

The Electronic ICU: A Wisconsin Case Study

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Dr. Bailey has no financial relationships to disclose

Objectives

- Review changes in healthcare at the national and local levels that make electronic ICU's attractive
- Describe how an electronic ICU operates
- Illustrate how an electronic ICU has affected patient outcomes at a Wisconsin hospital

American Hospitals Are Unsafe



Medical Errors...

A National Epidemic

- Institute of Medicine, *To Err is Human*
 - Estimated 48,000 to 96,000 deaths per year in US due to medical errors
 - Adverse events in 2.9-3.7% hospitalizations
 - 7-14% resulted in death, 2.6% resulted in permanent disability
 - 53-58% were preventable!

Medical Errors...

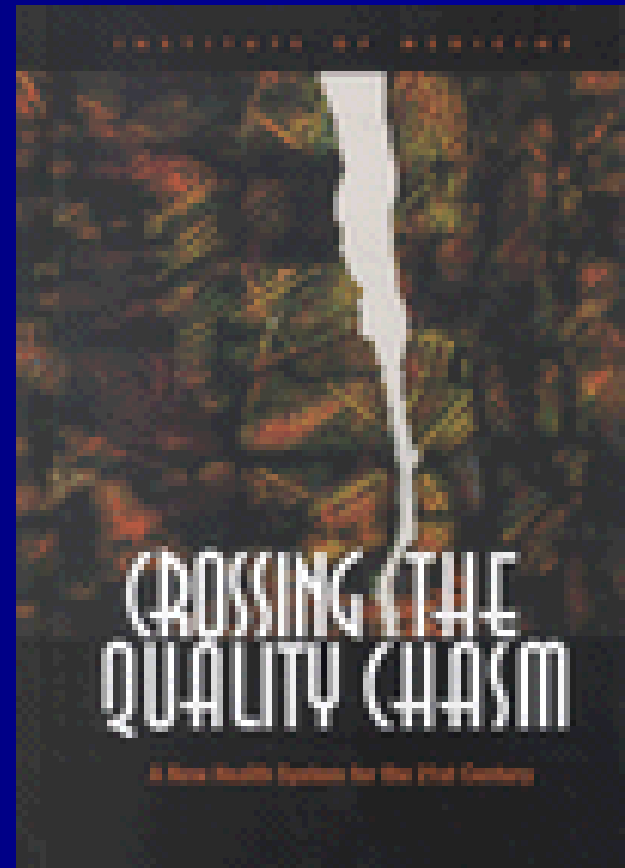
A National Epidemic

Heart Disease	726,974
Cancer	539,577
Stroke	159,791
COPD	109,029
Medical Errors	96,000
Accidents	95,644
Pneumonia/Flu	86,449
Diabetes	62,636
Suicide	30,535
Kidney Disease	25,331



Towards quality and safety

"Health care has safety and quality problems because it relies on outmoded systems of work. We cannot ask our doctors and nurses to work any harder. If we want safer, higher-quality care, we will need to have redesigned systems of care".





Institute for Safe Medication Practices

A Nonprofit Organization Educating the Healthcare Community and Consumers About Safe Medication Practices



IHI.org

A resource from the
Institute for Healthcare Improvement



United States Department of Health & Human Services



Agency for Healthcare Research and Quality

Advancing Excellence in Health Care

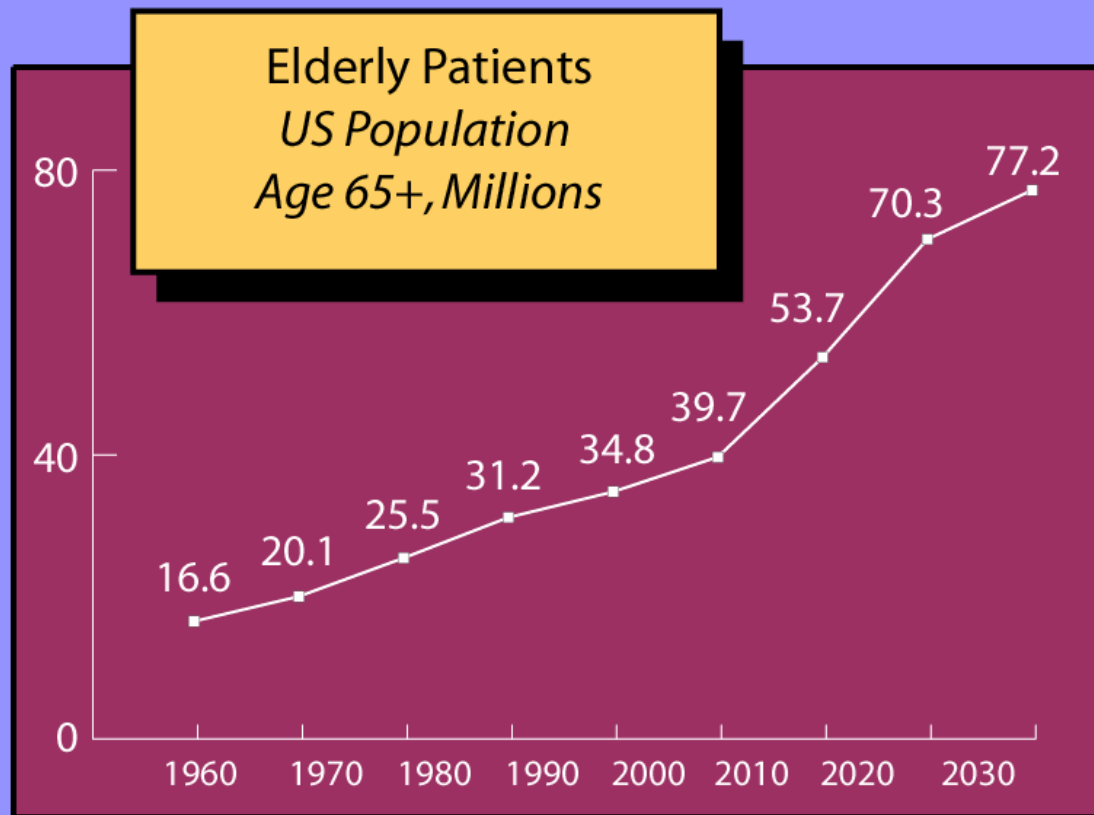
www.ahrq.gov



THE LEAPFROGGROUP

Informing Choices. Rewarding Excellence.
Getting Health Care Right.

ICU Demand Is Increasing



ICU's Are Under Scrutiny

- Four million patients annually
- \$67 Billion in annual spending
- 20% mortality rates
- 50,000 die *preventable* deaths

Industry Issues

- Employer Demand for Improved Patient Safety & Clinical Outcomes
- Hospital Need for Aggressive Cost Management
- Institute for Healthcare Improvement
- Governmental Pressure to Perform
 - National Quality Forum



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THE WALL STREET JOURNAL.

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WEDNESDAY, NOVEMBER 15, 2000

WSJ.com

Business Consortium to Launch Effort Seeking Higher Standards at Hospitals **Preventing Costly Errors**

Leapfrog's estimates of the benefits to the coalition's planned medical reforms

PLAN	BENEFITS
Hospitals should install computerized prescription systems	522,000 serious medication errors avoided
Hospitals should staff ICU wards with intensive-care specialists	53,850 lives saved
Employees should have certain high-risk surgeries done at high-volume hospitals	2,581 lives saved

Source: Leapfrog Group

Leapfrog Group

"Intensivists, physicians specially trained to care for critically ill patients, should staff intensive care units (ICUs). Almost 5 million patients are admitted to ICUs each year in the U.S., and more than 500,000 of these patients die. Studies reveal that at least one in ten patients who die in ICUs every day would survive if dedicated intensivists were present in the ICU and managing their care."

Well documented in the medical literature that ICU care by intensivists is associated with reduced mortality and ICU LOS

Journal of the American Medical Association, 2002; 288(17):2151-2162

**Physician Staffing Patterns and Outcomes in Critically Ill Patients:
A Systemic Review**

P.J. Pronovost, MD, PhD; D.C. Angus, MB, ChB, MPH; T. Dorman, MD; K.A. Robinson, MSc; T.T. Dremsizov, MBA, T.L. Young

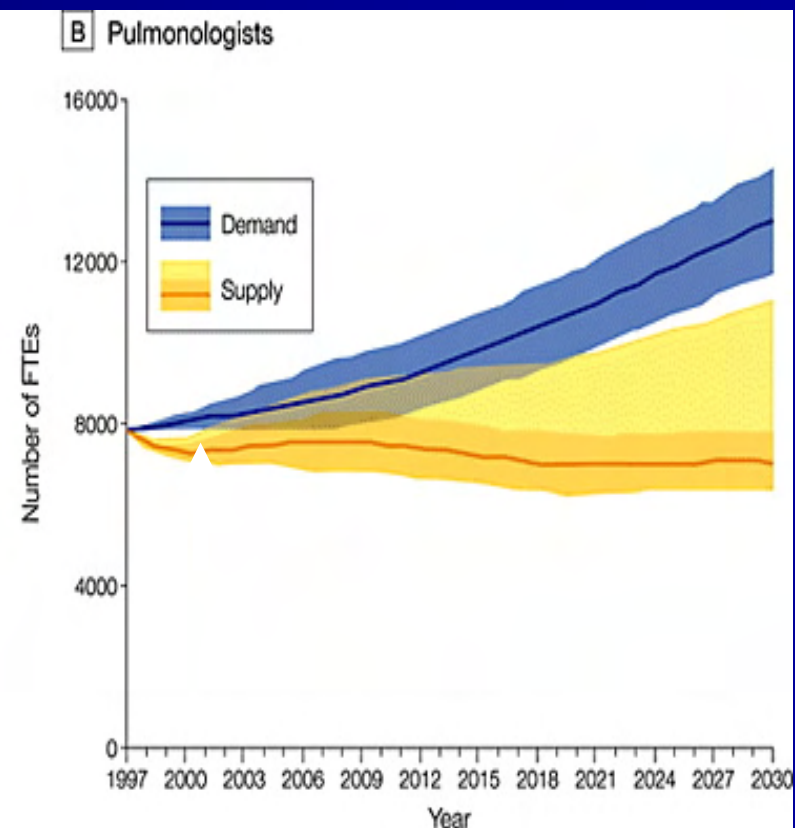
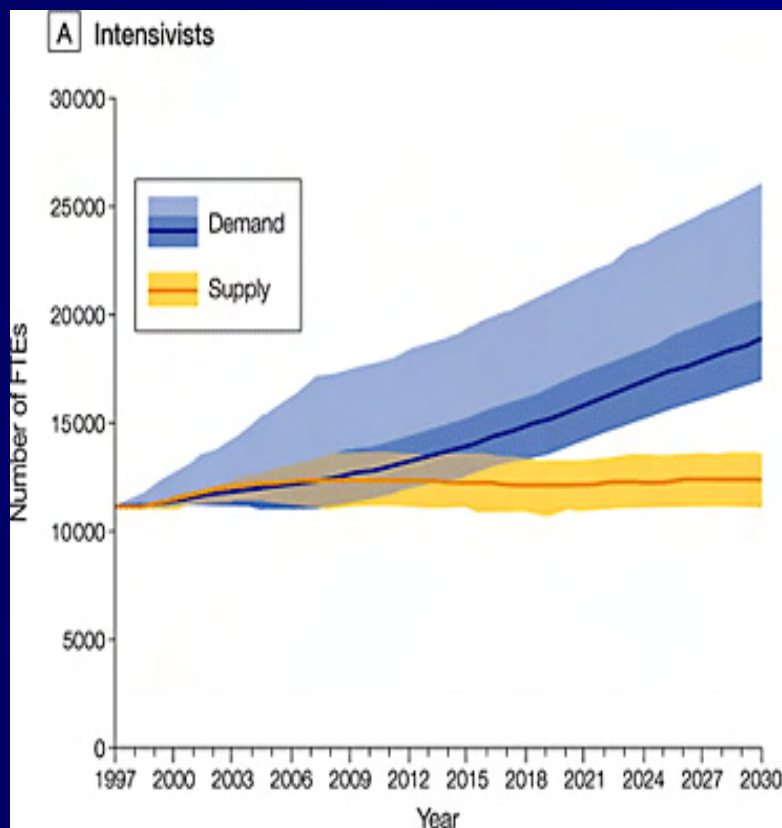
Intensivists Improve Care

- Increased on-site availability
- Increased physician expertise
- Protocols, decreased variation in care
- More collaborative care
- Decreased delays to care
- More focus on clinical “big picture”
- Alignment with institutional goals
- More responsive to family needs

Who Is Caring for Patients in the ICU?

- Less than 50% have an intensivist
- Less than 20% meet "High Intensity" staffing
- Only 4% met Leapfrog Criteria

Intensivists: Supply/Demand Projections: 1997 - 2030



**Committee on Manpower for Pulmonary and
Critical Care Societies (COMPACCS)**

JAMA. 2000;284:2762-2770

Saint Clare's Hospital



Weston Regional Medical Center



Ministry Health Care

- Network of hospitals, clinics, home care in Wisconsin and Minnesota
- Catholic Health System sponsored by the Sisters of the Sorrowful Mother
- Highly concentrated with 15 hospitals and 200+ physicians in north central Wisconsin

Ministry Health Care Affiliates

- ▲ Ministry Medical Group - Amherst
- ▲ Ministry Medical Group - Chain O'Lakes
- ▲ Ministry Medical Group - Crandon
- ▲ Ministry Medical Group - Eagle River
- ▲ Ministry Medical Group - Iola
- ▲ Ministry Medical Group - Laona
- ▲ Ministry Medical Group - Plover
- ▲ Ministry Medical Group - Point
- ▲ Ministry Medical Group - Rhinelander
- ▲ Ministry Medical Group - Rice Clinic
- ▲ Ministry Medical Group - Three Lakes
- ▲ Ministry Medical Group - Tomahawk
- ▲ Ministry Medical Group - Woodruff
- ▲ Ministry Medical Group - Weston
- ▲ North Shore Medical Clinic
- ▲ Victory Medical Group (Owen)
- ▲ Victory Medical Group (Stanley)
- ▲ Victory Medical Group (Thorp)
- ▲ Mercy Oakwood Medical Center*
- ▲ Franciscan Care and Rehabilitation Center*
- ▲ Affinity Medical Group - multiple locations



* Part of Affinity Health System, co-sponsored with Wheaton Franciscan Services, Inc. + Co-sponsored with Marshfield Clinic Department of Door County Memorial Hospital

Saint Clare's Hospital

- Opened October 4, 2005
- 96 variable acuity inpatient beds
- 11 Birth Center LDR
- Full service Emergency Department
- All-inclusive electronic health record and CPOE
- Competitive environment
- Tertiary referral center

Shortage of Intensivists in Wisconsin

- Wisconsin Healthcare Purchasers for Quality survey, October 2003
- 77.6% (38 of 49) urban Wisconsin hospitals completed survey
- 16.7% of hospitals in the survey reported having intensivists overseeing care in the ICU at least 8 hours a day

Conundrum

- Focus on quality and safety are defining changes in healthcare
- Government and private sector are demanding action
- Local needs are not being met
- How do we improve with limited resources, outdated systems, and physician shortages?

Answer: Think outside the box!

"Every system is perfectly designed to achieve the results it does."
Don Berwick, MD; Institute for Health Care Improvement

"Health care has safety and quality problems because it relies on outmoded systems of work. We cannot ask our doctors and nurses to work any harder. If we want safer, higher-quality care, we will need to have redesigned systems of care". -**The Institute of Medicine Report, Crossing the Quality Chasm, 2001**

Telemedicine as a Solution

- Rural applications
- Radiology
- Intensive Care Units

VISICU eICU System

- Privately held company founded in 1998 by two intensivists from Johns Hopkins.
- Patented eICU technology uses proprietary early warning software and remote monitoring
- Provides off-site intensivists and critical care nurses with the data needed to pro-actively care for ICU patients
- The eICU solution allows hospitals to leverage intensivist resources to care for an even larger number of patients simultaneously

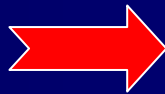
eICU experience in Wisconsin

- Critical Care Solutions, LLC in Milwaukee
 - Froedtert & Community Health
 - Bellin Health
 - ThedaCare
- Aurora Health Care
- University of Wisconsin Hospital & Clinics
- Advanced ICU Care, Inc. (St. Louis, MO)

Advanced ICU Care Program Components

Intensivists

**Critical
Care
Nurses**



Remote Monitoring
Proactive Patient
Intervention
Process Improvement
Education

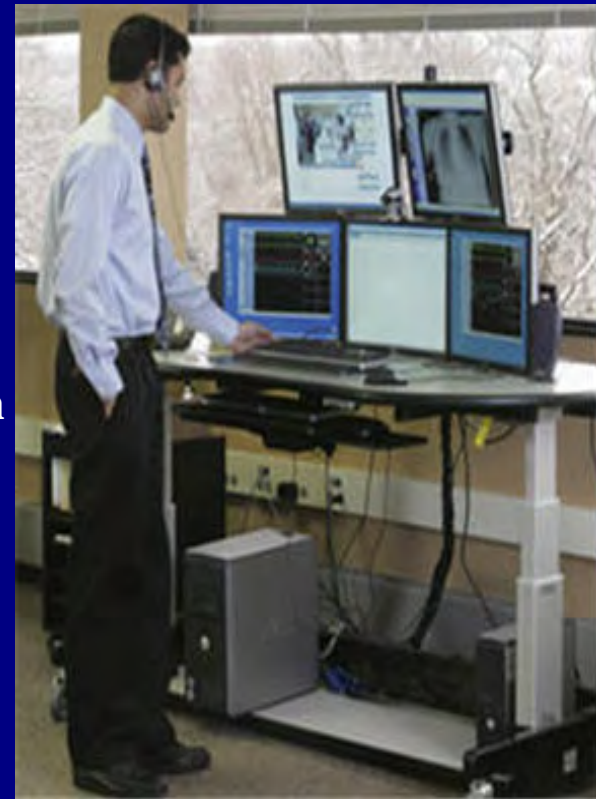


**Enhanced
Quality**
**Increased
Patient Safety**
Reduced Costs
Reduced Risk

How the Technology Works






Secure
Connection



Program Components

Proactive Patient Assessment

- Each patient reviewed depending on their condition every:

	1 hour
	2 hours
	4 hours

- Patients also assessed at the request of nursing staff or attending physician
- Smart Alerts

Program Components

- "Panic Button"
- In room audiovisual component
- Preprogrammed phone
- Web conferencing
- Mobile robot
- Credentialed members of medical staff
- Full access to EHR and CPOE

Scaremonger Features

Smart Alerts™

Smart Alerts
_ □ ×

Reload Patient Status Set Patient Limits Set Patient Baseline Font Size 20 pt ▾ Help

This workstation is currently monitoring 4 out of 11 unit(s) in 3 hospital(s).

Alarm Time	Site	Bed	Patient	HR Limit	HR Trend	O2 Limit	MAP Limit	MAP Trend
17:41 08/14	SNG - VICU	201	Douglas, F.		H [101] 124			
17:38 08/14	SNG - GICU	340	Parker, P.			[90] 87		
17:36 08/14	SHG - ICU	5	O'Hara, M.	H [130] 132				
17:33 08/14	SHG - ICU	6	Baldwin, B.		H [82] 101			L [92] 77
15:42 08/14	SHG - ICU	4	Soze, K.	H [100] 104				
14:20 08/14	SHG - ICU	3	Racer, S.				H [120] 126	
14:20 08/14	SHG - ICU	12	Crawford, S.				L [70] 65	

Heart Rate (HR) Limit alert is triggered when HR crosses high or low limit – active medical conditions determine high/low limits – example shows post-operative patient at-risk for perioperative coronary events. H, high; [limit value] current value

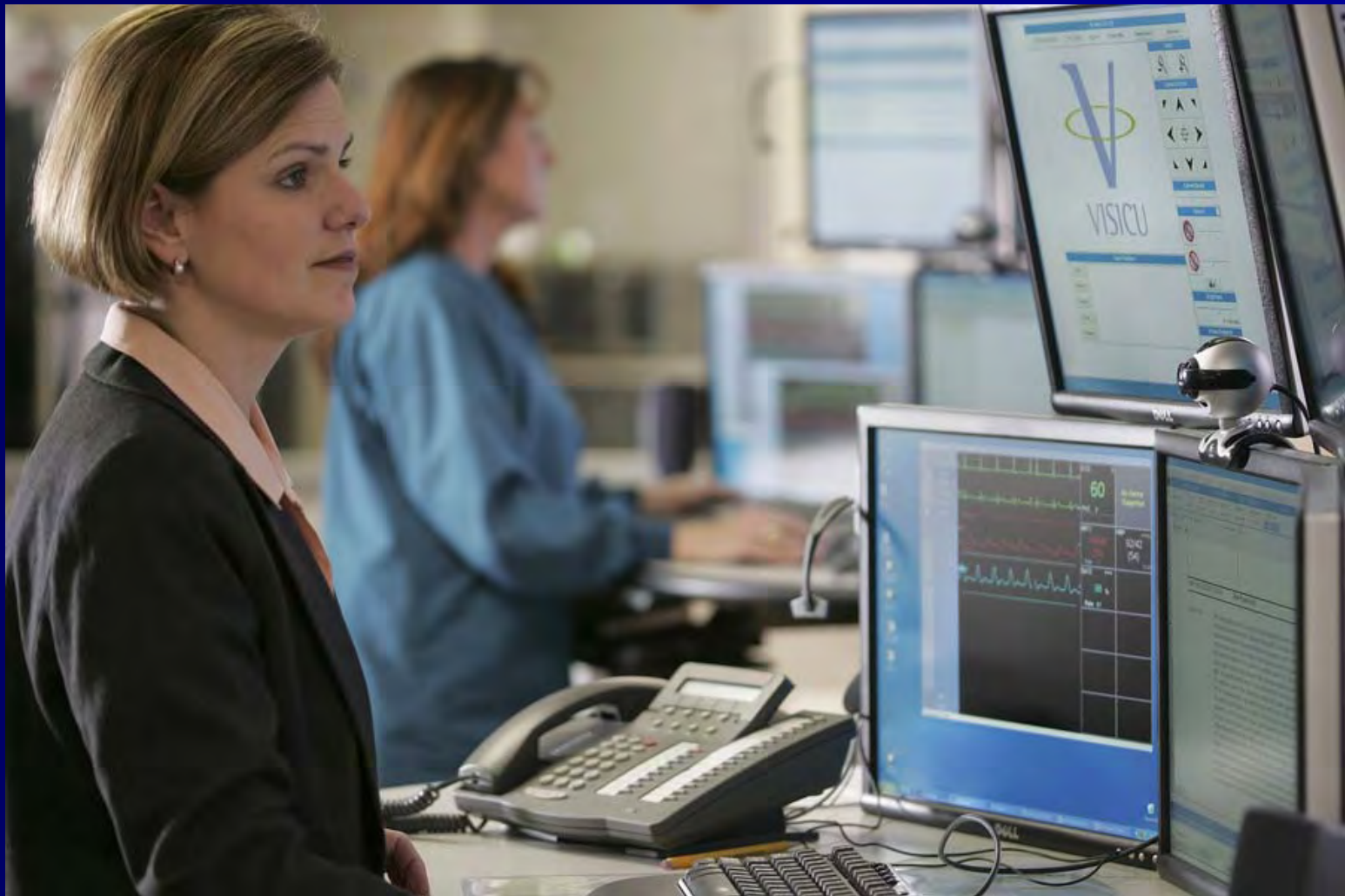
Heart Rate and Mean Arterial Blood Pressure (MAP) Trend alerts are triggered if HR and/or MAP change significantly over a several hour time interval – example shows a patient with rising HR and falling MAP who, on evaluation, was found to be hypovolemic. [baseline value] current value

Connected
Alarm Engine Ru

Advanced ICU Care eICU[®] Program



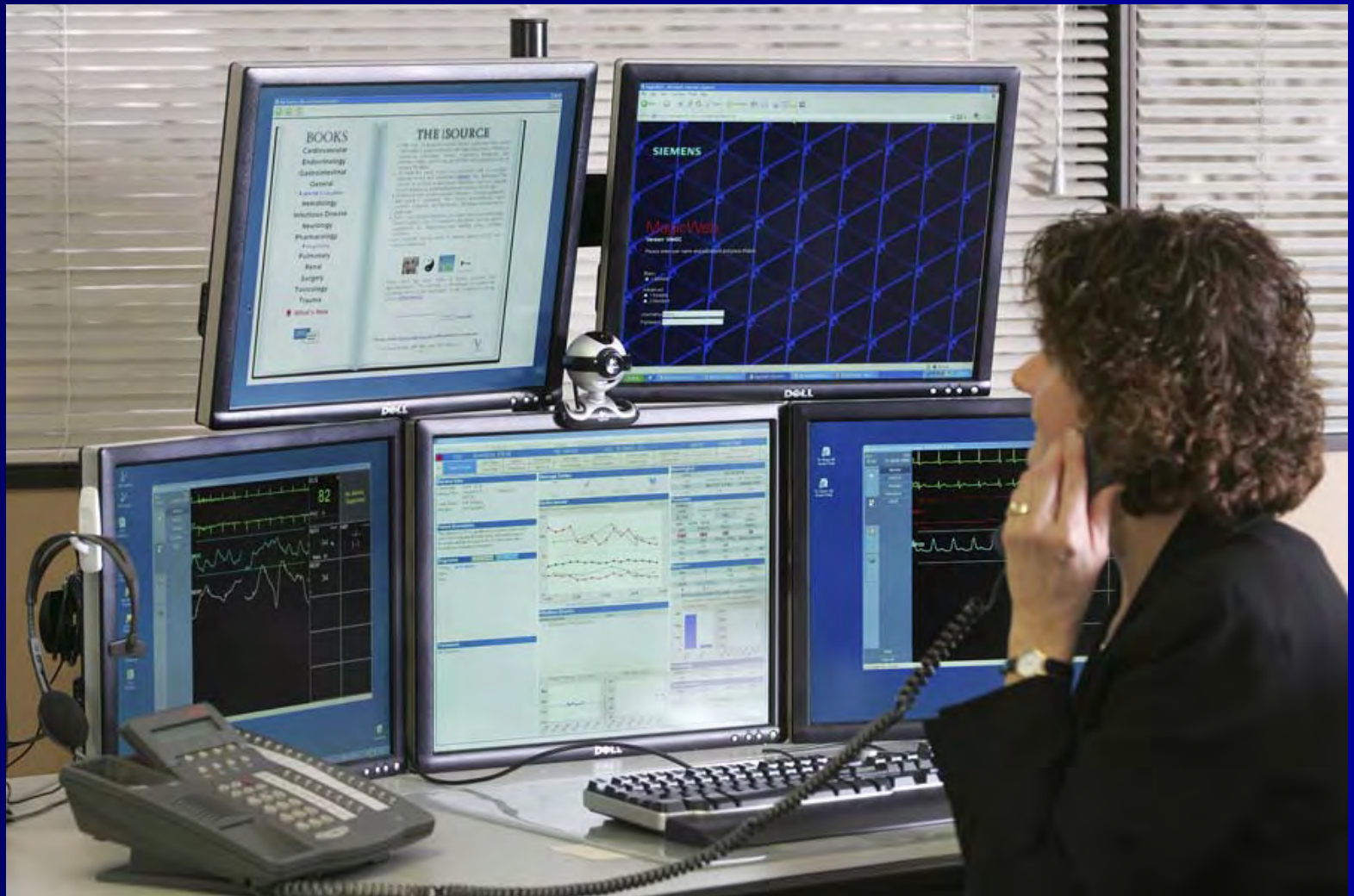
Advanced ICU Care eICU[®] Program



A Advanced ICU Care eICU[®] Program



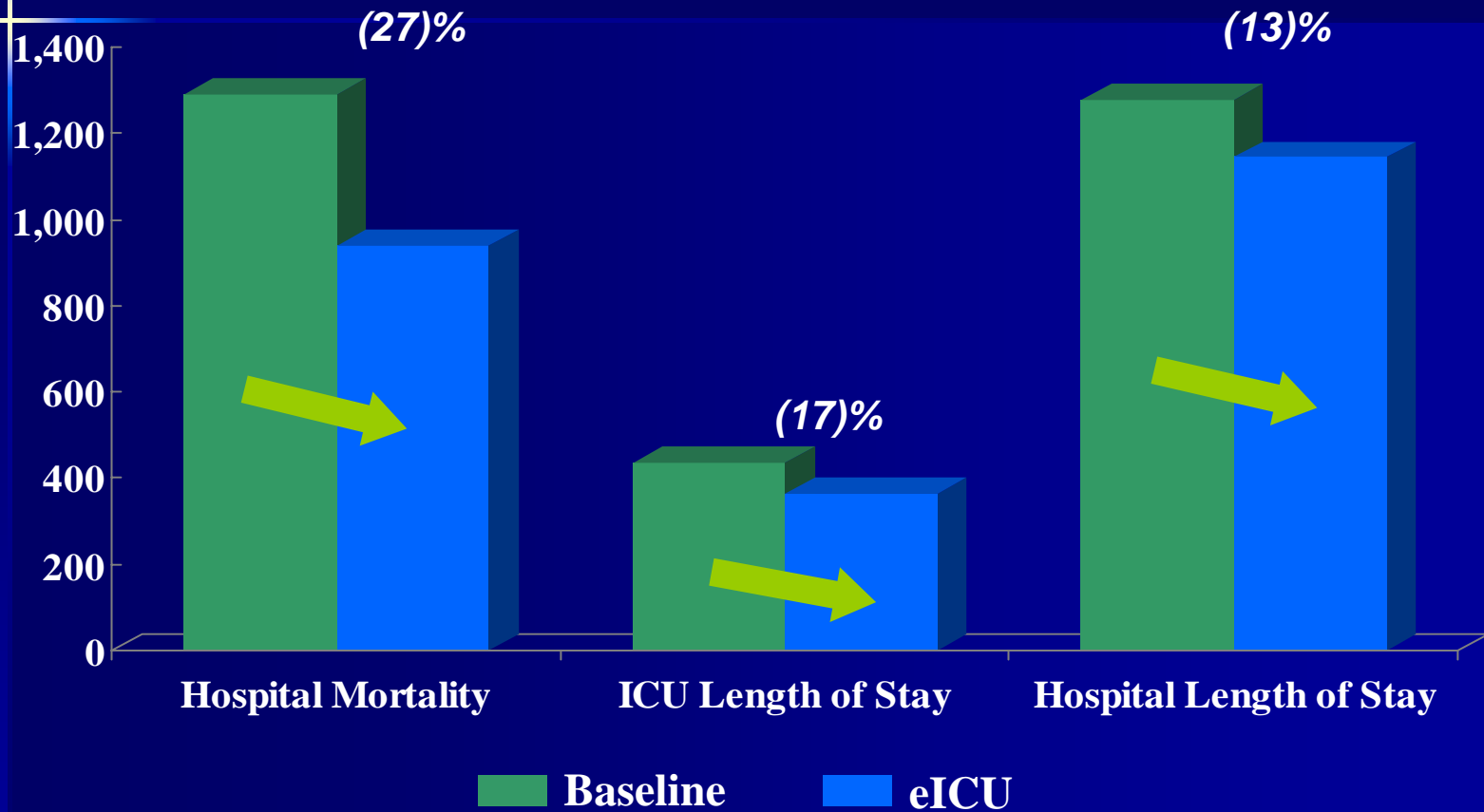
Advanced ICU Care eICU[®] Program



Benefits

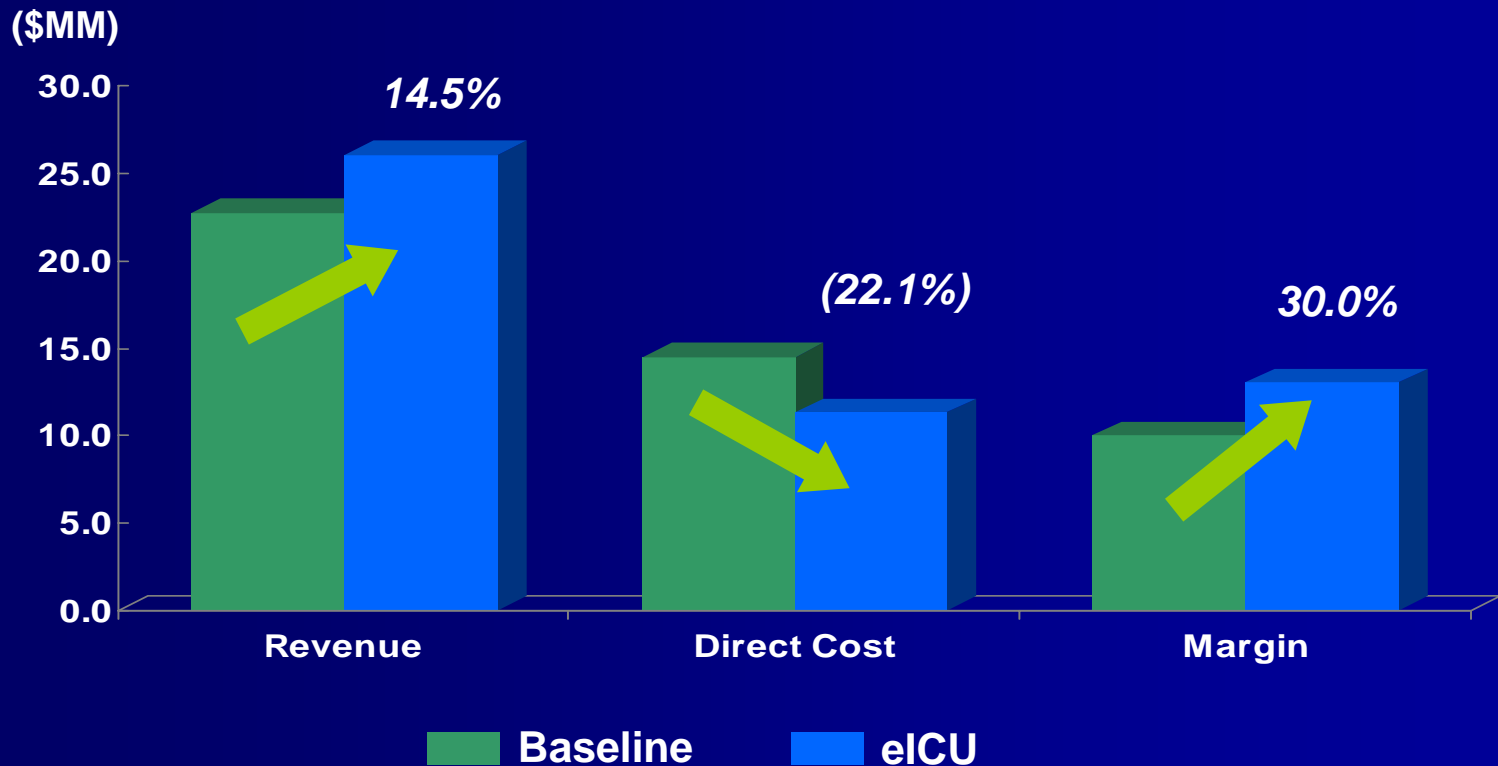


Sentara Healthcare: eICU[®] Case Study¹



(1) Severity Adjusted

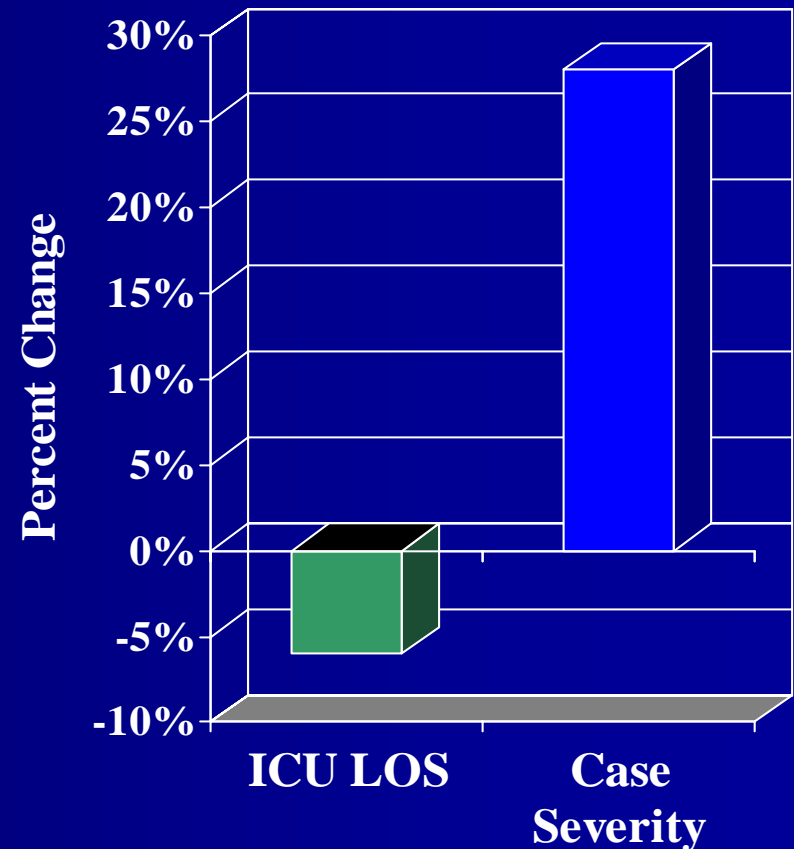
Sentara - Impact on ICU Finances



Sentara Healthcare: Case Study

Inova Alexandria – Financial Performance

- Cost Savings Top 5 DRGs
 - 6 month = \$375,000
 - Annualized \$750,000
 - Driven by ICU length of stay
- Overall Revenue Increase
 - Greater \$1 million
 - Driven by CMI increase



Physician Benefits

- Preserved autonomy
- Preserved professional fee billing
- Improved lifestyle
 - Fewer phone calls during the night and office hours
- Oversight of residents and interns
- Frees up hospitalists

“It would be extremely difficult to provide 24/7 coverage for patients in a hospital ICU because you just don’t have enough physicians or intensivists across the country. The service that Advanced ICU Care brings to the table allows us to provide an increased level of care that markedly improves patient safety.”

Larry Hegland, MD
Chief Medical Officer
St. Clare’s Hospital

Nursing Benefits

- Immediate intensivist availability
- Around the clock mentoring from senior Critical Care nurses
- Increased satisfaction and retention

“Nurses want to provide the highest level of care for their patients and realize that this partnership allows us to add a new level of safety for those in our care. It also gives us access to another set of highly trained eyes, the Advanced ICU Care nurses and intensivists, to enhance our nurses’ efforts at the bedside.”

**Marilyn Russell, RN
ICU Director**

Hospital Benefits

- Improved staff morale
- Improved financial performance
- Ability to benchmark ICU performance
- Competitive market advantage

Program Effectiveness is tied to Program Integration

It's not magic!



Admission Reconciliation List



Verification



Communication

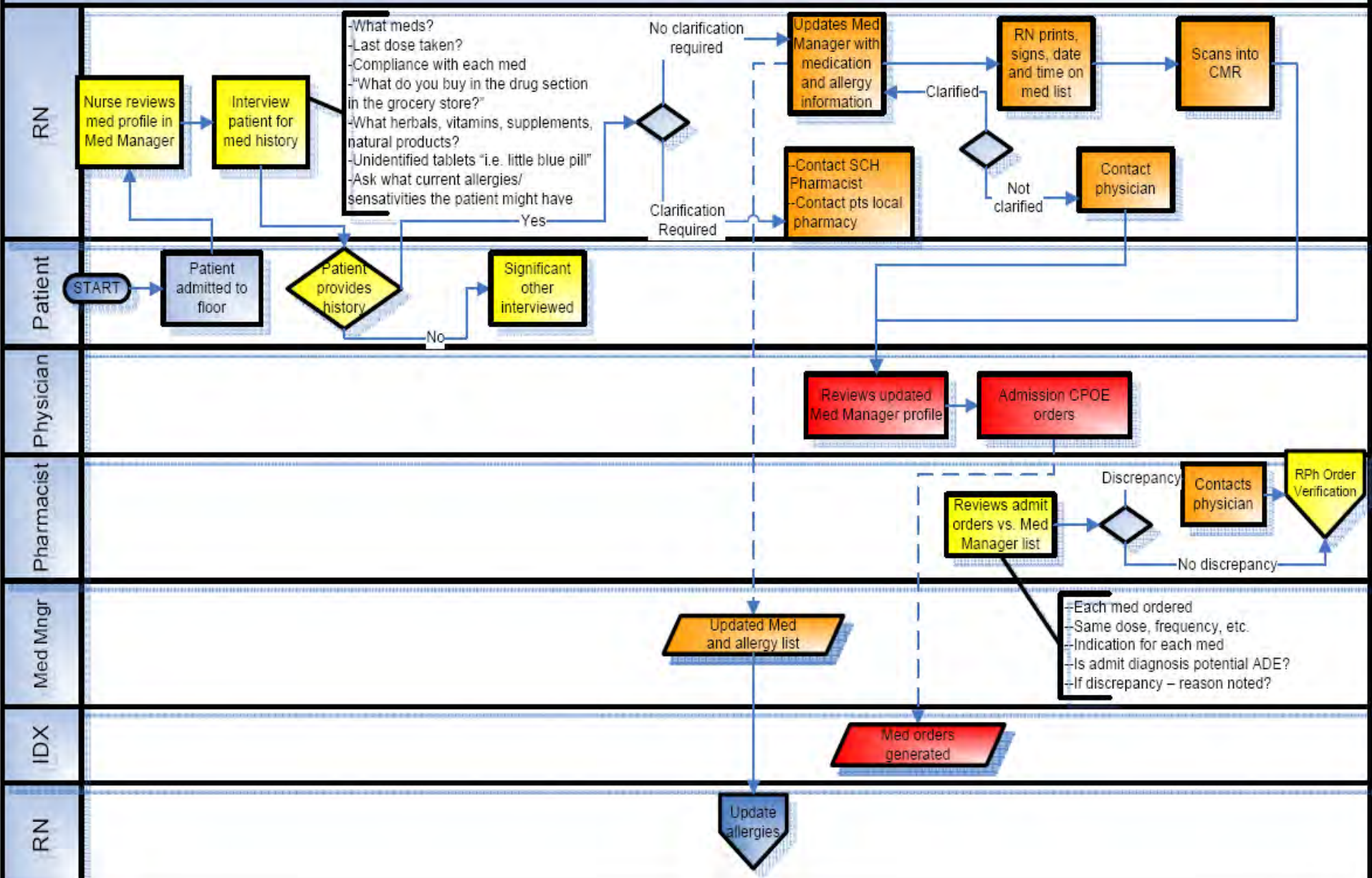


Clarification



Reconciliation

Gary Robb - V5



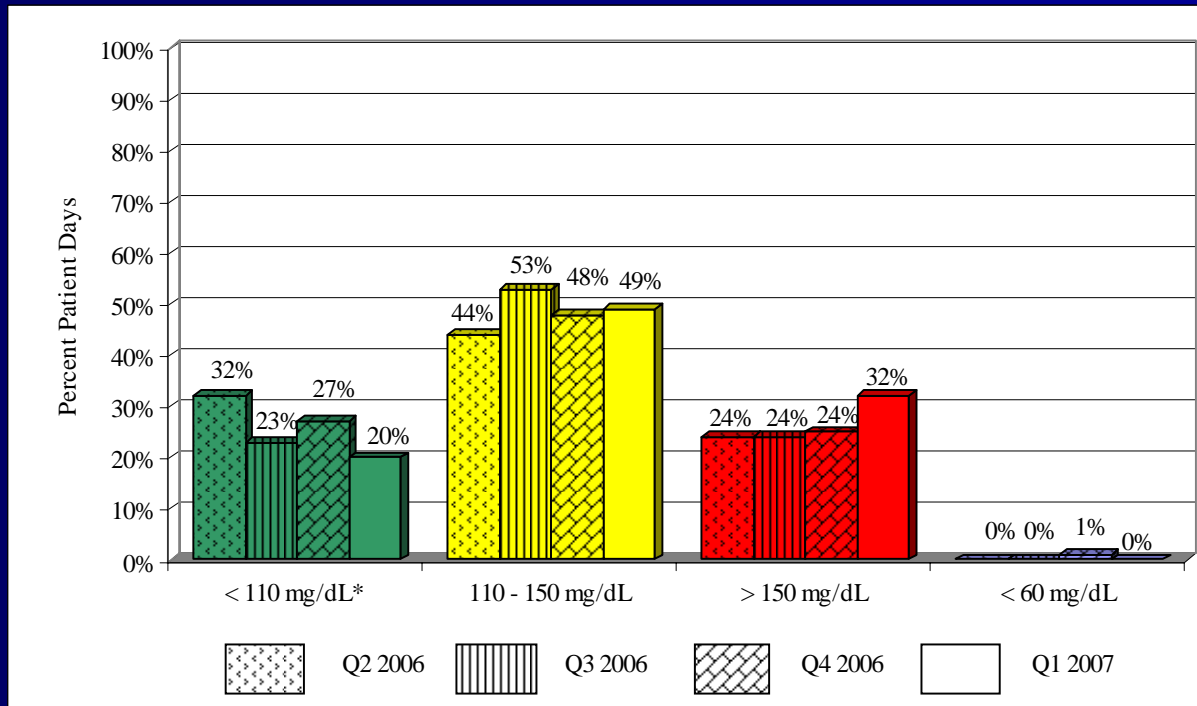
Saint Clare's Experience

- Hospital opened with 13 beds in October 2005, rapid growth
- Went live with eICU in January 2006
- Some minor IT glitches
- Initial physician reluctance
- Process, process, process
- Service line expansion

Saint Clare's Experience

- On-site intensivist 8 hours/day on weekdays
- AIC coverage noon - 7am seven days a week
- Hospitalists provide on-site support nights and weekends
- Average about 18 phone calls per day

Average Daily Glucose

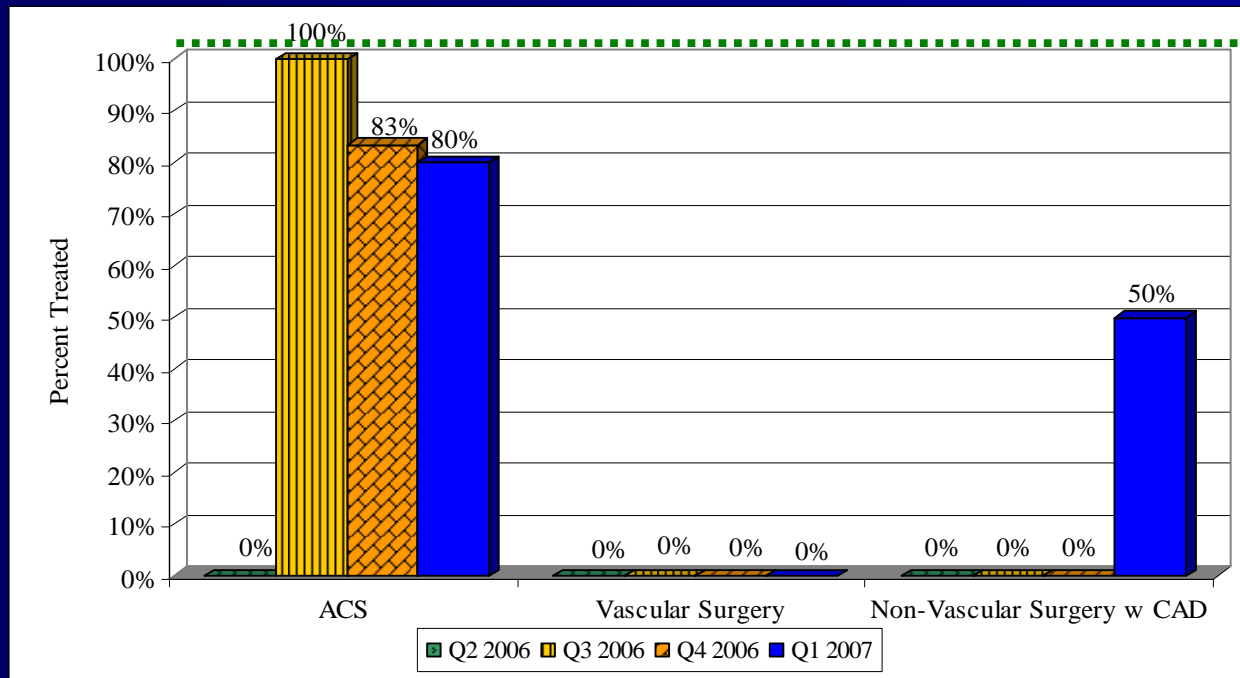


Quarter	Number of Patient Days with Values	Distribution of Average Daily Glucose			
		<110 mg/dL*	110-150 mg/dL	>150 mg/dL	<60 mg/dL
Q2 2006	170	32%	44%	24%	0%
Q3 2006	96	23%	53%	24%	0%
Q4 2006	116	27%	48%	25%	1%
Q1 2007	240	20%	49%	32%	0%

* Best Practice: Average Daily Glucose <110 mg/dL

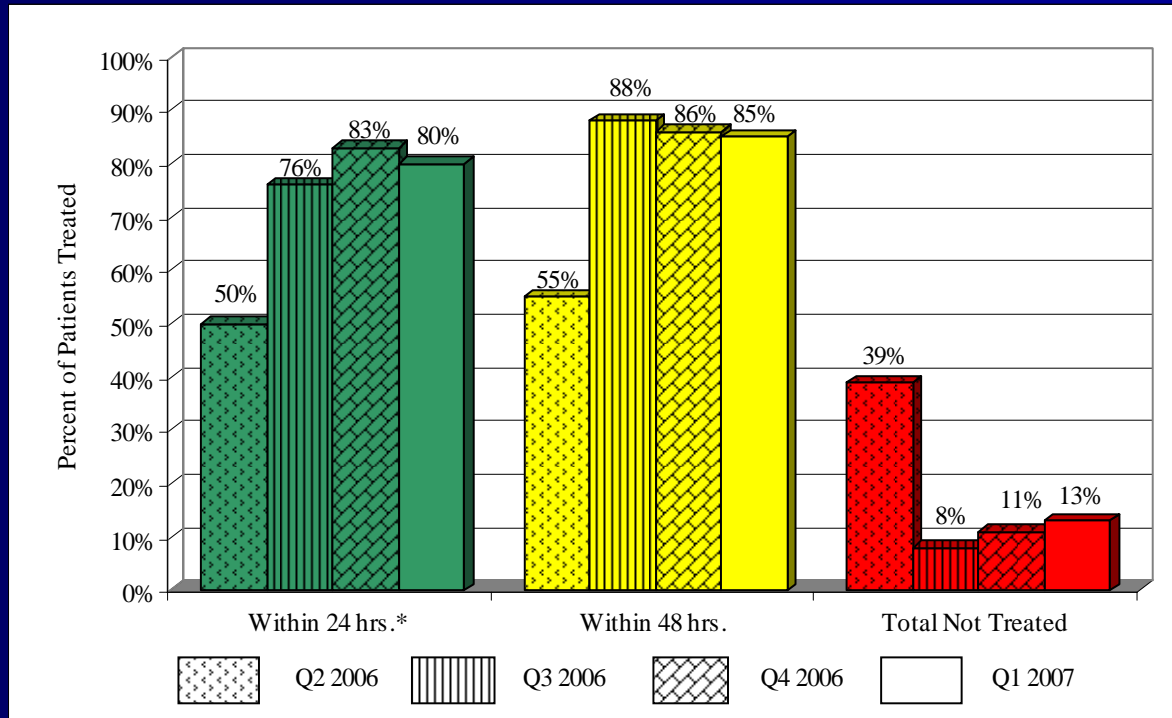
Patient Days equals those days in which a patient had at least one reportable glucose value.

Beta Blocker Usage



Quarter	Subgroups At Risk		
	ACS	Vascular Surgery	Non-vascular Surgery w/ CAD
Q2 2006	0% (0/4)	0% (0/2)	0% (0/0)
Q3 2006	100% (2/2)	0% (0/1)	0% (0/0)
Q4 2006	83% (5/6)	0% (0/0)	0% (0/0)
Q1 2007	80% (12/15)	0% (0/1)	50% (1/2)

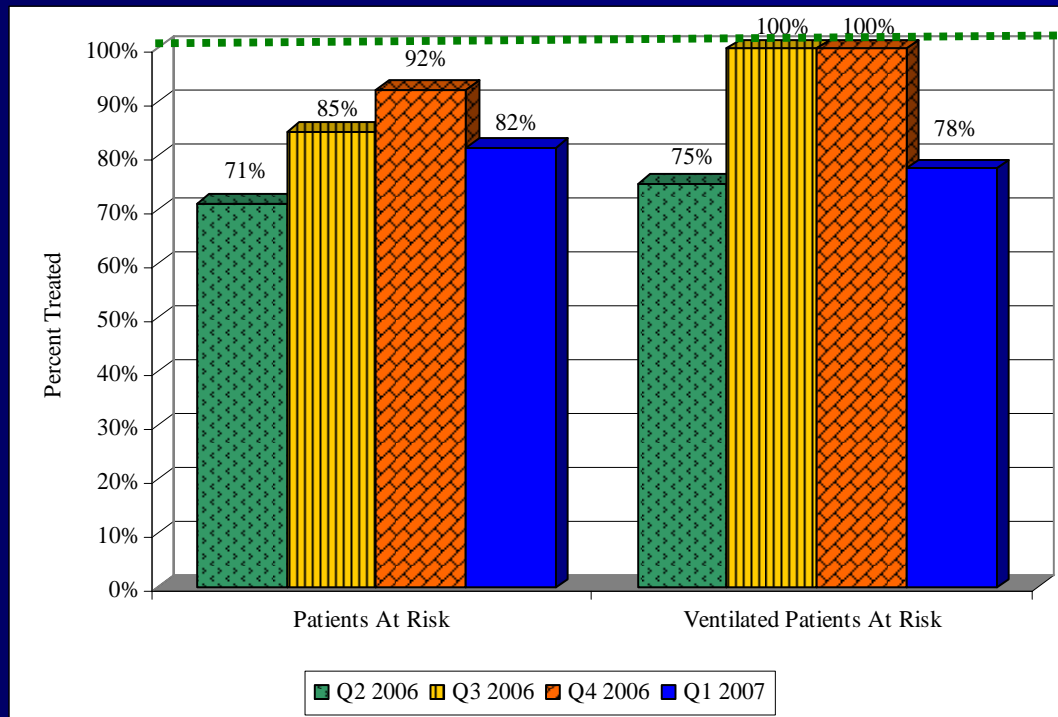
DVT Prophylaxis



Quarter	Number of Patients At Risk	Percent Treated Within		Percent of Patients Not Treated
		24 hrs. of ICU Admit*	48 hrs. of ICU Admit	
Q2 2006	38	50%	55%	39%
Q3 2006	25	76%	88%	8%
Q4 2006	35	83%	86%	11%
Q1 2007	61	80%	85%	13%

* Best Practice: Treatment within 24 hours of ICU admission

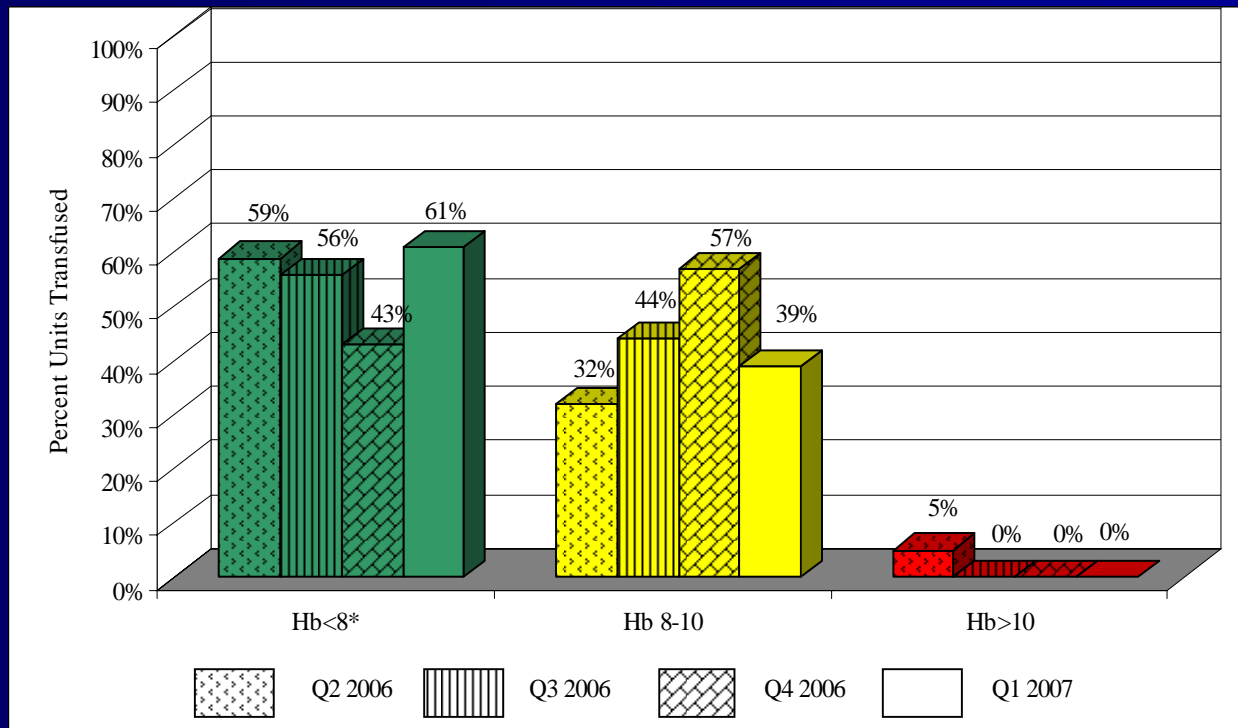
Stress Ulcer Prophylaxis



Quarter	Patients At Risk	Ventilated Patients At Risk
Q2 2006	71% (10/14)	75% (3/4)
Q3 2006	85% (11/13)	100% (7/7)
Q4 2006	92% (12/13)	100% (3/3)
Q1 2007	82% (18/22)	78% (7/9)

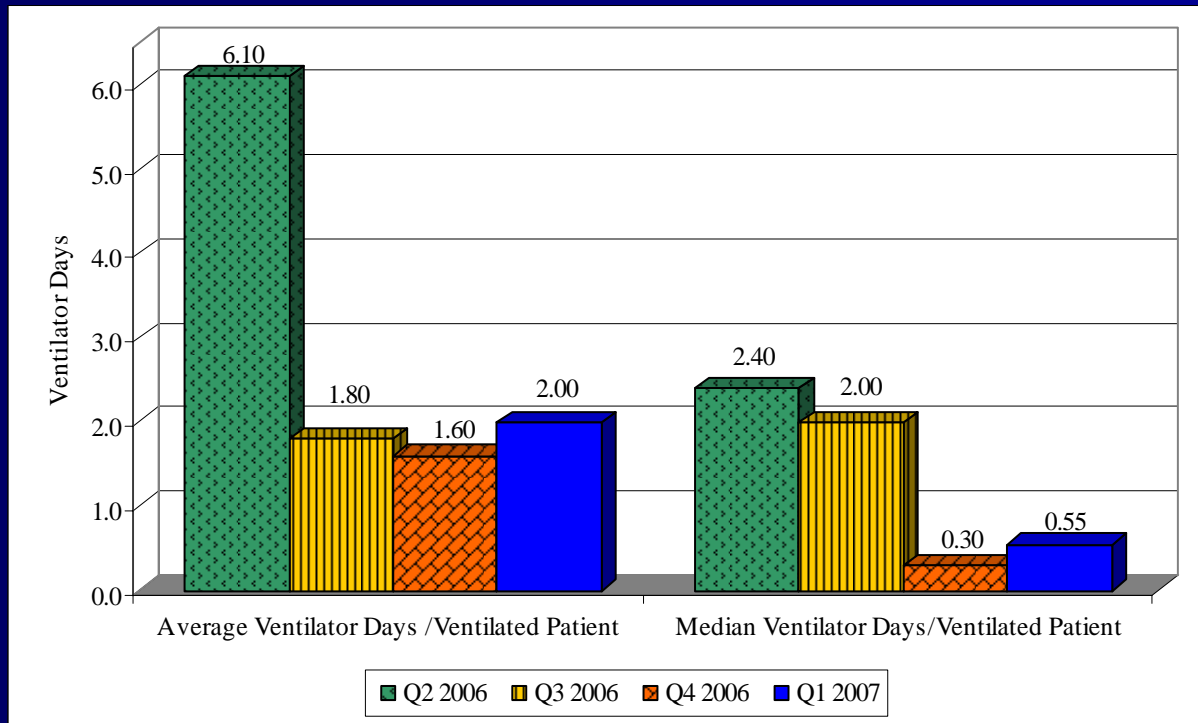
Number of patients at risk includes patients with head injury, serious burns, and coagulopathies

Blood Transfusions Patients Without ACS



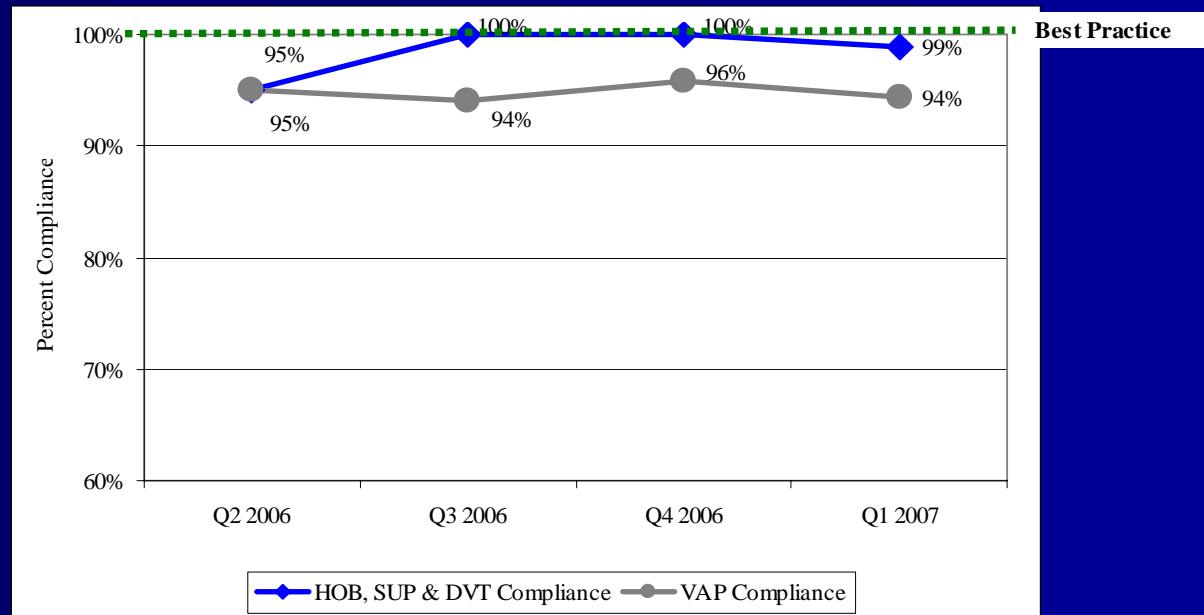
Quarter	Units Transfused	Hb < 8*	Hb 8-10	Hb > 10
Q2 2006	41	59%	32%	5%
Q3 2006	16	56%	44%	0%
Q4 2006	7	43%	57%	0%
Q1 2007	23	61%	39%	0%

Ventilator Days



Quarter	Total Vent Days	Vent Days/Ventilated Patient	
		Average	Median
Q2 2006	55	6.10	2.40
Q3 2006	25	1.80	2.00
Q4 2006	21	1.60	0.30
Q1 2007	81	2.00	0.55

Ventilator Associated Pneumonia Bundle

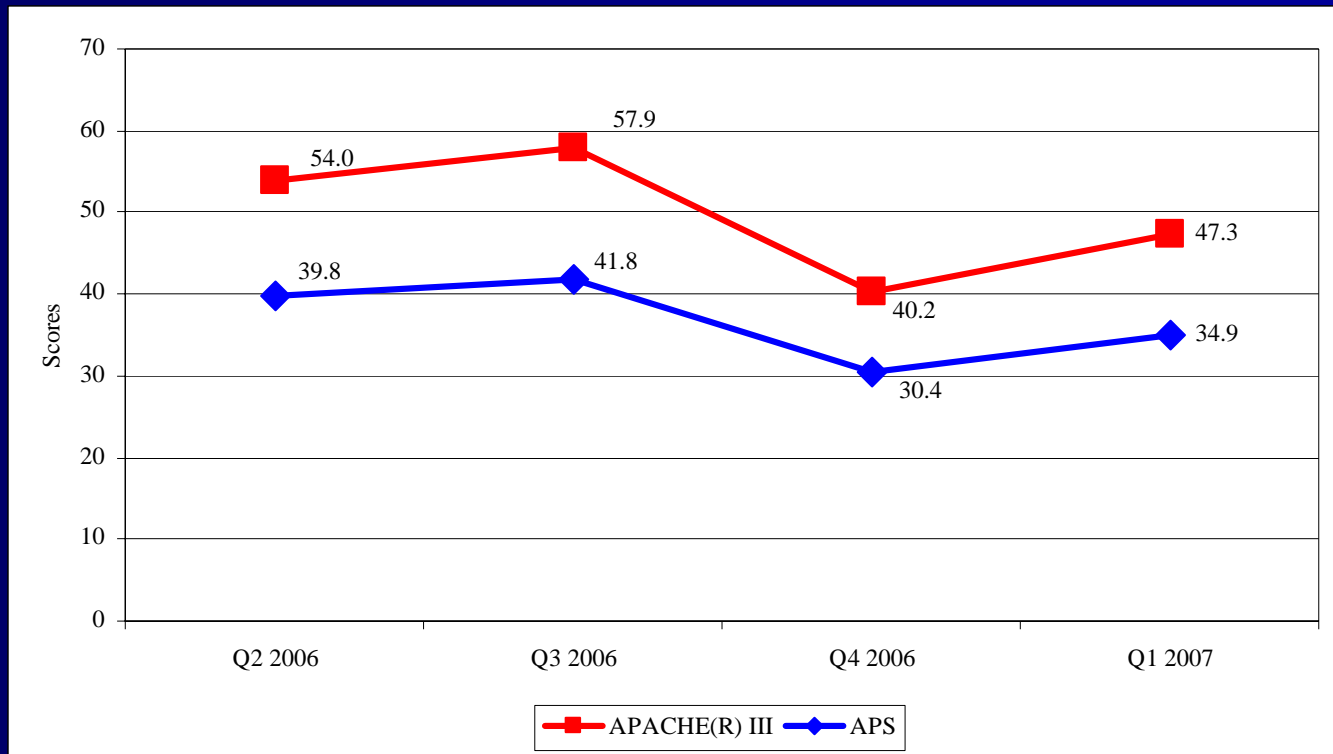


Quarter	Ventilated Patient Days	HOB 30			SUP		DVT		Compliance with HOB, SUP & DVT Criteria		Sedation Vacation/ Weaning Trial		Overall VAP Compliance	
		Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	
Q2 2006	21	21	100%	20	95%	21	100%	20	95%	20	95%	20	95%	
Q3 2006	17	17	100%	17	100%	17	100%	17	100%	16	94%	16	94%	
Q4 2006	24	24	100%	24	100%	24	100%	24	100%	23	96%	23	96%	
Q1 2007	89	88	99%	89	100%	89	100%	88	99%	85	96%	84	94%	

Number and Percentage represent patient days that meet the criteria.

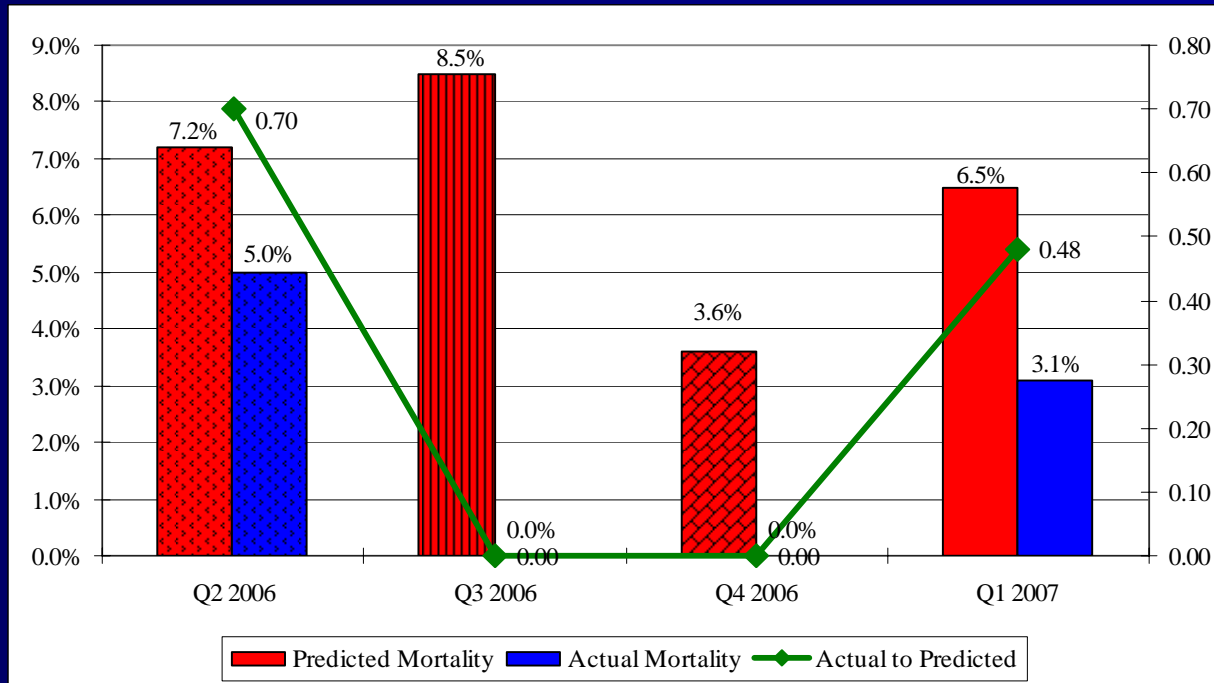
HOB 30 = Head of Bed elevated 30 degrees; SUP = Stress Ulcer Prophylaxis; DVT = DVT Prophylaxis

Severity Scores



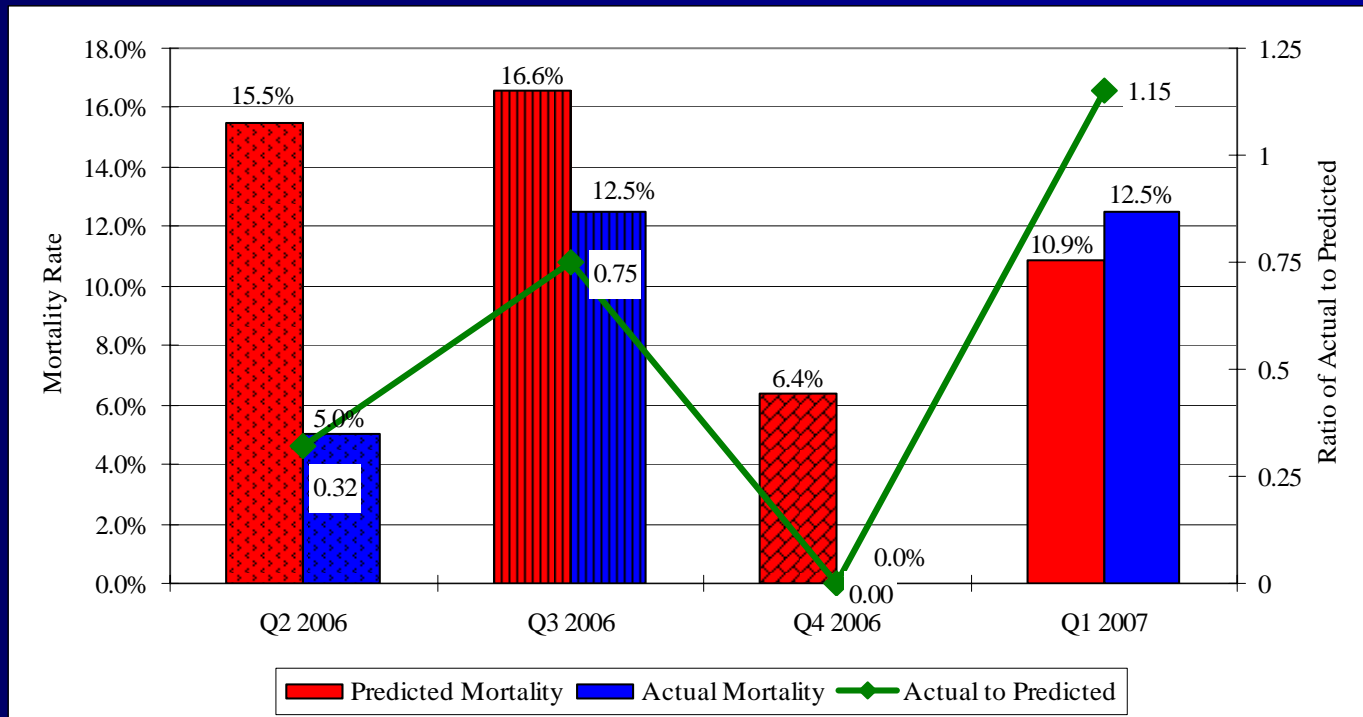
	2006			2007
	Qtr 2	Qtr 3	Qtr 4	Qtr 1
Average APACHE® III Score	54.0	57.9	40.2	47.3
Average Acute Physiology Score	39.8	41.8	30.4	34.9

Predicted and Actual ICU Mortality



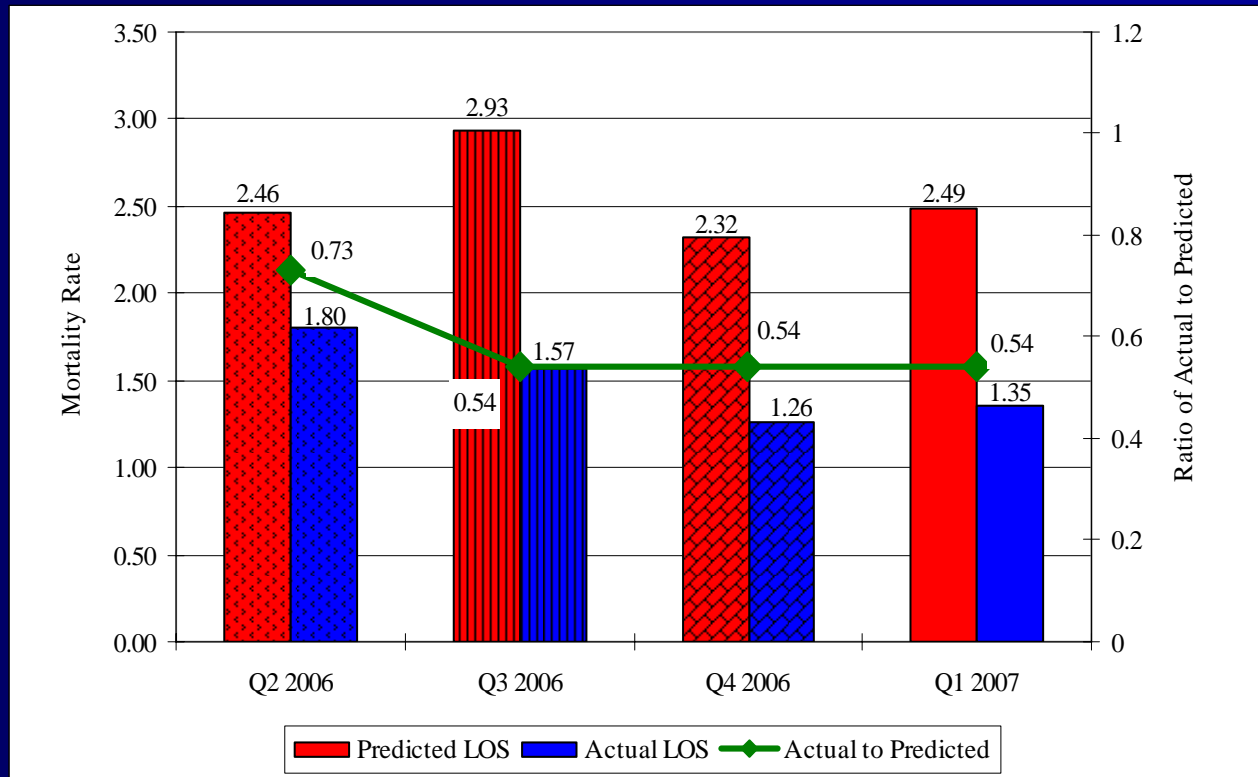
Quarter	ICU Mortality		
	Predicted	Actual	Actual to Predicted
Q2 2006	7.2%	5.0%	0.70
Q3 2006	8.5%	0.0%	0.00
Q4 2006	3.6%	0.0%	0.00
Q1 2007	6.5%	3.1%	0.48

Predicted and Actual Post ICU Hospital Mortality



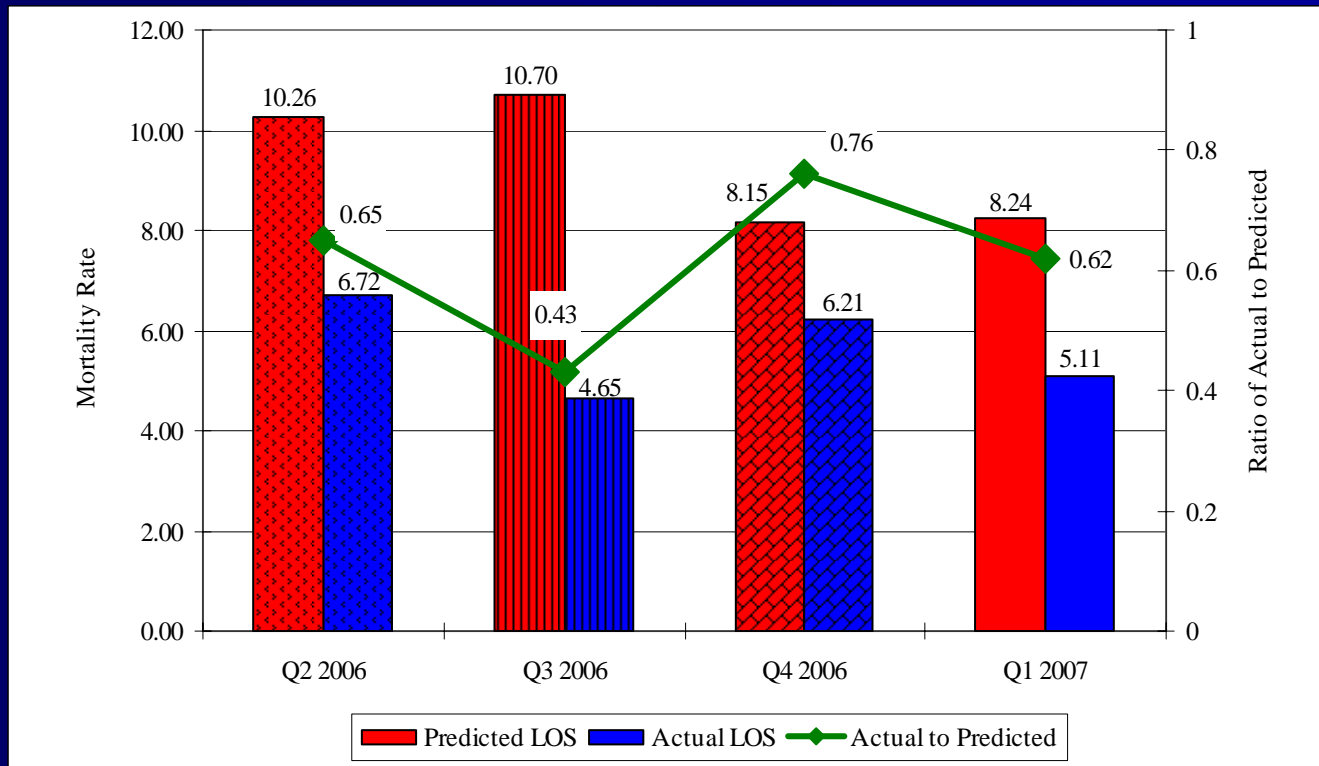
Quarter	ICU Mortality		
	Predicted	Actual	Actual to Predicted
Q2 2006	15.5%	5.0%	0.32
Q3 2006	16.6%	12.5%	0.75
Q4 2006	6.4%	0.0%	0.00
Q1 2007	10.9%	12.5%	1.15

Predicted and Actual ICU Length of Stay



Quarter	ICU Length of Stay		
	Predicted	Actual	Actual to Predicted
Q2 2006	2.46	1.80	0.73
Q3 2006	2.93	1.57	0.54
Q4 2006	2.32	1.26	0.54

Predicted and Actual Post ICU Hospital LOS



Quarter	Post ICU Length of Stay		
	Predicted	Actual	Actual to Predicted
Q2 2006	10.26	6.72	0.65
Q3 2006	10.70	4.65	0.43
Q4 2006	8.15	6.21	0.76

QUESTIONS?

