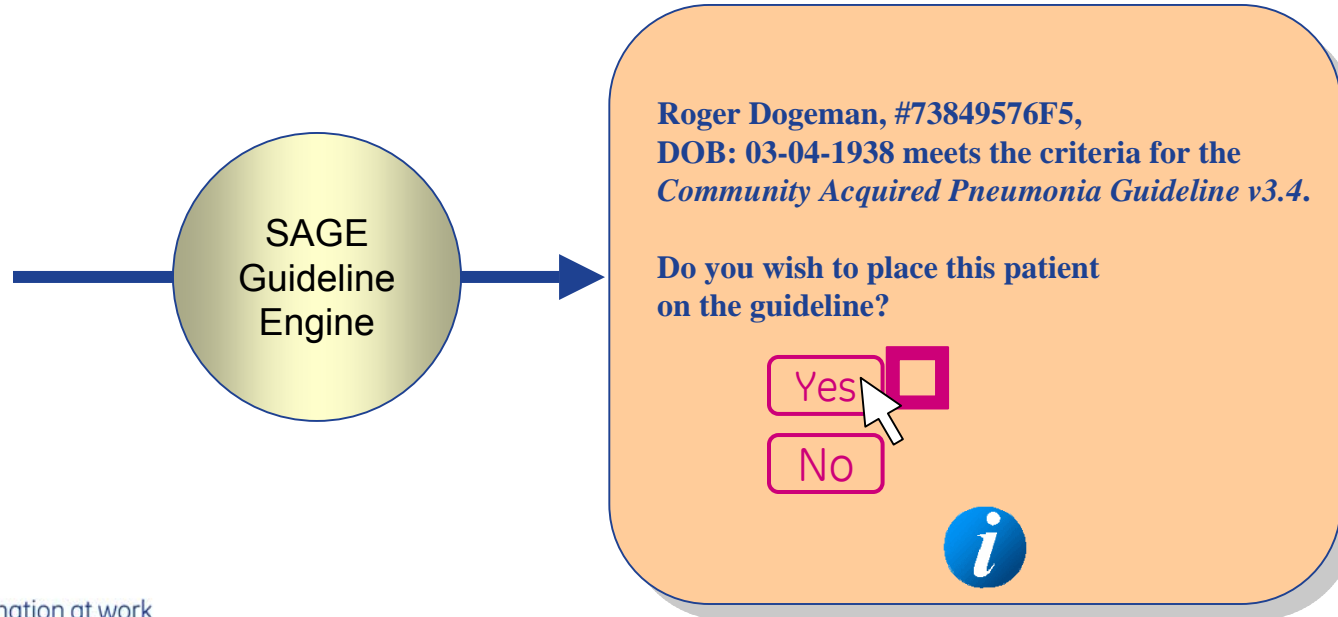
[Other common questions \(6\)](#)

[Search other resources \(3\)](#)

Collaborating with ER Resident, Dr. Forseman responds to SAGE

SAGE inquires:

After checking for eligibility (not female and pregnant, no HIV, no recent hospitalization), SAGE asks if the physician wants to use the CAP guideline for this patient.



SAGE determines Pulmonary Severity Index

First, SAGE presents current values

and inquires for unknowns.

*Age :

*Sex :

☐ Nursing Home Resident

Comorbid Diseases :

☒ Renal Disease

☐ Liver Disease

☐ CHF

☐ Cerebrovascular Disease

☐ Neoplasia

Physical Exam :

☐ Altered Mental Status

☐ SBP < 90

☐ Temp < 35 or >= 40

☐ RR >= 30

☐ HR >= 125

Labs :

☐ PH < 7.35

☒ PO2 < 60 or Sat < 90

☐ NA < 130

☐ HCT < 30

☐ Gluc > 250

☒ BUN > 30

☐ Pleural Effusion

SAGE determines PSI

Given new observations, SAGE determines PSI score and explains that hospitalization is recommended for this patient.

Pneumonia Severity Index Results

Class : IV
Score : 107
Mortality : 9.5%

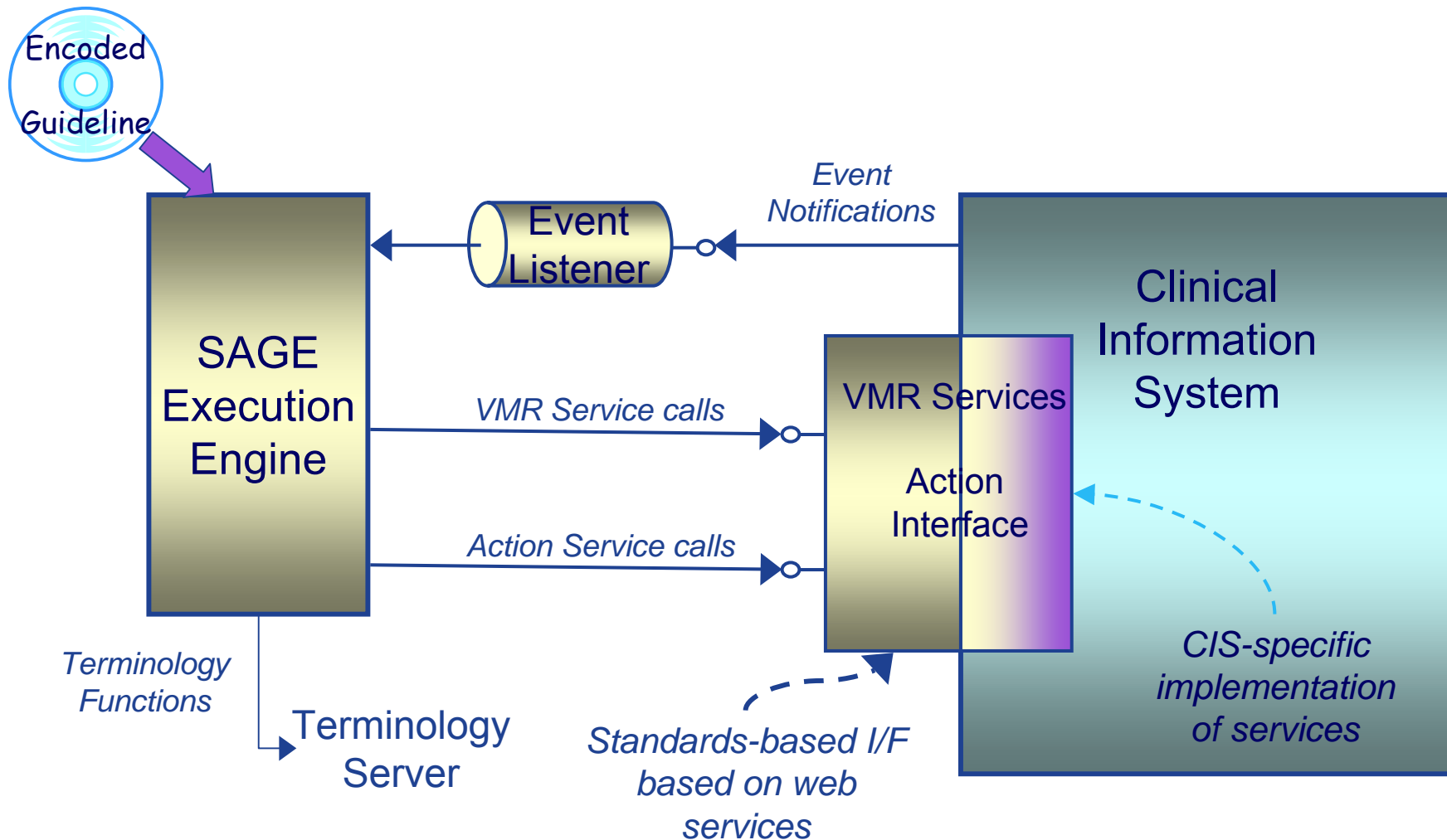
Pneumonia Severity Index

Risk	Class	Score	Mortality
Low	I	< 51	0.1%
Low	II	51 - 70	0.6%
Low	III	71 - 90	0.9%
Medium	IV	90 - 130	9.5%
High	V	> 130	26.7%

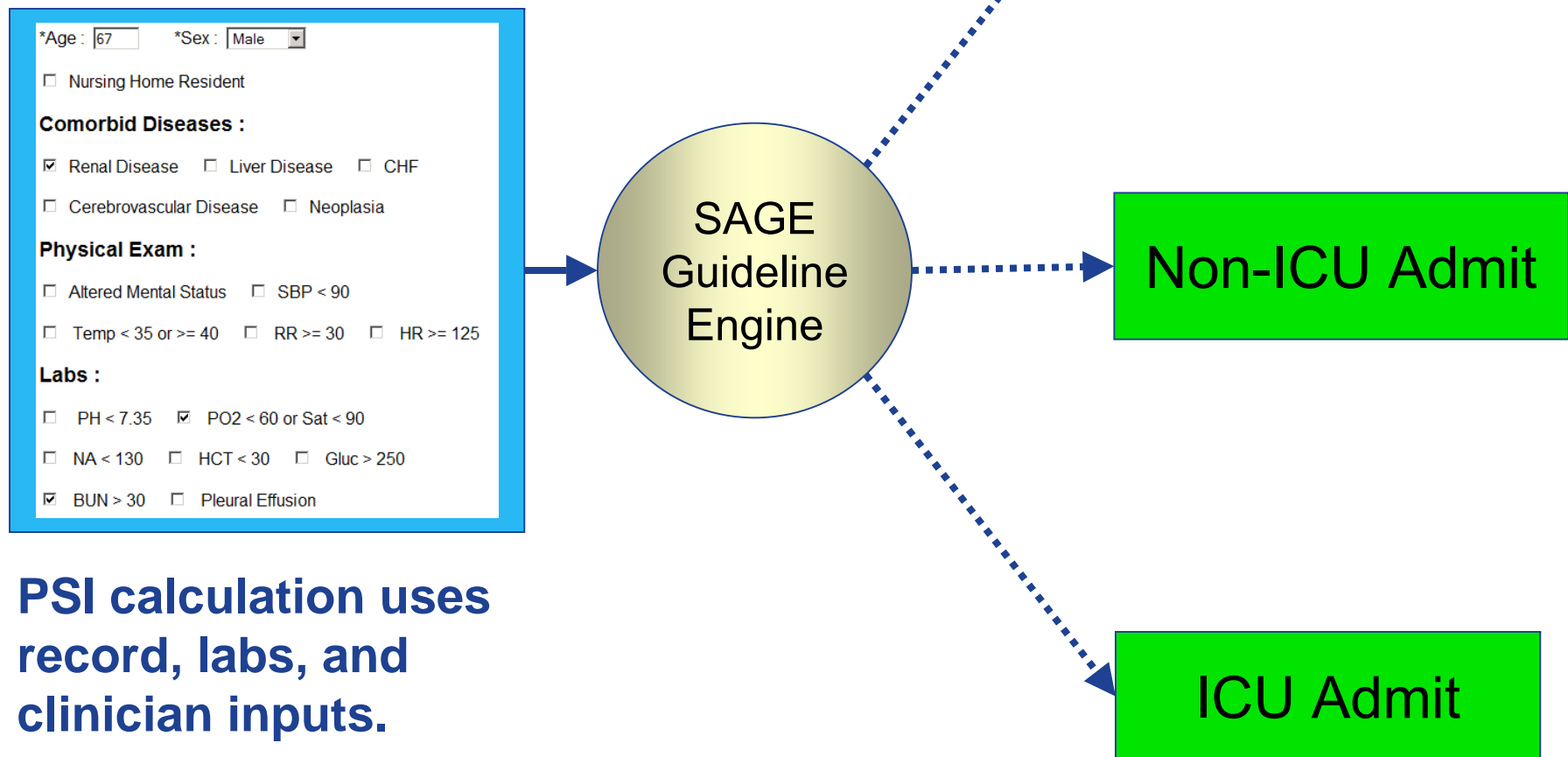
**Hospitalization is recommended for class IV and V.
Class III should be based on clinical judgement.**



SAGE Guideline Execution Architecture



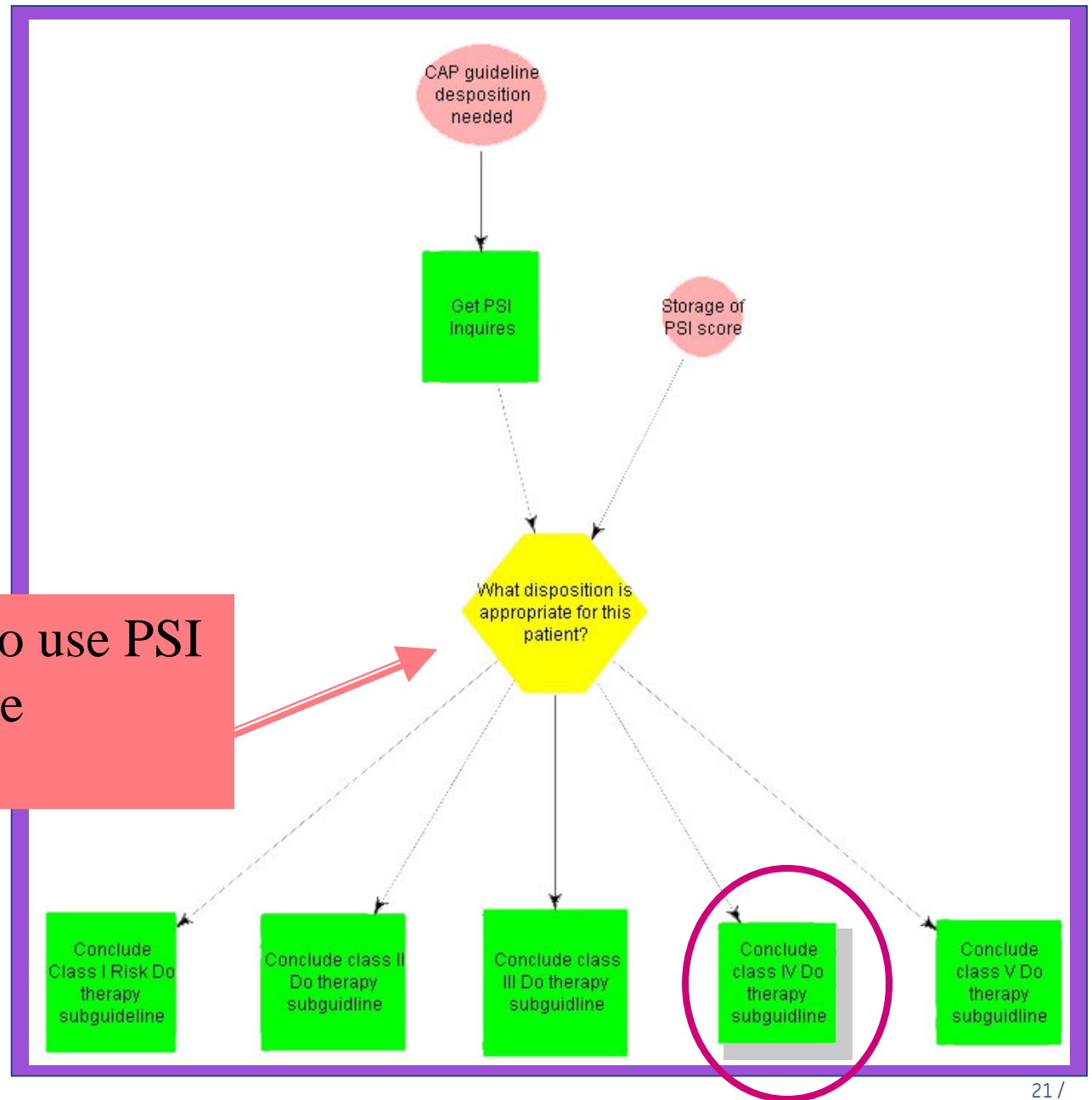
We have three possible treatment outcomes.



PSI calculation uses record, labs, and clinician inputs.

SAGE Guideline Logic in Protégé

SAGE now ready to use PSI
score to make triage
recommendation.



Choice is made to treat as
Non-ICU inpatient.

*Age: *Sex:

☐ Nursing Home Resident

Comorbid Diseases :

☒ Renal Disease ☐ Liver Disease ☐ CHF

☐ Cerebrovascular Disease ☐ Neoplasia

Physical Exam :

☐ Altered Mental Status ☐ SBP < 90

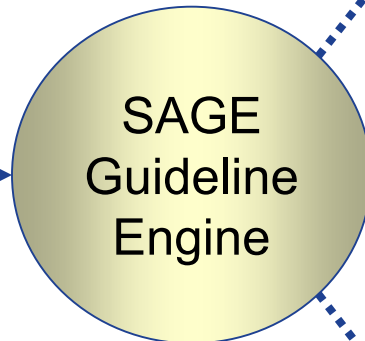
☐ Temp < 35 or >= 40 ☐ RR >= 30 ☐ HR >= 125

Labs :

☐ PH < 7.35 ☒ PO2 < 60 or Sat < 90

☐ NA < 130 ☐ HCT < 30 ☐ Gluc > 250

☒ BUN > 30 ☐ Pleural Effusion



Outpatient Rx

Non-ICU Admit

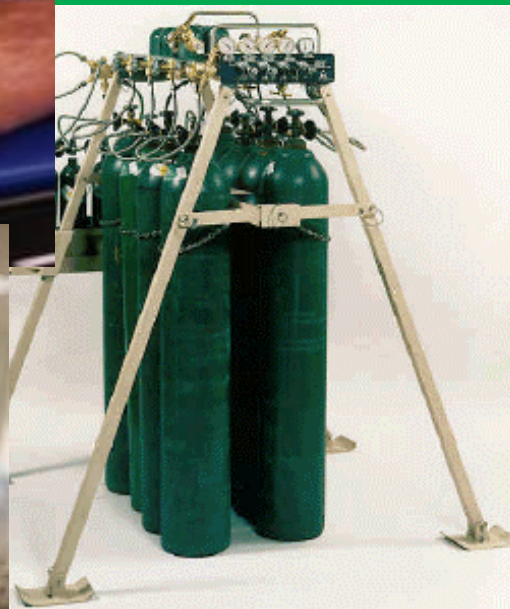
ICU Admit

PSI calculation uses
record, labs, and
clinician inputs.

09:27 Monday, 22 Mar 2010

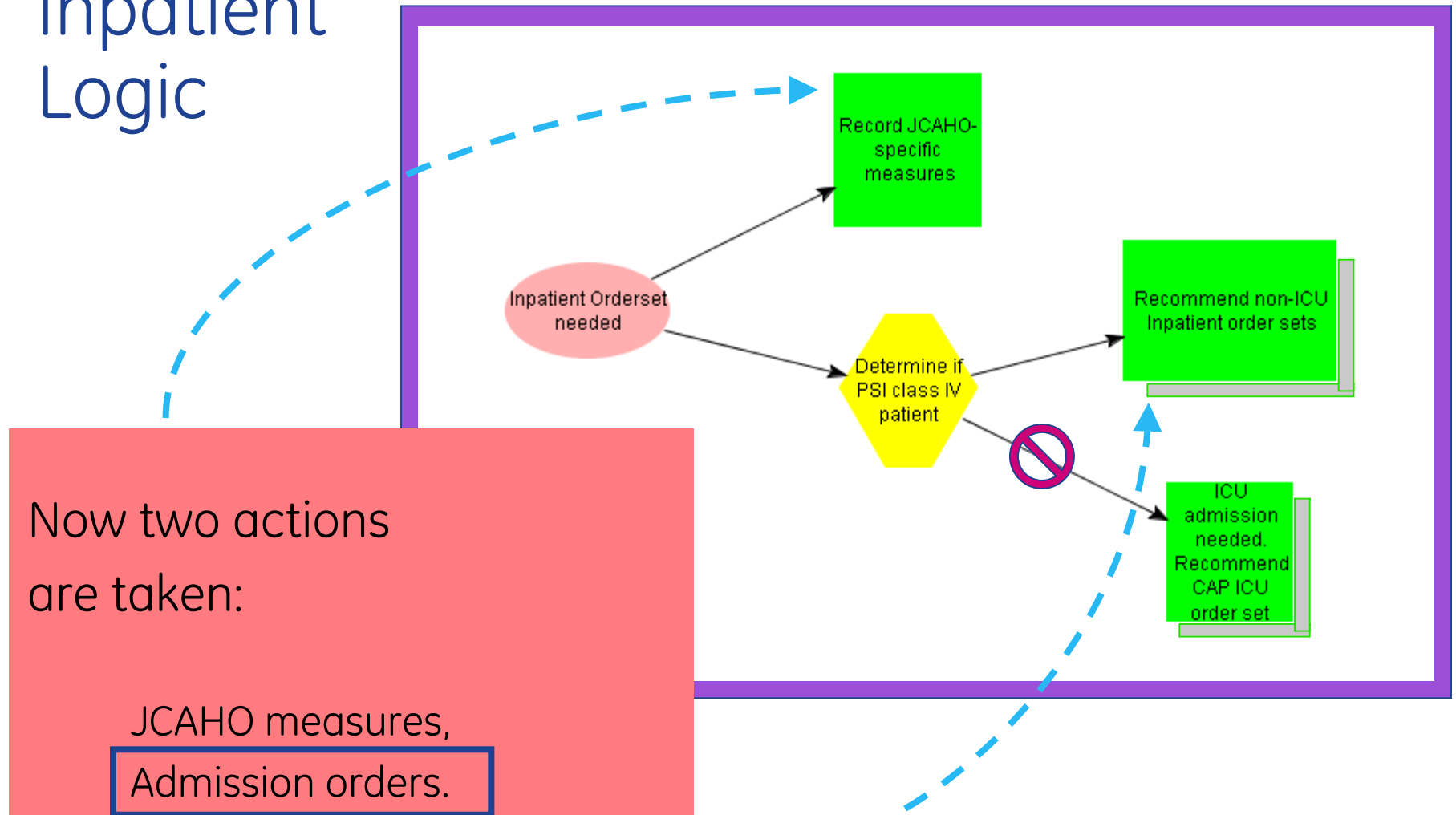
Ward 3-West

Day of Admission

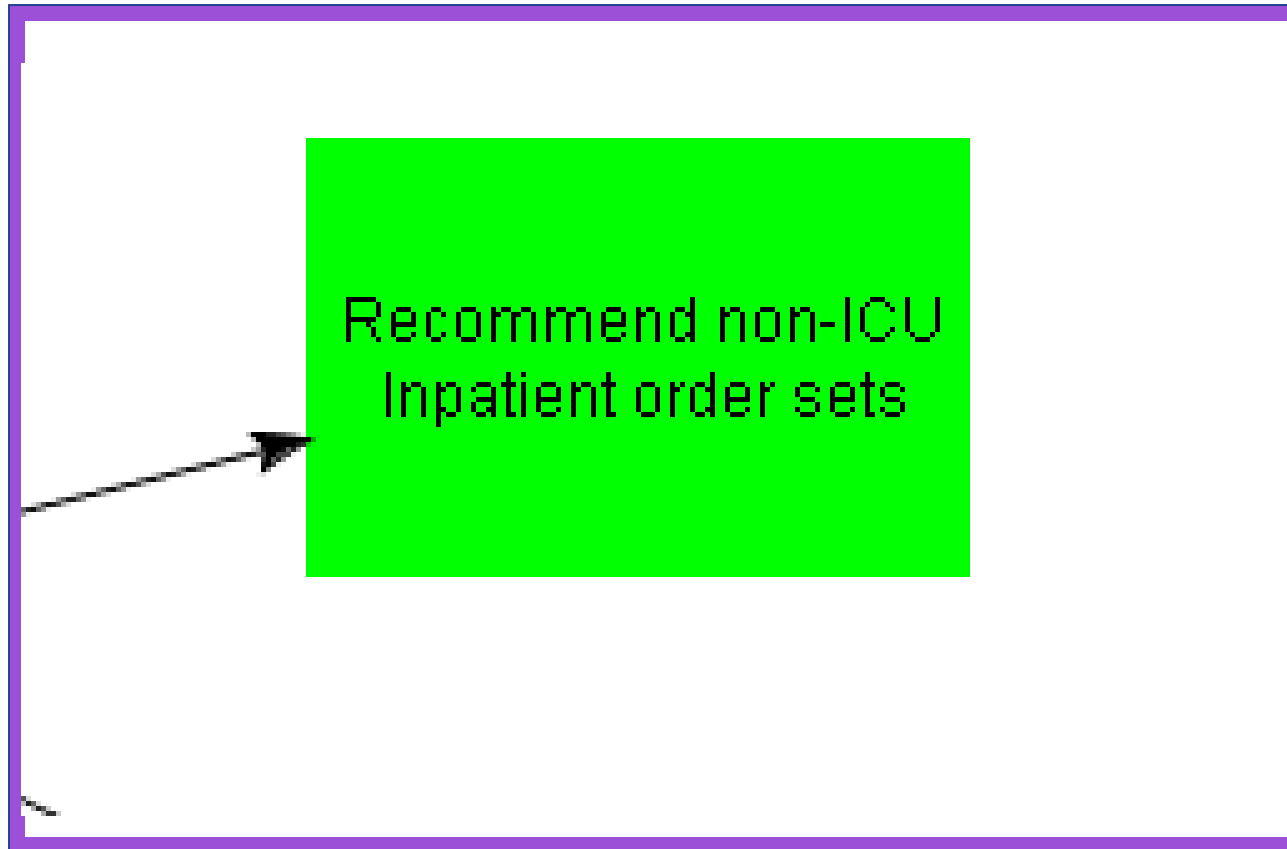


imagination at work

Subguideline for Inpatient Logic



SAGE uses a standard HL7 Order Set



SAGE and CIS both have standard order set.

SAGE acts on order items or groups of order items.

It may pre-select, and/or annotate.

Generated CAP Non-ICU Admission Order Set

Full Order Set

Community Acquired Pneumonia: Hospital Admission, General Inpatient (Adult)

ALL of these are required:

- ▶ Admission Discharge Transfer
- ▶ Consults
- ▶ Vital Signs Assessment
- ▶ Diet
- ▶ Activity
- ▶ Laboratory
- ▶ Ancillary
- ▶ Treatments
- ▶ Education
- ▶ IV Fluids
- ▶ Medication

Open Here

Submit



imagination at work

Non-ICU Admission Orders for Medications

▼ Medication

Choose among these:

- ☐ Administer first dose of antibiotics within 4 hours of admission
- ☒ ▼ No recent antibiotic therapy **There was no evidence of recent Abx therapy, please confirm.**

Choose ONE of these:

- ☒ ▼ Macrolid plus Beta-lactam
Both of these are required:
 - Ampicillin and sulbactam (Unasyn) 3 g IV Piggyback q6 hr
 - Azithromycin 500 mg IV Piggyback q day (Infuse over 1 hr) **Pt is on Warfarin, monitor levels if using Azithromycin**
- ☐ Moxifloxacin 400 mg IV Piggyback q day **Patient has an allergy to fluoroquinolones. Patient has a relative contraindication to a fluoroquinolone drug.**

- ☐ ► Recent antibiotic therapy excluding fluoroquinolones
- ☐ ► Recent antibiotic therapy including fluoroquinolones
- ☐ ► Antipyretic Agents, Adult
- ☐ ► Bronchodilator
- ☐ ► Additional medication orders

SAGE annotates



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Other CAP Actions

Order Sets for

- Outpatient Therapy
- Inpatient ICU Admission
- Switching from IV to PO Meds
- Discharge Planning,
triggered by patient status nearing normal

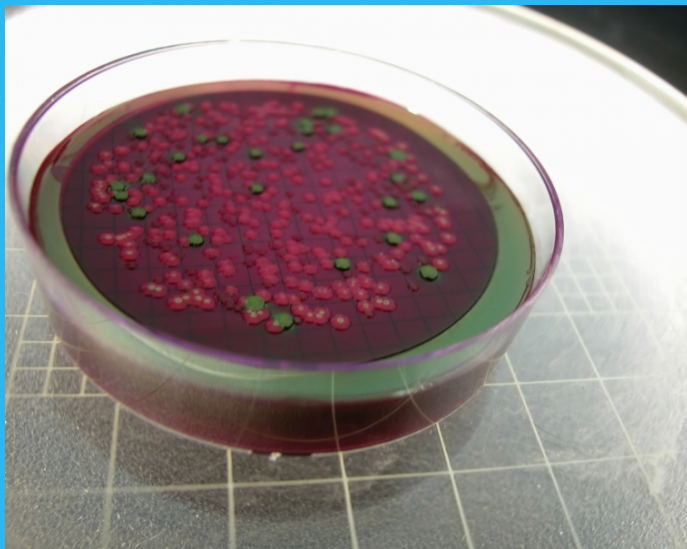


Additional JCAHO and CMS event monitors

Can be expanded to cover other aspects of orders:
diet, oxygen, ambulation, etc.

09:40 Monday, 22 Mar 2010

Dr. Letrice, Chief of Infectious Disease,
reads email after returning from grand rounds.



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To: letrichel@mayo.edu

From: guidelines@accp.com

Subject: New CAP Guideline Released, v5.0



The latest edition of our popular **Community Acquired Pneumonia** guideline is available starting 21 Mar 2010. Major changes include improved antibiotic coverage for pseudomonas and for aspiration, and tighter control parameters for oxygen therapy.

Review experience in trials [here](#).

Downloads: (SAGE) [ACCP_CAP5.0](#)



Guideline Downloaded

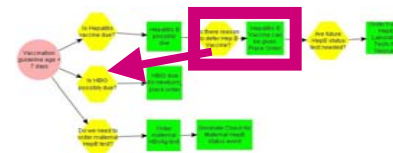


We have a new knowledge augmented workflow in standard format. It can be shared with other colleagues at Mayo for review.

Dr. Letrice forwards the files, and asks for conference on new guideline in 2 weeks. He hopes to localize and thus implement the new guideline by May.



Each participant can run in simulation mode on virtual or real patients from Centricity Enterprise. The system supports comparing installed and new guidelines as coded, and can point out where variances would have occurred.

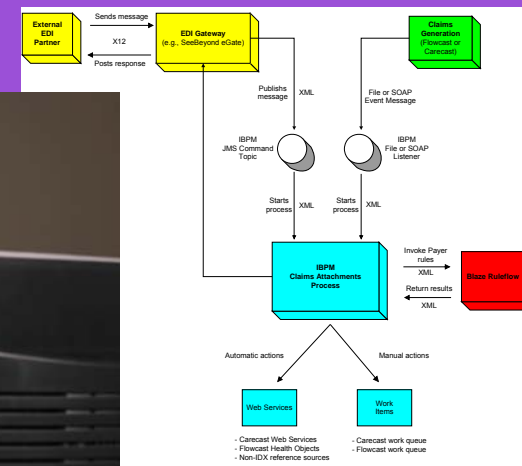


Examine
Test
Localize
Verify
Review
Certify
Install



09:40 Wednesday, 24 Mar 2010

Director, Performance Improvement and Risk Management



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Guideline specifies the collection of CMS & JCAHO Specific Measures

Record JCAHO-specific measures

Data have already been gathered about this CAP case:

Pneumococcal vaccination up to date? **yes**

Influenza vaccination up to date? **no**

At risk for pseudomonas? **no**

Transferred from outside? **no**

Previous antibiotics for CAP prior to arrival? **no**

Blood cultures obtained prior to arrival? **no**

Comfort measures only? **no**

CMS and JCAHO Measures Monitored

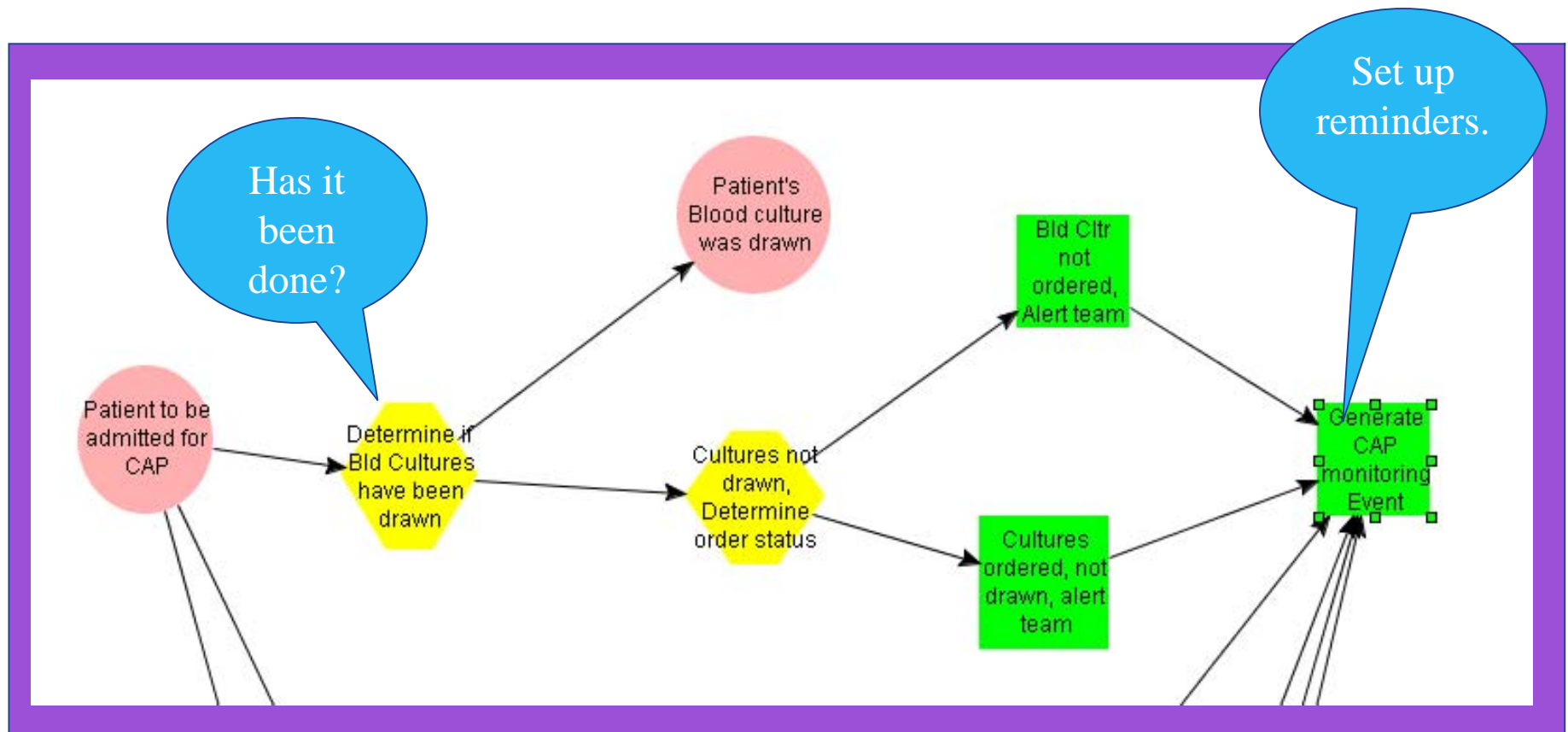
Specify tracking of actions against time or other events.
For CAP we have:

Set Measure ID #	Measure Short Name
PN-3a*	Blood Culture Within 24 Hours Prior to or After Hospital Arrival
PN-3b	Blood Culture Before First Antibiotic
PN-5**	Antibiotic Timing (Mean)
PN-5a**	Initial Antibiotic Received Within 8 Hours of Hospital Arrival
PN-5b	Initial Antibiotic Received Within 4 Hours of Hospital Arrival

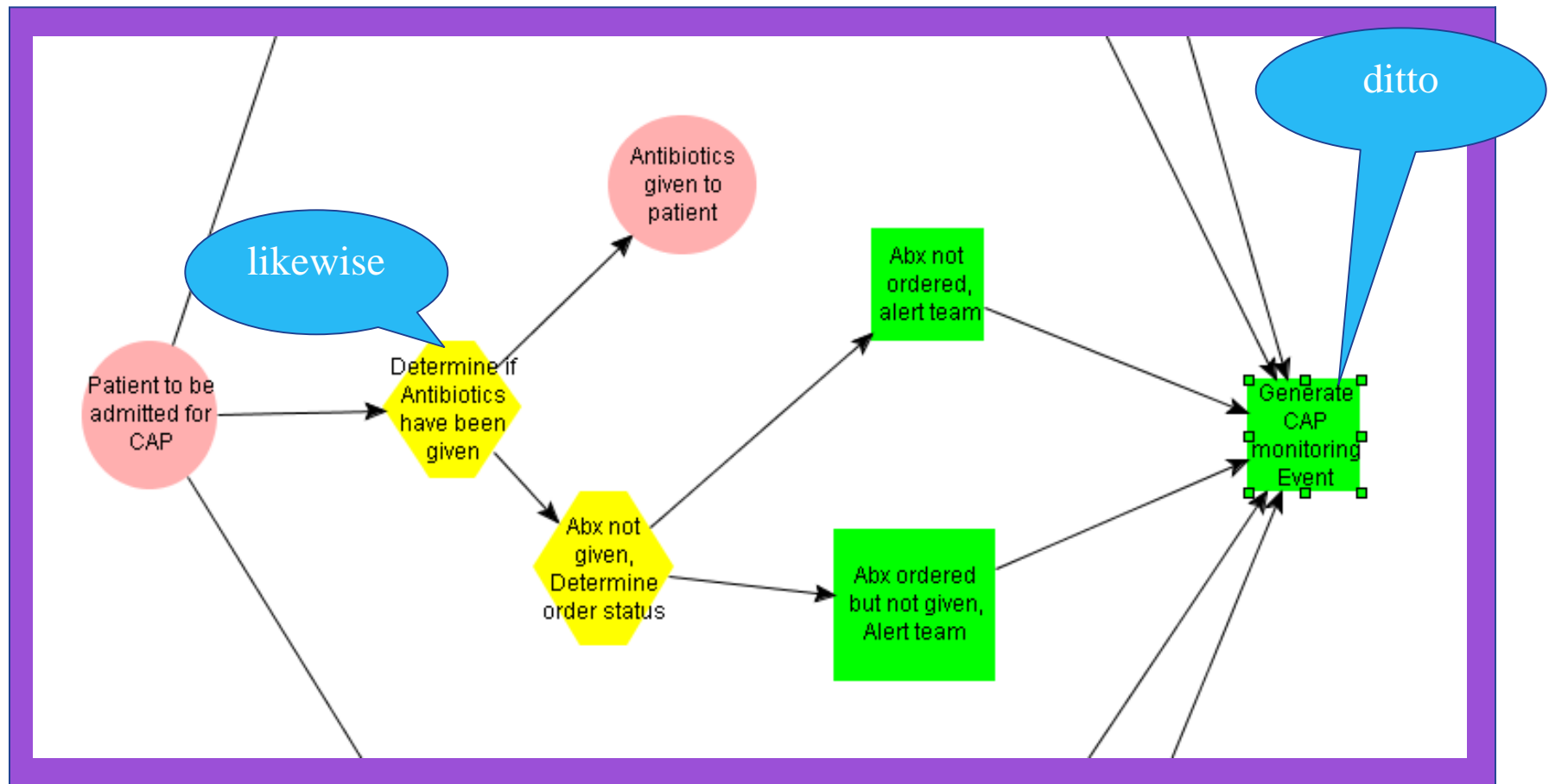
*CMS ONLY **Joint Commission ONLY

SAGE sets timers to watch for events (or lack thereof) to inform clinicians to act within measure's time or event boundaries.

Blood Culture Timing



Antibiotic Timing



Comparison of CMS, JCAHO, HQA and APU Measures¹

Performance Measures: Static and Active

CMS JCAHO HQA APU

	CMS	JCAHO	HQA	APU
	✓	✓	✓	✓
	✓	✓	✓	✓
	✓		✓	✓
AMI-4 Adult Smoking Cessation Advice/Counseling			3	
AMI-5 Beta Blocker Prescribed at Discharge				✓
AMI-6 Beta Blocker at Arrival				✓
AMI-7 Mean Time to Thrombolysis				
AMI-7a Thrombolytic Agent Received Within 30				
AMI-8 Mean Time to PCI				
AMI-8a PCI Received Within 15				
AMI-9 Inpatient M				
AMI Test				
AMI-T1a				
AMI-T1b				
AMI-T2 Lip				
Heart Failure				
HF-1 Discharg				
HF-2 LVF Asses				
HF-3 ACEI or AI				
HF-4 Adult Smok				
Pneumonia (PN)				
PN-1 Oxygenation	✓	✓	✓	✓
PN-2 Pneumococ	✓	✓	✓	✓
PN-3a Blood Culture				
Patients Who				
Hospital Arrival	✓	✓ ⁵		
PN-3b Blood Culture	✓	✓	✓ ³	

Collection automated where possible.
Inputs evoked at time data are available.
All data recorded for analysis.
Driven by encoded public guidelines.
Simply part of regular workflow.
Can use for clinical trials as well.

Research, meta analysis,
"crafting the guideline"

Author

Disambiguation,
encoding, testing

Encode

Guidelines.net?
Guidelines-R-Us.com?

Publish

Download to local
care delivery organization

Import

Clinical editing,
guideline set up

Install

Guidelines active
in local CIS

In Practice

Outcomes
research

Evaluate

Consolidated
feedback

Feedback

•
s
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SAGE



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