Telemedicine in Critical Care: e-ICU Model

9th Annual Clinical Informatics Summit

Beckman Center

May 19, 2017

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Increasing Complexity of Critical Care

Variable practices within individual units

A Double Standard

We currently provide two levels of care:

- Daytime
- Nights and weekends

Patient Mortality Is Associated With Staff Resources and Workload in the ICU: A Multicenter Observational Study. CCM 2015; 43:1587-1594

Mortality Rate After Nonelective Hospital Admission
Ricciardi R, et al: Arch Surg 2011; 146(5):545-551

CHEST

Official publication of the American College of Chest Physicians

CHEST ONLINE

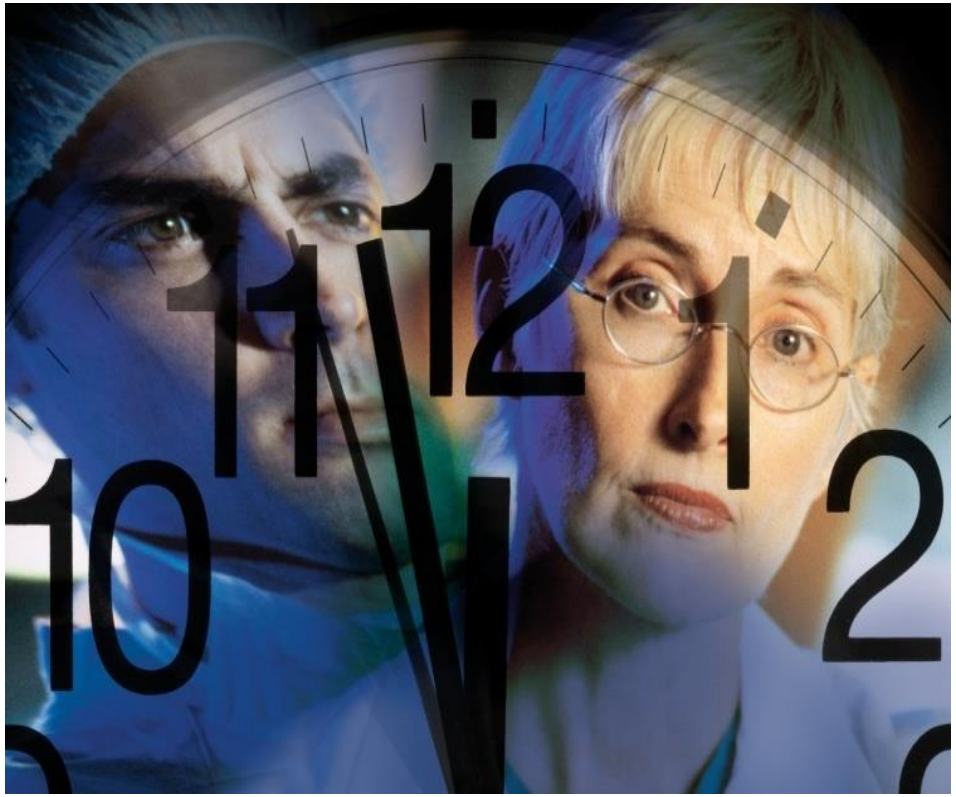
Association Between Time of Admission to the ICU and Mortality : A Systematic Review and Metaanalysis 2010; 136:66-75

The NEW ENGLAND JOURNAL of MEDICINE

ESTABLISHED IN 1812 MARCH 15, 2007 VOL. 356 NO. 11

Weekend versus Weekday Admission and Mortality from Myocardial Infarction

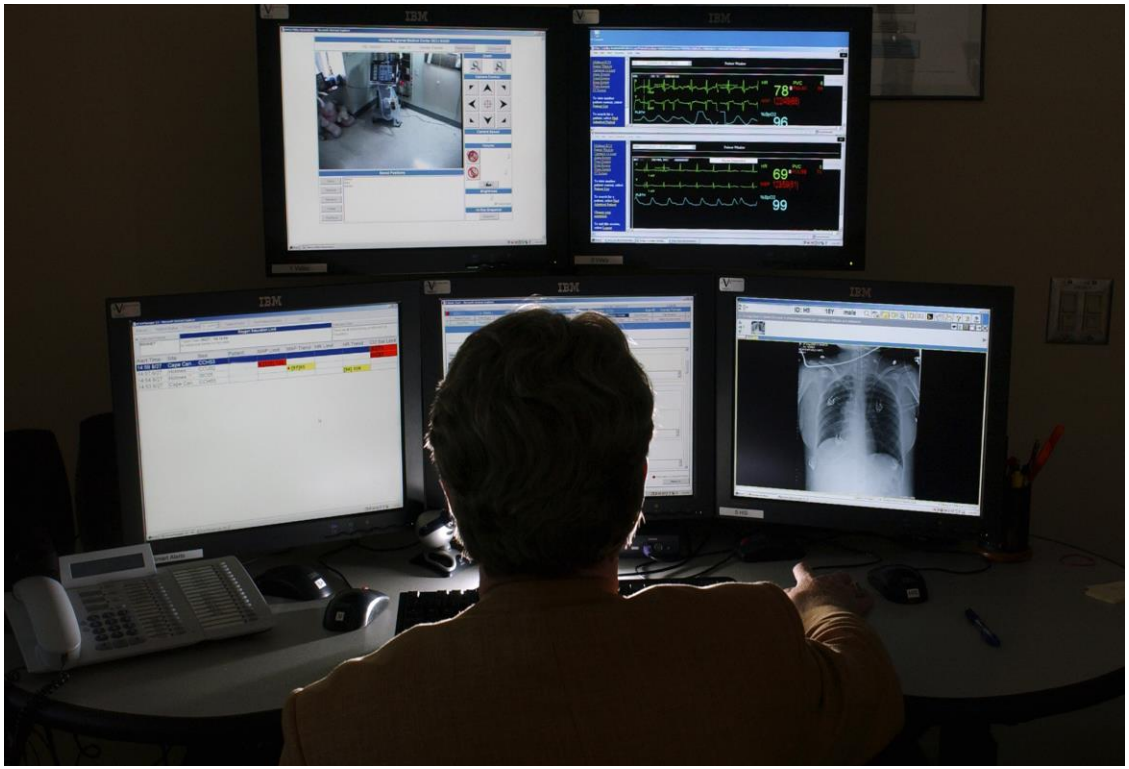
William J. Kostis, Ph.D., Kitaw Demissie, M.D., Ph.D., Stephen W. Marcella, M.D., M.P.H., Yu-Hsuan Shao, M.H.S., Alan C. Wilson, Ph.D., and Abel E. Moreyra, M.D., for the Myocardial Infarction Data Acquisition System (MIDAS 10) Study Group



"We have two standards of care in our hospitals, the first during the day Monday to Friday and the second, evenings, nights and weekends"
David Shulkin M.D. ,CEO,
NEJM May 2008

"An awake and alert intensivist that assists in ICU management and uses dedicated alerts and alarms for physiological instability to deliver proactive care is far more effective than a sleeping intensivist contacted by telephone"

Note: Residents and Nurses are reluctant to call Attendings at home for proactive orders



Rapid, High-fidelity Communication

- Two-way audio-video system
- Live monitoring & data tracking

} linking ICU patients to Monitoring Ctr

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24/7 Support provided to bedside team

e-ICU Team provides:

- Rounding at admission & PRN patient demands.
- Identifies need for early intervention, weaning, transfer, palliative care, etc.
- Multidisciplinary rounds with bedside team via camera.
- Enters orders for bundle compliance and routine maintenance.
- Facilitates enhanced CMI coding & case management intervention.

ICU Population Management – Similar to Air traffic Control

Safety Net

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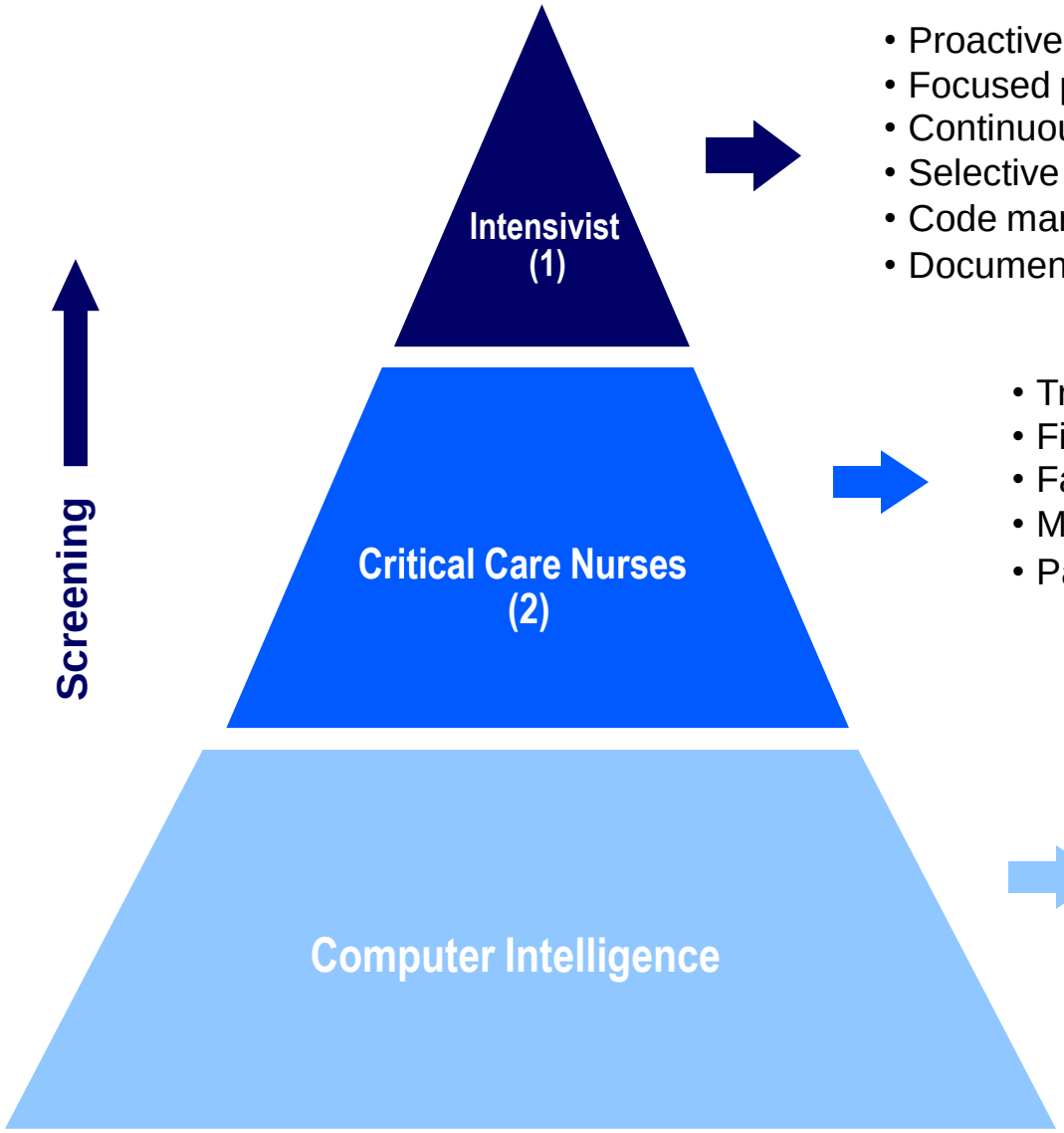
Ensuring safe glide paths for ICU recovery

e-ICU: a leveraged care delivery model



- Proactive clinical intervention
- Focused patient Oversight
- Continuous rounding on sick patients
- Selective rounding on stable patients
- Code management, procedure supervision
- Document orders and brief progress notes

- Triage patients for MD review
- Filter Smart Alerts
- Facilitate evidenced-based practice
- Mentor new/inexperienced staff
- Patient rounding

- Continuous monitoring
- Manages and deploys alerts to the remote e-ICU team
- Allows interoperability with all major EMR vendors
- Reports on global ICU benchmarks
- Big Data handling capabilities
- Vehicle for development of predictive analytics

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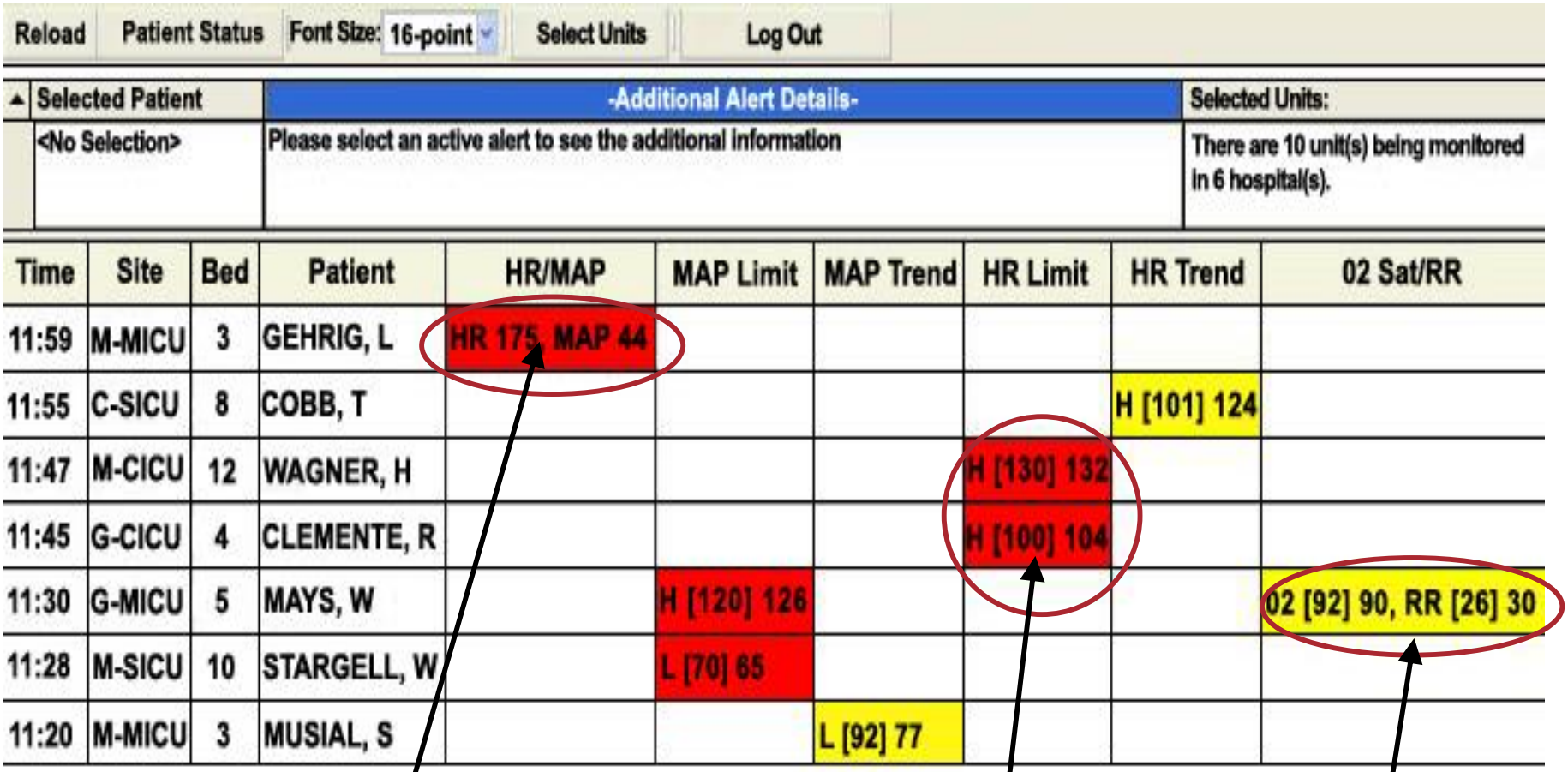
e-ICU Continuous Evaluation



Reload | Patient Status | Font Size: 16-point | Select Units | Log Out

Selected Patient	-Additional Alert Details-	Selected Units:
<No Selection>	Please select an active alert to see the additional information	There are 10 unit(s) being monitored in 6 hospital(s).

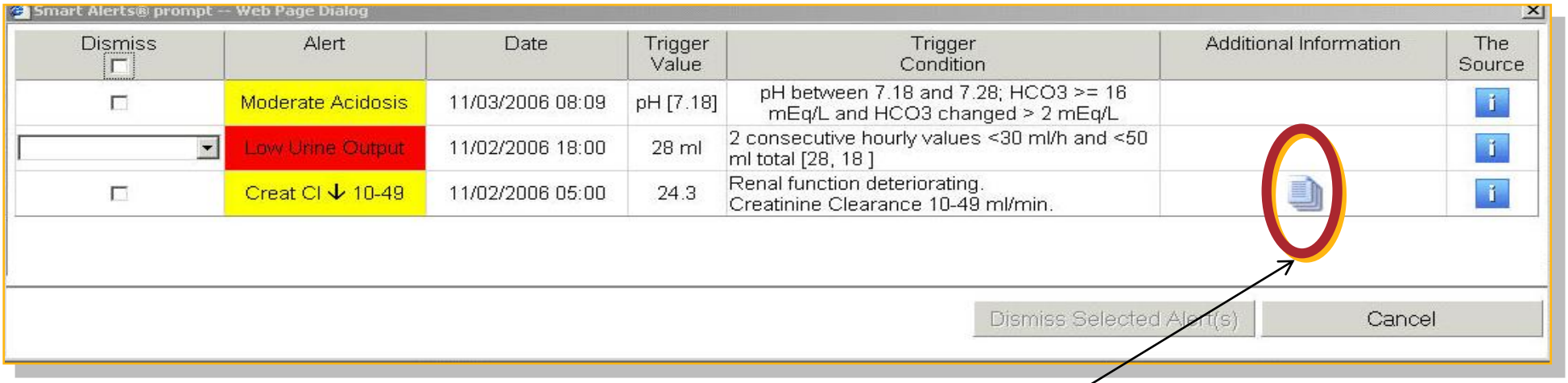
Time	Site	Bed	Patient	HR/MAP	MAP Limit	MAP Trend	HR Limit	HR Trend	02 Sat/RR
11:59	M-MICU	3	GEHRIG, L	HR 175, MAP 44					
11:55	C-SICU	8	COBB, T					H [101] 124	
11:47	M-CICU	12	WAGNER, H				H [130] 132		
11:45	G-CICU	4	CLEMENTE, R				H [100] 104		
11:30	G-MICU	5	MAYS, W		H [120] 126				02 [92] 90, RR [26] 30
11:28	M-SICU	10	STARGELL, W		L [70] 65				
11:20	M-MICU	3	MUSIAL, S			L [92] 77			

Combined parameters

Patient-specific parameters

Color coded

eCM Smart Alerts®



- Potassium
- Hemoglobin
- Acid Base
- Urine Output

- CrCl
- DVT Prophylaxis
- End of Life
- Sepsis

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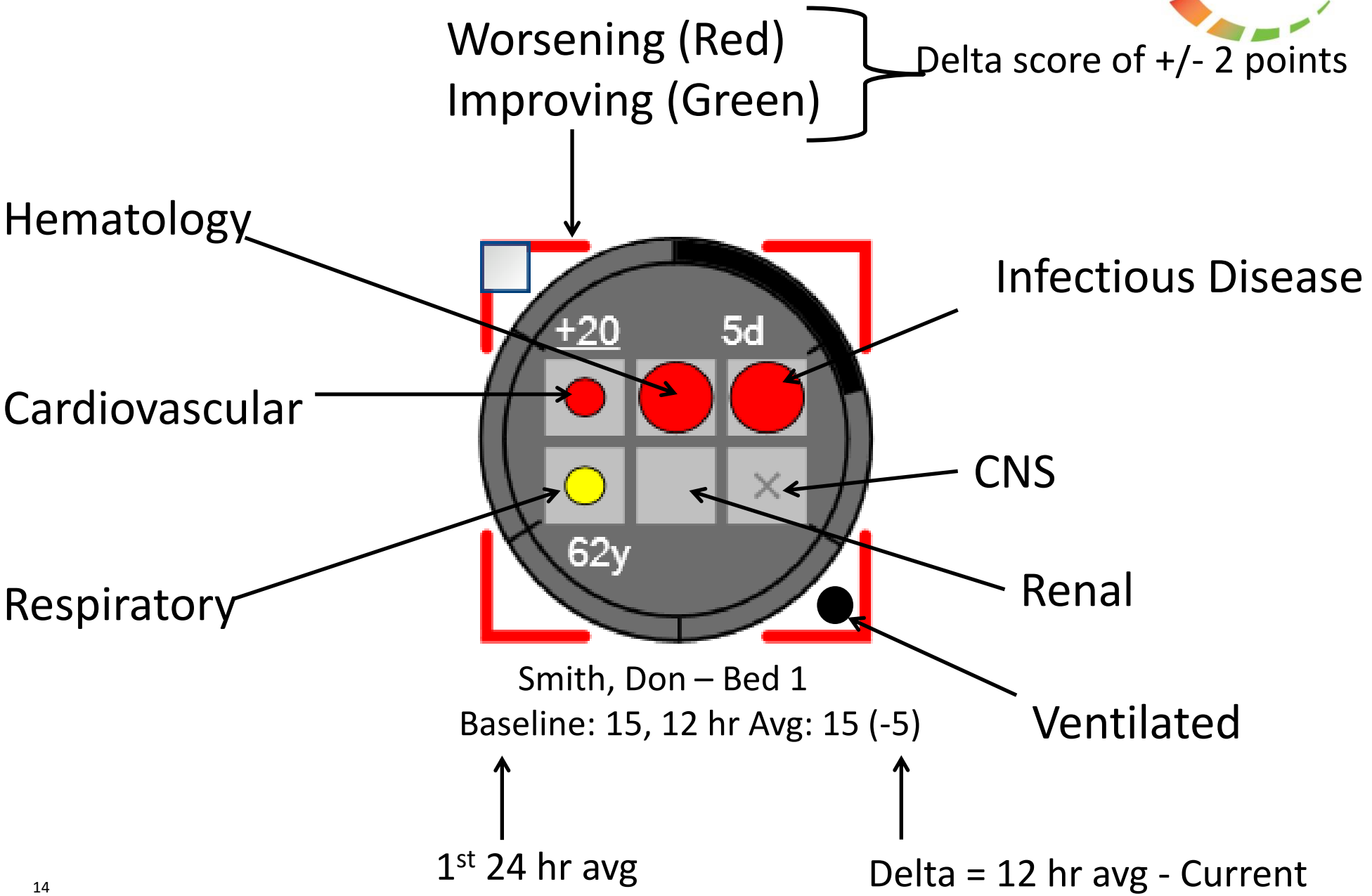
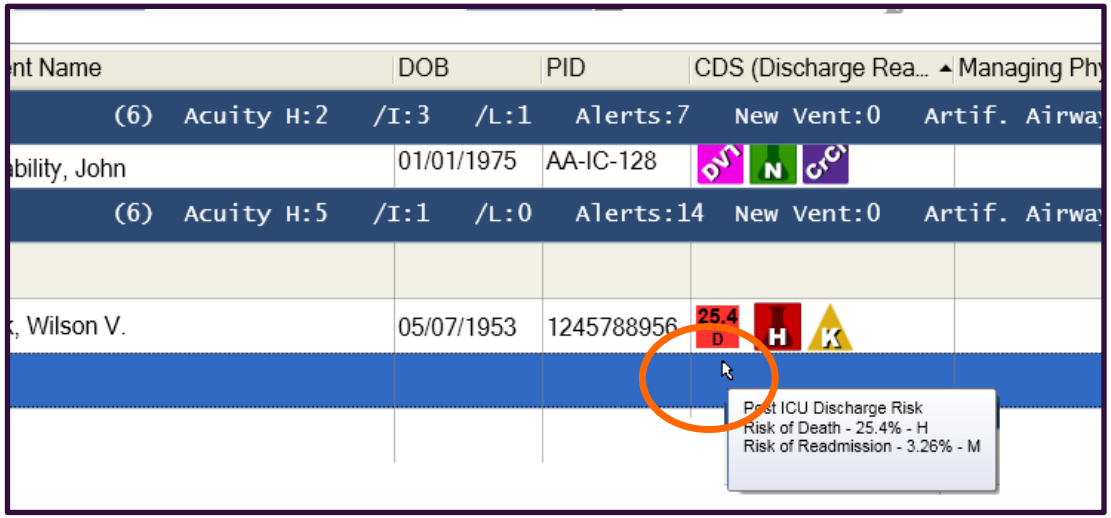
Automated Acuity – Graphical Metaphor

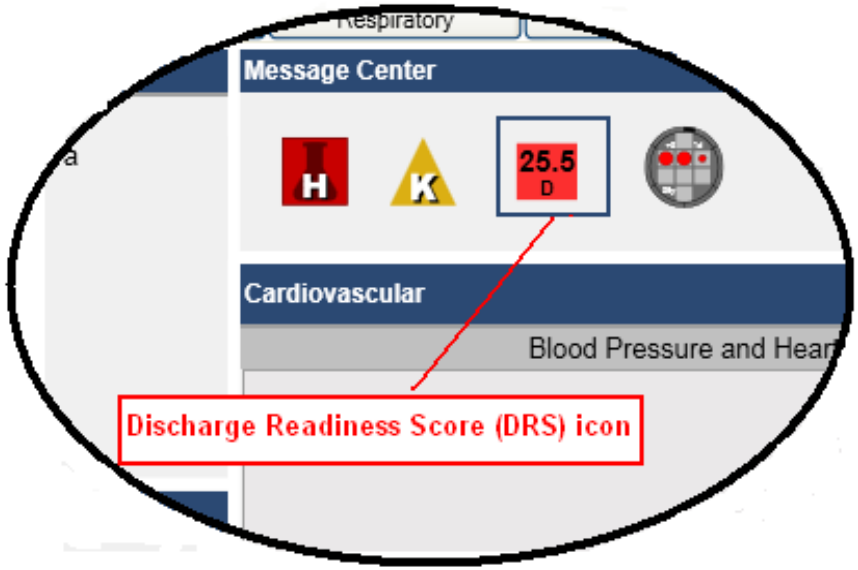


Discharge Readiness Scores (DRS)

- Predicts a patient's **Risk of Death** & **Risk of Readmission** within 48 hours of ICU discharge.

- Displays on . . .
  - Patient Census
  - Discharge Readiness DMR
  - Patient Profile





Derived from eRI Database > 2,500,000 patients

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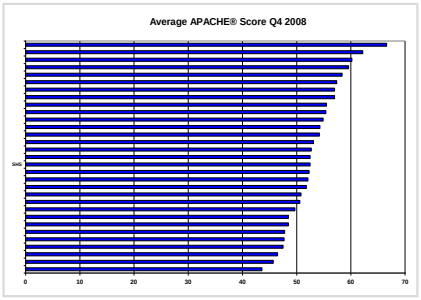
e-ICU Reporting: Tracking Process Improvement

Define, Measure, Analyze, Improve, Control & Transform Care

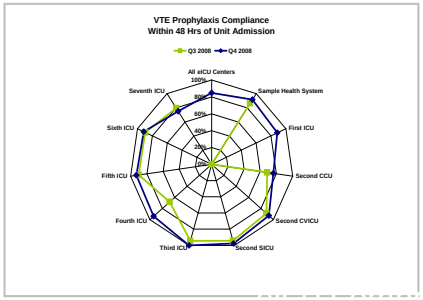
Benchmark Reports

Clinical Outcomes



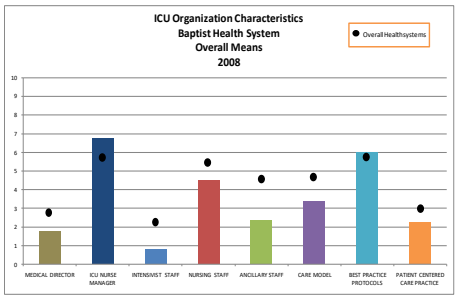
- Severity-adjusted mortality
- Severity-adjusted LOS
- Low risk monitor patients
- Severity Adjusted vent days
- Delirium & PTSD

Performance/Process



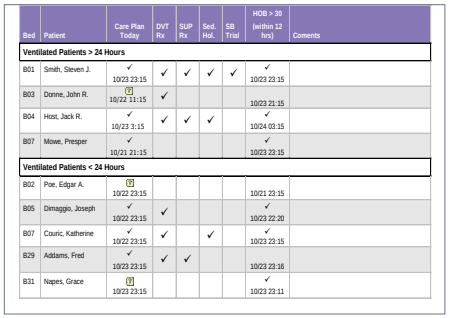
- VTE & GI prophylaxis
- Median ventilator days
- Stress Ulcer prophylaxis
- Low tidal volume ventilation
- Blood Transfusion threshold
- Beta-blocker usage
- Glycemic control (AM Glu CT)
- CLABSI, CAUTI, HAPU
- eICU Physician Interventions

Organizational Metrics



- VAP/VAE bundle
- Sepsis bundle
- Glucose control
- MI bundle
- Discharge readiness
- APACHE Missing Data

Daily Management Reports



Bed	Patient	Care Plan Today	DVT Rx	SUP Rx	Sed. Hol.	SB Trial	HOB > 30 (within 12 hrs)	Coments
Ventilated Patients > 24 Hours								
B01	Smith, Steven J.	✓ 10/23 23:15	✓	✓	✓	✓	✓ 10/23 23:15	
B03	Donne, John R.	? 10/22 11:15	✓				10/23 21:15	
B04	Host, Jack R.	✓ 10/23 3:15	✓	✓	✓		✓ 10/24 03:15	
B07	Mowe, Presper	✓ 10/21 21:15					✓ 10/23 23:15	
Ventilated Patients < 24 Hours								
B02	Poe, Edgar A.	? 10/22 23:15					10/21 23:15	
B05	Dimaggio, Joseph	✓ 10/22 23:15	✓				✓ 10/23 22:20	
B07	Couric, Katherine	✓ 10/22 23:15	✓		✓		✓ 10/23 23:15	
B29	Addams, Fred	✓ 10/23 23:15	✓	✓			10/23 23:16	
B31	Napes, Grace	? 10/23 23:15					✓ 10/23 23:11	

eSearch: Ad-hoc, customizable reporting down to the patient level

Benefits: ⇓'d mortality, LOS, & preventable complications

6290 adults admitted to 7 ICUs (3 medical, 3 surgical, & 1 mixed cardiovascular)

One 834-bed academic medical center on 2 campuses:

UMASS

UMassMemorial

Study 2005-2007

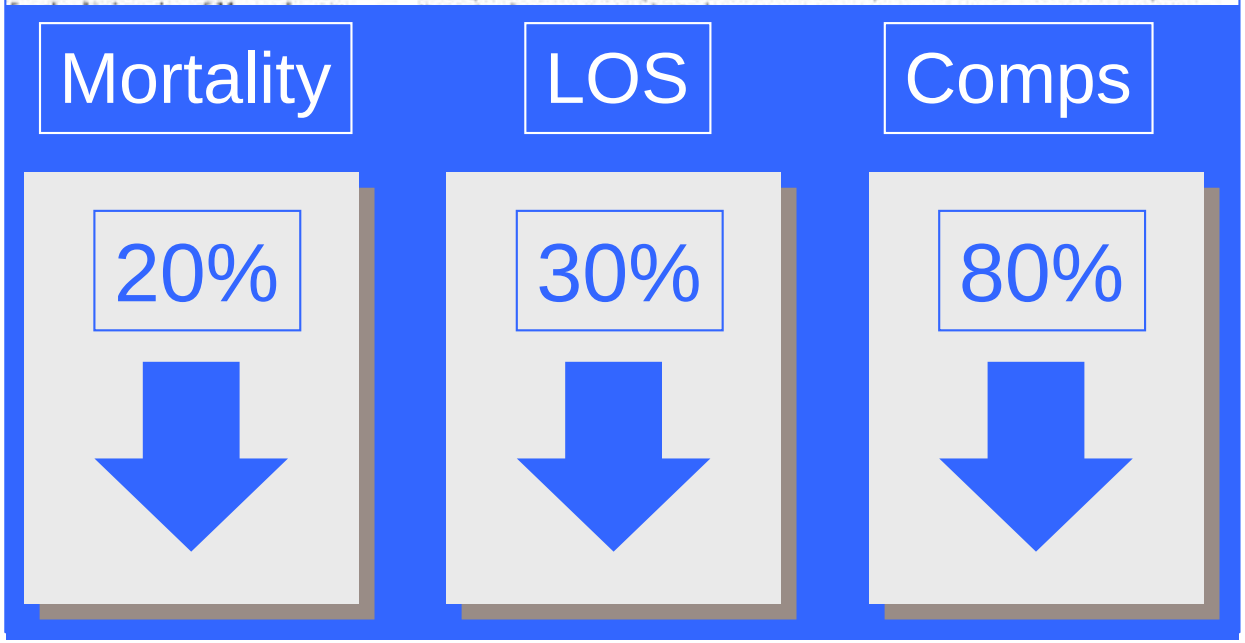
Hospital Mortality, Length of Stay, and Preventable Complications Among Critically Ill Patients Before and After Tele-ICU Reengineering of Critical Care Processes

Craig M. Lilly, MD
Shawn Cody, MSN/MBA, RN
Huifang Zhao, PhD
Karen Landry
Stephen P. Baker, MScPH
John McIlwaine, DO
M. Willis Chandler, MBA
Richard S. Irwin, MD

Context The association of an adult tele-intensive care unit (ICU) intervention with hospital mortality, length of stay, best practice adherence, and preventable complications for an academic medical center has not been reported.

Objective To quantify the association of a tele-ICU intervention with hospital mortality, length of stay, and complications that are preventable by adherence to best practices.

Design, Setting, and Patients Prospective stepped-wedge clinical practice study of 6290 adults admitted to any of 7 ICUs (3 medical, 3 surgical, and 1 mixed cardiovascular) on 2 campuses of an 834-bed academic medical center that was performed from April 26, 2005, through September 30, 2007. Electronically supported and monitored processes for best practice adherence, care plan creation, and clinician response



JAMA. 2011; 305(21):2175-2183

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e-ICU Practice Guidelines Adherence & Results

Table 4. Association of Tele-ICU Intervention Group With Best Practice and Complication Measures

Clinical Practice Guideline Adherence	No./Total (%) of Patients Eligible[a]		OR (95% CI)	*P* Value
	Preintervention Group	Tele-ICU Group		
Prophylaxis				
Stress ulcer	1253/1505 (83)	4550/4760 (96)	4.57 (3.91-5.77)	<.001
Deep venous thrombosis	1299/1527 (85)	4707/4733 (99.5)	15.4 (11.3-21.1)	<.001
Best practice				
Cardiovascular protection	311/391 (80)	2866/2894 (99)	30.7 (19.3-49.2)	<.001
Prevention of ventilator-associated pneumonia	190/582 (33)	770/1492 (52)	2.20 (1.79-2.70)	<.001
Ventilator-associated pneumonia	76/584 (13)	32/1949 (1.6)	0.15 (0.09-0.23)	<.001
Catheter-related bloodstream infection	19/1529 (1)	29/4761 (0.6)	0.50 (0.27-0.93)	.005
Acute kidney injury	174/1452 (12)	540/4565 (12)	1.00 (0.71-1.69)	.38
After hours care plan review for ICU admissions, No. (%)	705/1529 (46)[b]	2287/4761 (48)[c]		
Interventions for physiological instability	All bedside clinician initiated	483[d] 37 573[e]		

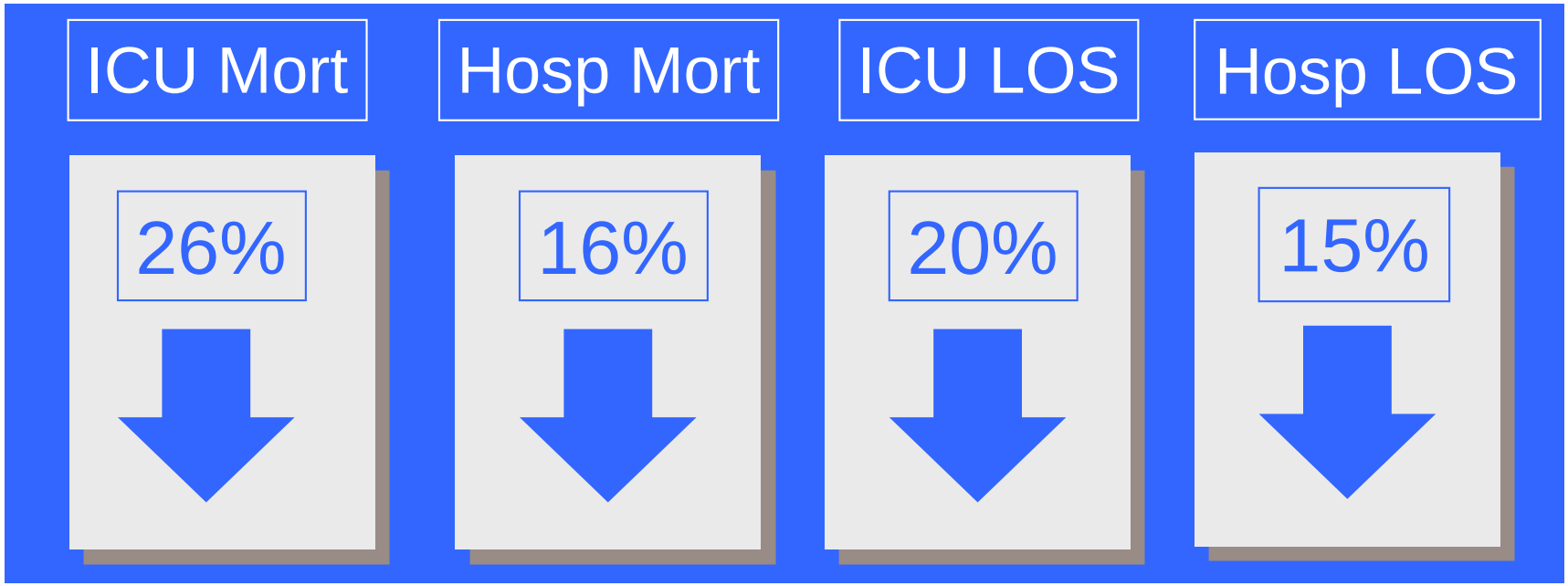
Abbreviations: CI, confidence interval; ICU, intensive care unit; OR, odds ratio.
[a] Unless otherwise indicated.
[b] Off-hours admission reviews not using a workstation.
[c] Off-hours admissions reviews using a workstation.
[d] Initiated by bedside clinician.
[e] Initiated prior to action by bedside clinicians.

Hospital Mortality, Length of Stay, and Preventable Complications Among Critically Ill Patients Before and After Tele-ICU Reengineering of Critical Care Processes, Lilly et al, JAMA, May 2011.

Recent Data 56 ICUs – 2014 Chest

Total patients studied: Overall, 118,990 adult patients (11,558 control subjects, 107,432 intervention group patients) from 56 ICUs in 32 hospitals from 19 US health-care systems.

Key findings: compared to patients receiving usual ICU care, patients who received e-ICU care had:



Lilly CM, et al: A Multicenter Study of ICU Telemedicine
***Chest*. 2014**; 145(3):500-507

CHEST

Original Research

CRITICAL CARE

A Multicenter Study of ICU Telemedicine Reengineering of Adult Critical Care

*Craig M. Lilly, MD, FCCP; John M. McLaughlin, PhD, MSPH; Huifang Zhao, PhD; Stephen P. Baker, MScPH; Shawn Cody, RN, MSN, MBA; and Richard S. Irwin, MD, Master FCCP; for the UMass Memorial Critical Care Operations Group**

Background: **Few studies have evaluated both the overall effect of ICU telemedicine programs and the effect of individual components of the intervention on clinical outcomes.**

Methods: **The effects of nonrandomized ICU telemedicine interventions on crude and adjusted mortality and length of stay (LOS) were measured. Additionally, individual intervention components related to process and setting of care were evaluated for their association with mortality and LOS.**

Results: **Overall, 118,990 adult patients (11,558 control subjects, 107,432 intervention group patients) from 56 ICUs in 32 hospitals from 19 US health-care systems were included. After statistical adjustment, hospital (hazard ratio [HR] = 0.84; 95% CI, 0.78-0.89; $P < .001$) and ICU (HR = 0.74; 95% CI, 0.68-0.79; $P < .001$) mortality in the ICU telemedicine intervention group was significantly better than that of control subjects. Moreover, adjusted hospital LOS was reduced, on average, by 0.5 (95% CI, 0.4-0.5), 1.0 (95% CI, 0.7-1.3), and 3.6 (95% CI, 2.3-4.8) days, and adjusted ICU LOS was reduced by 1.1 (95% CI, 0.8-1.4), 2.5 (95% CI, 1.6-3.4), and 4.5 (95% CI, 1.5-7.2) days among those who stayed in the ICU for ≥ 7, ≥ 14, and ≥ 30 days, respectively. Individual components of the interventions that were associated with lower mortality, reduced LOS, or both included (1) intensivist case review within 1 h of admission, (2) timely use of performance data, (3) adherence to ICU best practices, and (4) quicker alert response times.**

Conclusions: **ICU telemedicine interventions, specifically interventions that increase early intensivist case involvement, improve adherence to ICU best practices, reduce response times to alarms, and encourage the use of performance data, were associated with lower mortality and LOS.**

CHEST 2014; 145(3):500–507

Abbreviations: APACHE = Acute Physiology and Chronic Health Evaluation; HR = hazard ratio; LOS = length of stay

Multi-Centre Outcomes

Unadjusted case fatality rates

Hospital

(10.8 vs. 9.9; p = 0.003)

ICU

(7.8 vs. 5.8, p < 0.01)

Unadjusted length of stays

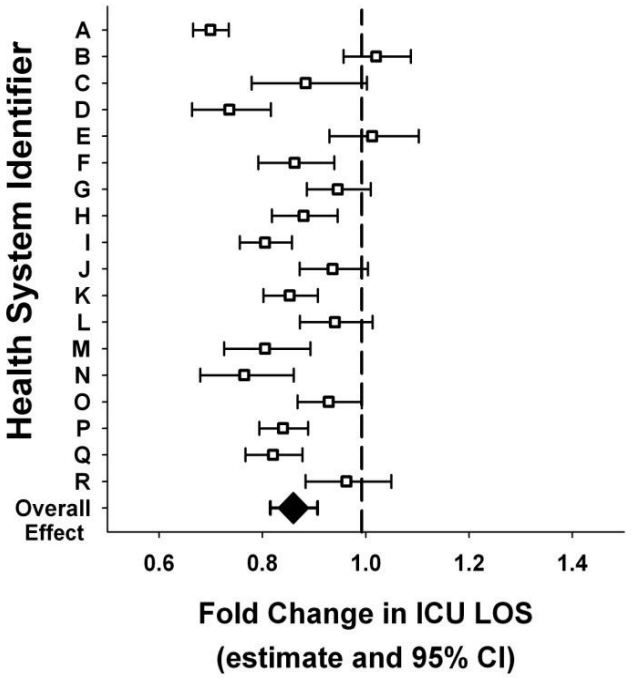
Hospital

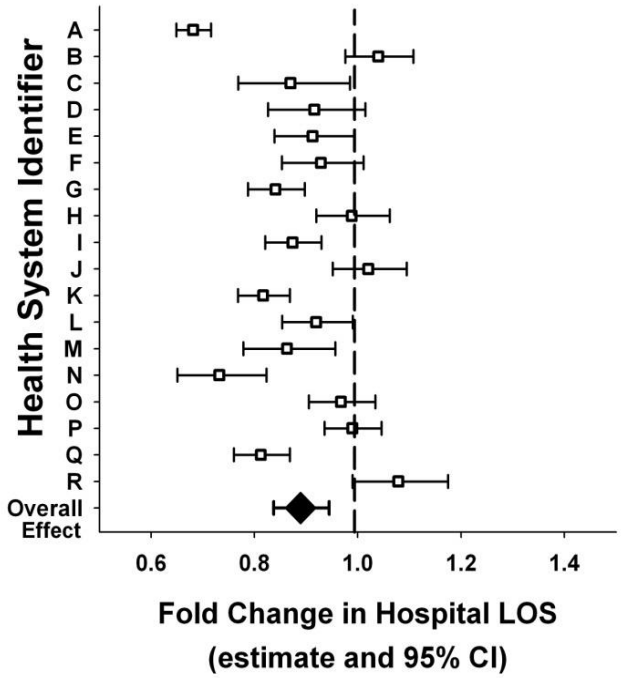
(10.3 ± 18.7 vs. 9.7 ± 14.1)

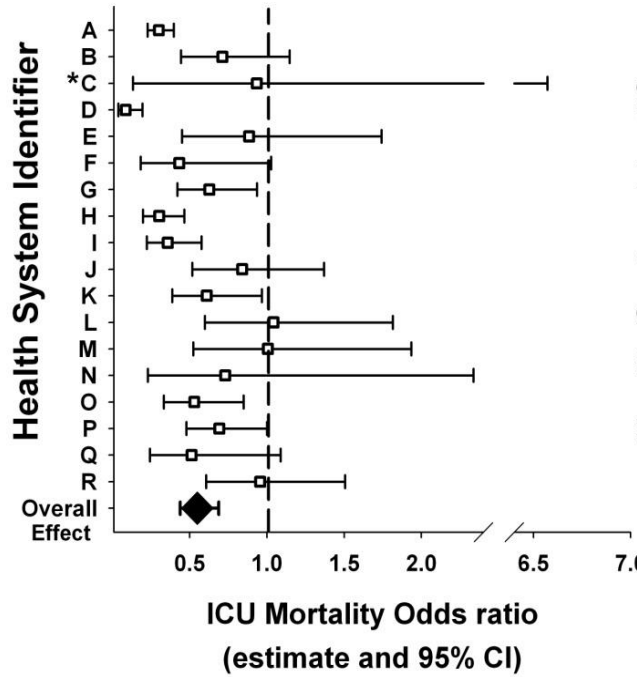
ICU

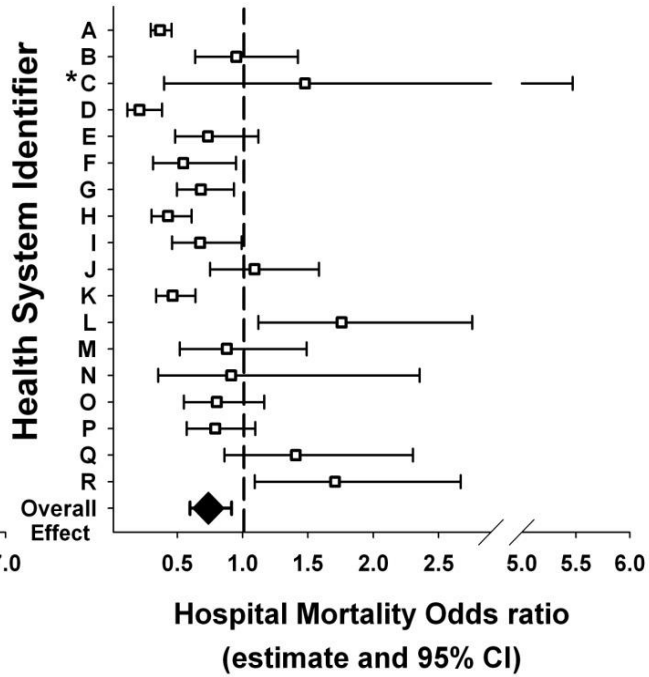
(4.4 ± 12.1 vs. 3.5 ± 5.5)

Both p < 0.001









Lilly et al. Chest 2014;
145 (3):500-507.

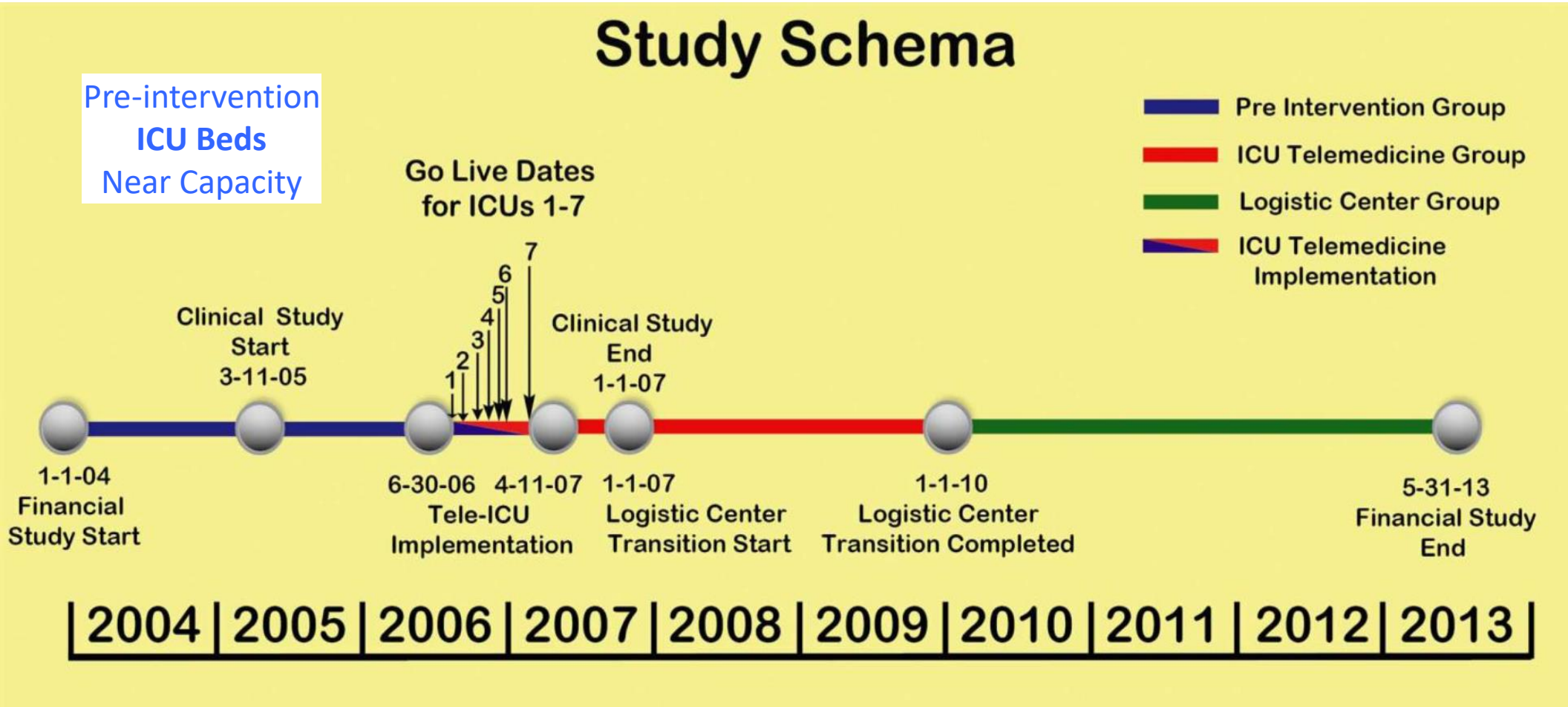
Financial Outcomes:

CHEST AMERICAN COLLEGE of CHEST PHYSICIANS 2017 151(2):286-297

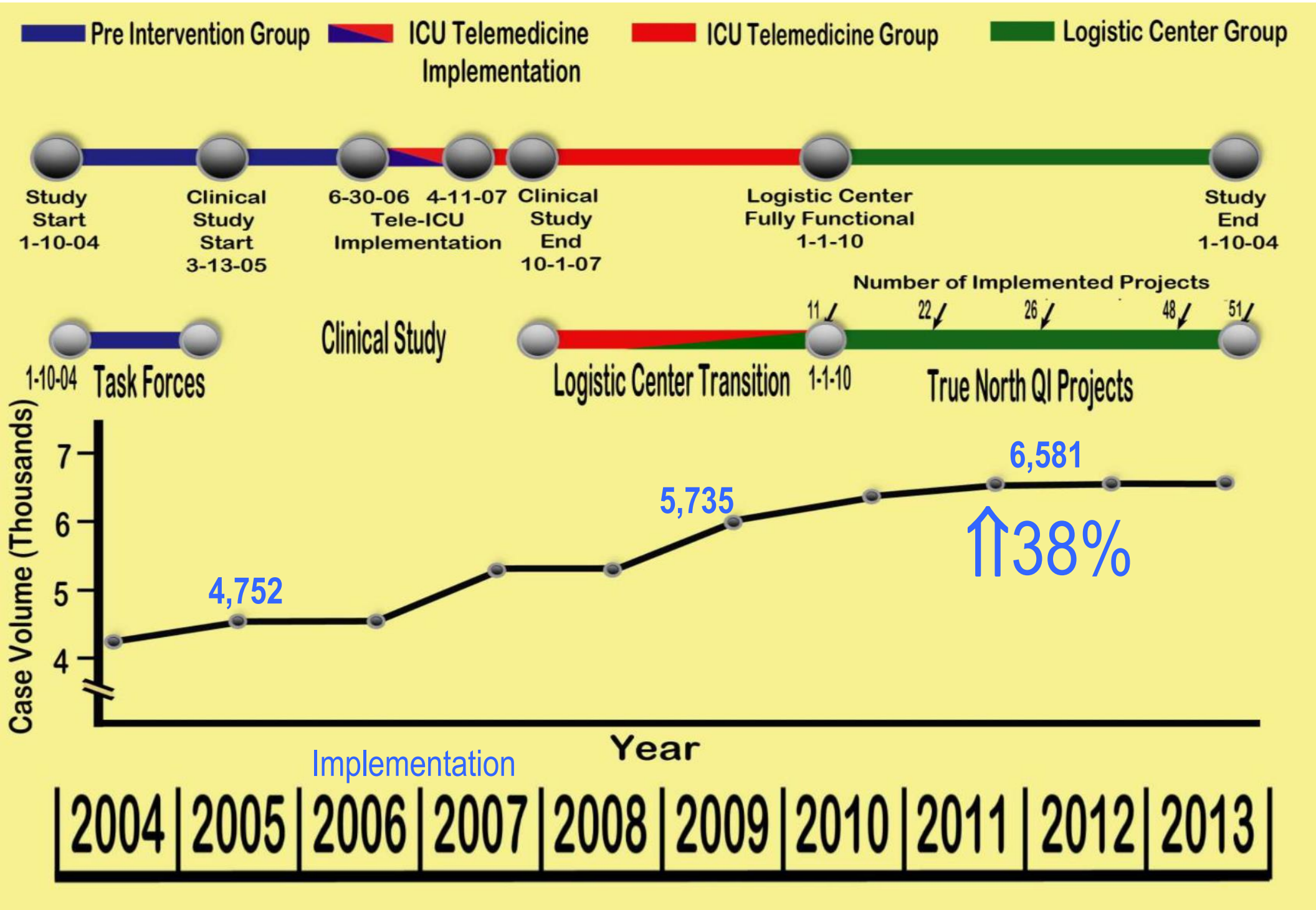
ICU Telemedicine Program Financial Outcomes

7 ICUs, n=51,203 adult ICU patients

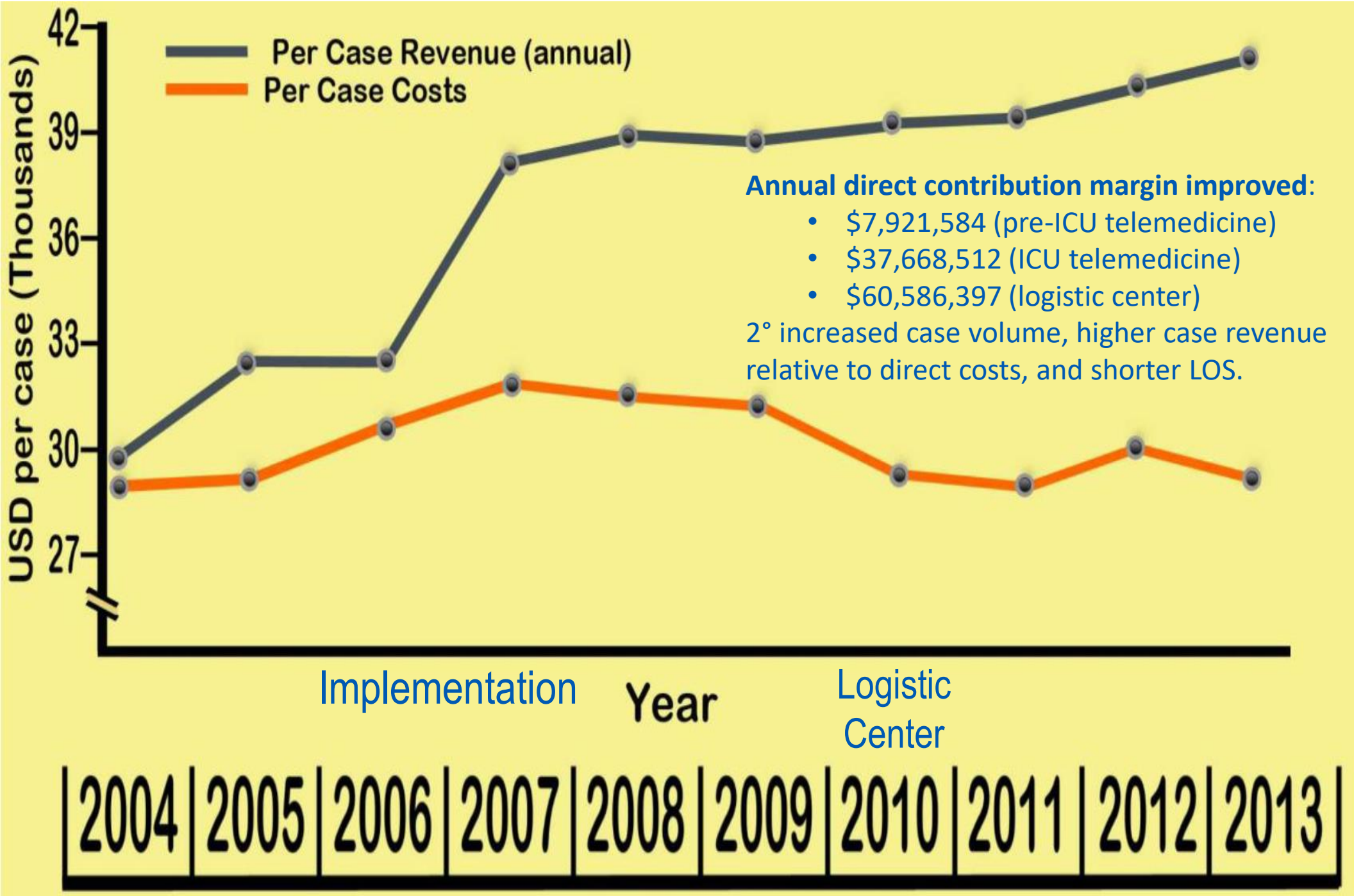
Craig M. Lilly, MD,[a,b,c,d] Christine Motzkus, MPH, Teresa Rincon, RN, BSN, Shawn E. Cody, PhD, MSN/MBA, RN[e,f], Karen Landry, BS,[e] and Richard S. Irwin, MD [a,g] for the UMass Memorial Critical Care Operations Group*



Interventions & Case Volume over time – U Mass



Interventions and Financial Outcomes – U Mass



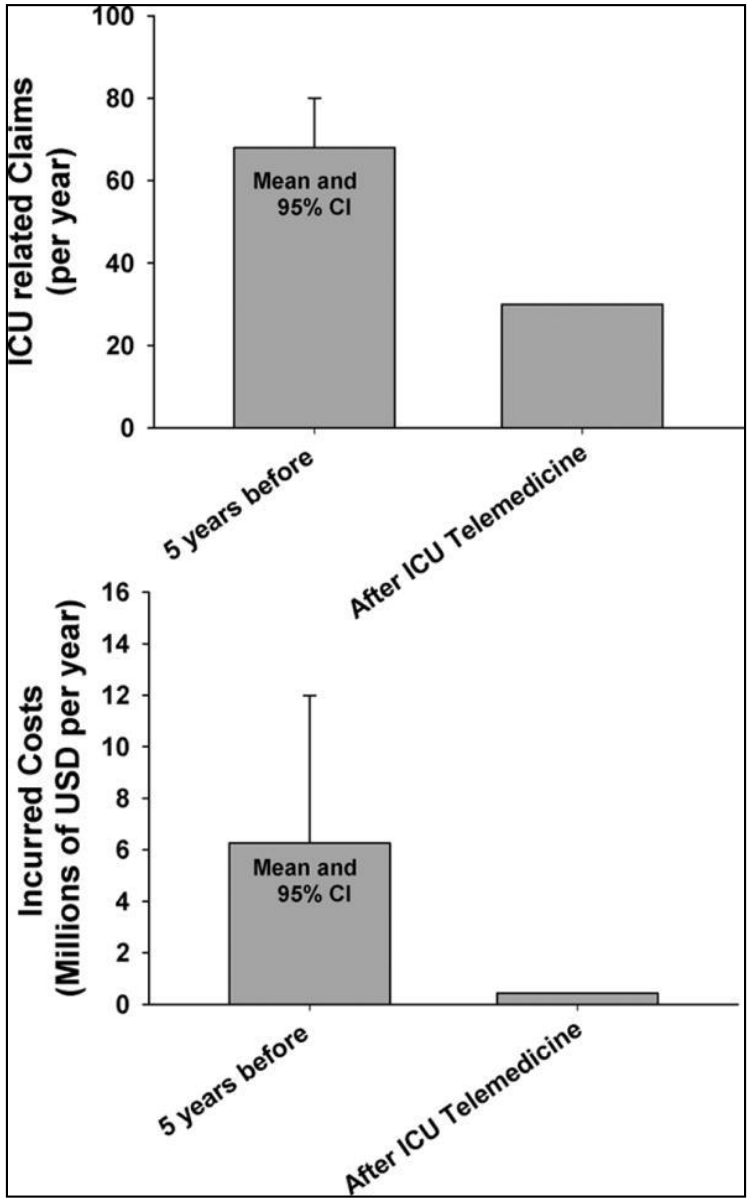
Annual direct contribution margin improved:

- $7,921,584 (pre-ICU telemedicine)
- $37,668,512 (ICU telemedicine)
- $60,586,397 (logistic center)

2° increased case volume, higher case revenue relative to direct costs, and shorter LOS.

Reduced Malpractice Claims & Costs at U Mass

- Prior to e-ICU implementation the average annual ICU related malpractice costs = $6 M
- After implementation of e-ICU, annual malpractice costs dropped to <$0.5 M.
- These cost-per-claim reductions were not observed in groups of patients of the healthcare system that were not supported with an ICU telemedicine program.



Critical Care Telemedicine: Evolution & State of the Art. CCM. 2014; 42(11): 2429-36.

eICU Impacts on Nurse Staffing, Satisfaction, & Retention

Implementation of a tele-ICU was associated with improved teamwork and safety among ICU nurses.[1]

Improved responses in the 'relations and communication', 'psychological working conditions and burnout', and the 'education' subscales after implementation of a teleICU program.[2]

Staff were more confident about patient coverage and physician accessibility, and did not report any unnecessary interruptions in patient care.[1]

Other positive motives for using tele-ICU are the ability to provide evidence-based care, opportunities for continued education/training, and enhanced collaboration and teamwork.[3,4,5]

Other motivational factors included overcoming service gaps, maintaining patient satisfaction and providing clinical support.[4]

Nurses agree that tele-ICUs improve collaboration, job performance and communication, as well as being useful in nursing assessments and allowing bedside nurses more time for patient care.[5]

(1) Chu-Weininger et al. : Impact of tele-ICU on provider attitudes about Teamwork & Safety Climate. Qual Saf Health Care. 2010; 19(6): e39
(2) Romig et al: Perceived benefit of a telemedicine consultative service in a highly staffed ICU. J Crit Care 2012; 27 (4):426.e9-16.
(3) Alshubaily, et al: Staff perceptions of a telemedicine intensive care unit. Thesis submitted to Auckland University of Technology 2014. .
(4) Rogove et al; Barriers to Telemedicine: Survey of Current Users in Acute Care Units. TELEMEDICINE and e-HEALTH Jan/Feb 2012
(5) Kristie Aylett: Nurse Survey Assesses Impact of ICU Telemedicine., Am Assoc Crit Care Nurses. Jan 2016

Additional examples with financial benefits

Avera Health, S. Dakota: >160 patients able to stay in hometown hospital (supported by Avera Tele-ICU); $1M saved in air transport costs.(1)

Maine Medical Center: During 1st 33 months after eICU implementation, turnover of registered nurses decreased 56%; $1.1M per year saved.(2)

Resurrection Health Care, Illinois: 38% decrease in ICU LOS in 6 months; resulting in $3M saved.(3)

Via Christi Regional Med Center, Kansas: eICU partnership to prevent air embolism; yielded $720,000 in non-reimbursable patient care costs.(4)

(1) Zawada et al. Clinical and fiscal impact of rural tele-intensivist staffing program on transfer of patients from their community to a tertiary care hospital. Crit Care Med. 2008; 36(12 Suppl): A86.
(2) Goran SF: Making the move: from bedside to camera-side. Critical Care Nurse. 2012; 32 (1) 20-29.
(3) Goran SF: A Second Set of Eyes: An Introduction to Tele-ICU," Critical Care Nurse, 2010; 30(4), 46-55.
(4) Cowboy, et al.: Preventing air embolus with tele-ICU collaborative. Chest 2009; 136(4):16S

e-ICU Cost and Recovery of Cost

U Mass Memorial MC

$7.1 million cost (includes capital & operations)
30% length of stay reduction and increased volumes results in lower costs and net financial improvement for UMMMC of $5,400 per case
Full recovery of all costs within one year

Community Hospitals 1 and 2 (UMMC Holmes County and UMMC Grenada)

$400,000 (each) investment
Higher volume (45% average) of patients of greater severity resulted in increased revenue and net financial improvement of $2,500 (average) per case
Full recovery of all costs within one year

Financial benefit to payers

The average cost per case was reduced by $2,600 in an academic medical center.

NEHI's Dec. 2010 report, Critical Care, Critical Choices: The Case for Tele-ICUs in Intensive Care

Key Goals of e-ICU Implementation at UCI

Enhanced quality and safety, increased capacity, improved operational and cost efficiencies.

- In accordance with UCI Health Strategic Framework, e-ICU will facilitate:
  - Standardized care protocols & clinical strategies
  - Enhanced lines of authority regarding medical decisions
  - Earlier engagement of urgent / emergency response pathways
  - Increased use of handoffs & improved bedside team coordination
  - Decreased resource (lab / imaging / pharm) utilization
  - Improved Patient Satisfaction
  - Increased Culture of Safety scores and Nursing Satisfaction

- e-ICU implementation is expected to:
  - Increase access to transfer patients needing surgical procedures
  - Improve transfer center coordination,
  - Decreased readmissions
  - Provide infrastructure for strategic outreach to partner hospitals
  - Serve as the backbone to expand other telemedicine services such as Tele-Stroke, ePharmacy, entire hospital-to-home continuum.

Secondary Goals

- Decrease in physician/nurse burnout (1,2,3)
- Improvement in nursing recruitment (1,2,3) & retention(1,2)
- Increase Leapfrog and regulatory compliance
- Decreased malpractice expenses (4)
- Enhanced financial performance (↓'d resource utilization)
- Improved "Culture of Safety" perspective of staff(5,6)
- Use of Big Data and predictive analytics to improve patient care, and to support Academic and Research missions

(1) Hoonakker et al *J Crit Care*, *2013*, 28, 315.e13 – 135.e21
(2) MacDonald, Interview with Kevin Vaziri of Dignity Health, *FierceHealthcare*, May *2015*
(3) AHRQ "Using Telehealth to Improve Quality and Safety"
(4) Lilly CM, et al: *CCM* November, *2014*
(5) Chu-Weininger, et al: Tele-ICU impact on Provider Attitudes. *Qual Safe Health Care 2010;* 19(6): e39.
(6) Khunlertkit, et al: Contributions of Tele-ICU technology to quality & safety. *J Crit Care*, *2013*

Enhancements: Disruptive Technologies

- UC Irvine Engineering
- Other Tech / Device / Innovators
- Internet of things, wireless (un-tethered monitoring)
- Exhaled molecules
- Genetic Analytics
- Continuous Lactate Monitoring: Elliot Botvinick, Ph.D.
- ClearSense data: Charles Boicey, Lisa Dahm
- Predictive Analytics: Mike Nalls, Faraz Faghri

Competition: other e-ICU Systems

eICU Programs

As of January 7, 2014

UC Irvine Health

UC Irvine can be 1st So Cal Center with e-ICU

3 North Cal e-ICU Systems:

- Sutter Health (2 cores in North Cal.)
- John Muir Health

Only 28 e-ICU capable hospitals.

(Representing 6% of ICU beds in CA)

UC Irvine Health – can become 2ndt academic med. center West of Mississippi with e-ICU capabilities

NEHI Study: Tele ICU in California

2011 NEHI study* identified rural regions as targets for tele-ICU services:

- Los Angeles county
- Orange
- San Bernardino County
- Riverside County
- Central Valley
- Rural Eastern Sierra region: Inyo, Mono and Alpine Counties

- Planning for Tele- ICU in California.
- Phase 1 Environmental Scan.

Report to the California HealthCare Foundation

UC Irvine Health

Others in Orange County want e-ICU (Confidential)

Hoag/Covenant – Andre Vovan, MD (runs critical care) asked Richard Afable introduced e-ICU to wealthy donors in Palm Springs (last fall) → went well.

CHOC Children's.

HOAG HOSPITAL

St.JosephHealth

Formed **ACO** 2014

Providence Health & St. Joseph Health to merge this year

Richard Afable, MD, MPH understands e-ICU is a powerful accelerator for outreach & alliance building

Goal: e-ICU deal to be signed in Q_4 2017

Have 85 ICU beds in Lubbock,Texas on board

Want outreach ASAP in Orange County & region.

UCSF & John Muir formed joint venture → ACO

UCSF
University of California
San Francisco

JOHN MUIR
HEALTH

Preliminary discussions for e-ICU collaboration with UCSF physicians using John Muir's Hub

Sutter expanding south

Sutter Health
With You. For Life.

MERCED SUN-STAR

Telehealth expanding at Memorial Hospital Los Banos

BY ANA B. IBARRA
aibarra@mercedsunstar.com July 8, 2014

Like many community hospitals in the Central Valley, Memorial Hospital Los Banos struggled to recruit critical care intensivists to the area. However, 10 years ago, Sutter Health, the hospital's parent company, invested in an alternative that, according to hospital officials, has worked just as well and is ready to expand.

The solution? A 24-hour electronic Intensive Care Unit that monitors patients from a small room of experts nearly 150 miles away in central hubs in Sacramento and San Francisco.

According to John Winchell, eICU director in the Sacramento region, Sutter's eICU was the first of its kind on the West Coast and second in the nation. Winchell said the system allows all patients to have access to a team of physicians and nurses specifically trained in the care of the critically ill, 24 hours a day, seven days a week.

UC Irvine Health

Advanced ICU Care – Opportunity?

Corporate office: St. Louis, Mo +500 employees

Core monitoring sites: NY, St. Louis, Irvine, Honolulu, Tel Aviv, India

Largest independent provider of tele-ICU programs in the U.S

Intensivist group, Critical Care Services, PC, formed A-ICU Care in '05.

Mary Jo Gorman, M.D., MBA – Founder & past CEO

Lou Silverman, MBA – Chairman and CEO

Regional sales / outreach:

- Were negotiating with UCLA (deal fell through last year)
- Has Mercy Medical Ctr in Merced but, Mercy recently purchased by Dignity
- Recently UC Davis negotiations fell through.

Lloyd H. Dean (CEO) = huge e-ICU supporter

Modern Healthcare

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Dignity Health.
Mercy Medical Center

Independent Community Hospitals, You Have an Ally

CHC
Community Hospital Corp

Healthcare Business News

Ascension Health plans joint-venture with Dignity, Tenet to run Ariz. hospitals

By Beth Kutscher
Posted: July 22, 2014 - 5:00 pm ET
Tags: Accountable Care Organizations, Ascension Health, Deals, Dignity Health, Tenet Healthcare Corp.

Ascension Health plans to transfer part of its ownership in the Carondelet Health Network in Arizona into a three-way joint venture that includes **Tenet Healthcare Corp.** and **Dignity Health**.

The three hospital groups Tuesday signed **a letter of intent (PDF)** to form a Tucson, Ariz.-based joint venture in which Tenet would hold a majority stake and Ascension would be a minority partner. Dignity Health also would hold an undisclosed interest in the joint venture, which would own and operate Carondelet.

Purchased MD group led by Dr. Bhatia – to become e-ICU Director for all of Dignity.
Have 1,400 ICU beds & will drive for outreach as well. AZ → → CA
Already have Merced Hospital wired by A-ICU

Banner Health®

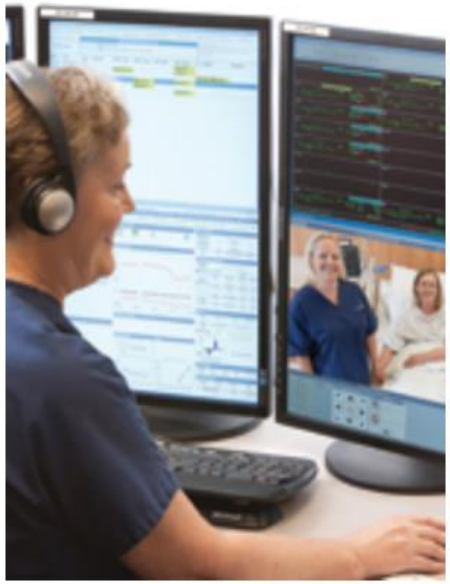
Banner = early adopter of e-ICU (2006).
In 2012 ICU LOS was 20,000 below predicted. Total hospital days reduced by 49,000. **Costs avoided 1 year = $68 M.** *

Banner iCare™ Intensive Care

Patients at McKee Medical Center benefit from an additional layer of care provided by the advanced technology called Banner iCare™.

This advanced technology enhances the care and safety of critically ill patients by teaming our on-site medical staff with intensive-care specialists who follow patients' care from a remote monitoring center 24 hours a day, seven days a week.

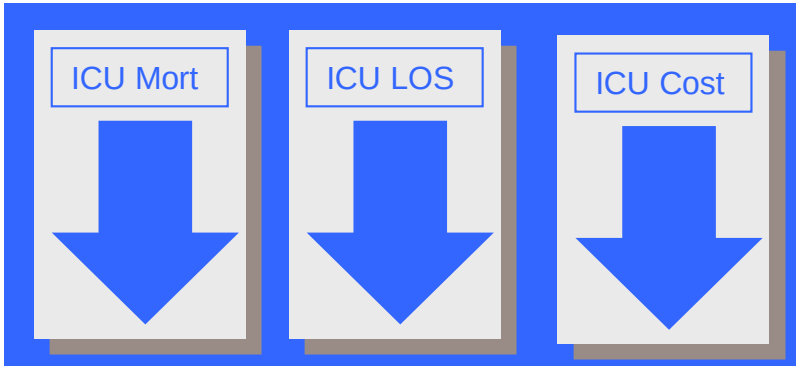
With the Banner iCare monitoring system, data such as patient information, vital signs, laboratory data and X-rays from the sickest hospital patients are fed to an off-site team of intensive-care physician specialists and critical-care nurses.



Attacking outreach in Az & Colorado, California is next

* http://telemedicine.arizona.edu/blog/banner-health-eicu-shortens-hospital-stays-improves-patient-care

e-ICU Opportunity for UC Irvine Health



#1 Improve quality & safety@ UC Irvine Health

#2 Increase critical care quality in partner hospitals

Orange, Riverside, San Bernardino, (even LA) Counties.

#3 Increase UC Irvine Health footprint & branding

UC Irvine Health

↑Throughput = ↓LOS + Bed Creation

UC Irvine ICU Bed Occupancy Continues to Increase

84% - FY 2015: 83% for the 4 main ICUs & 93% for the BURN ICU

86% - FY 2016 thru May (11 mos): 85% (51.2 / 60 beds) for the 4 main ICUs and 90% (6.3 / 8 beds) for the BURN ICU

88% For June 2016 (30 days): 89% (53.4 / 60) for the 4 main ICUs and 79% (6.3 / 8 beds) for Burn ICU

89% For July 2016 (31 days): 88% (52.7 / 60) for the 4 main ICUs and 94% (7.5 / 8 beds) for Burn ICU

UC Irvine ICU Beds Created Using Current Calculations

4,455 Total ICU Cases:

- 20,285 **ICU** days
- 13,080 **Floor** days

Avoided days by 15-20% LOS Reduction (ICU & Floor)

- **ICU** days X **15-20%** reduction = **3,043 – 4,057** avoided ICU days
- **Floor** days X **10-15%** reduction = **1,308 – 1,962** avoided floor days

Calculate beds created for units with occupancy >80-85%

- Number of **ICU** days avoided / 300 days = **10.1** –to- **13.5**
- Number of **Floor** days avoided / 300 days = **4.4** –to- **6.5**

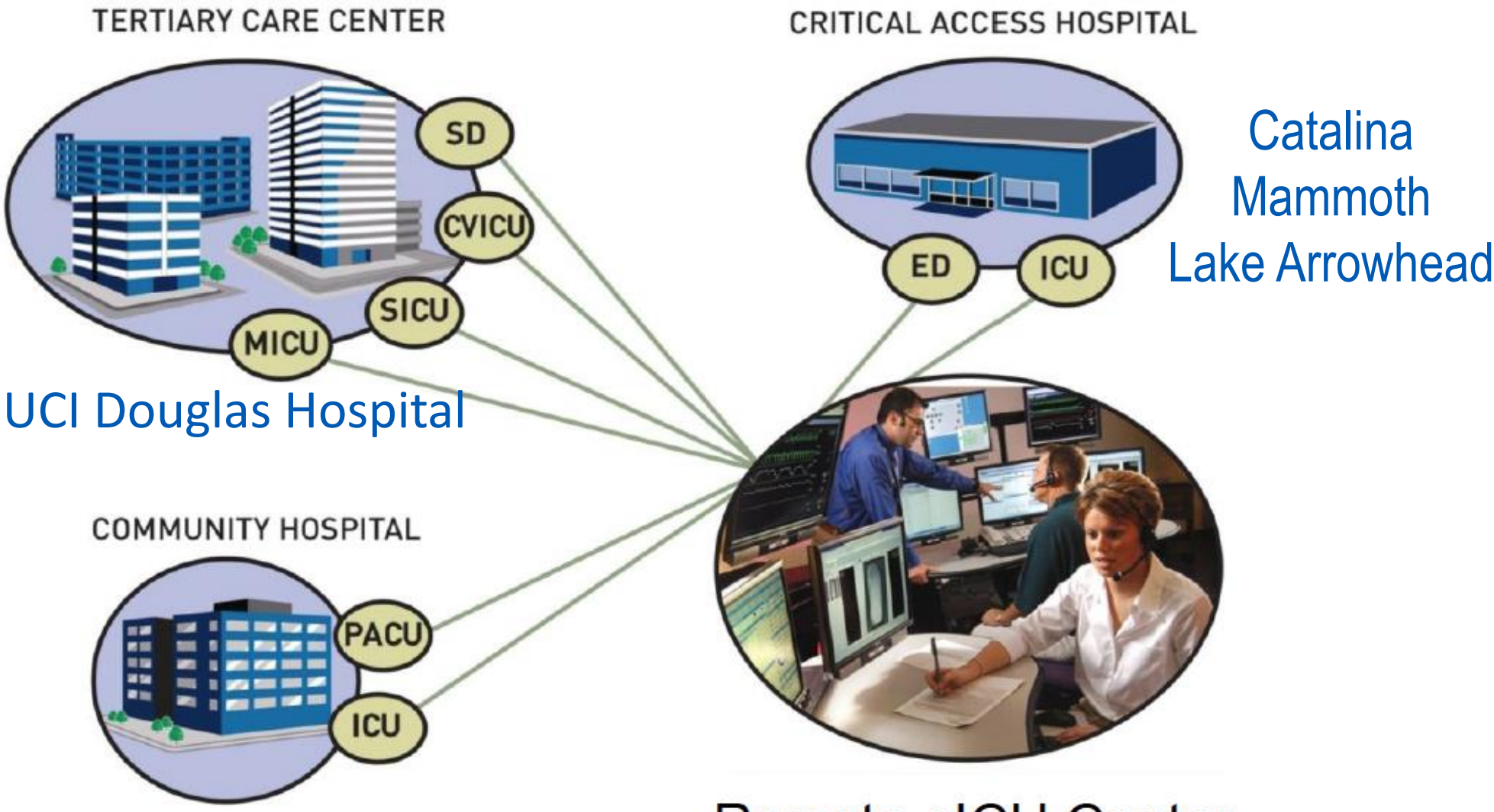
Total 14.5 -to- 20 beds created b/t ICU and Floor

Conservative (Red) numbers use 15% reduction factor

Average (blue) numbers show 20% LOS reduction

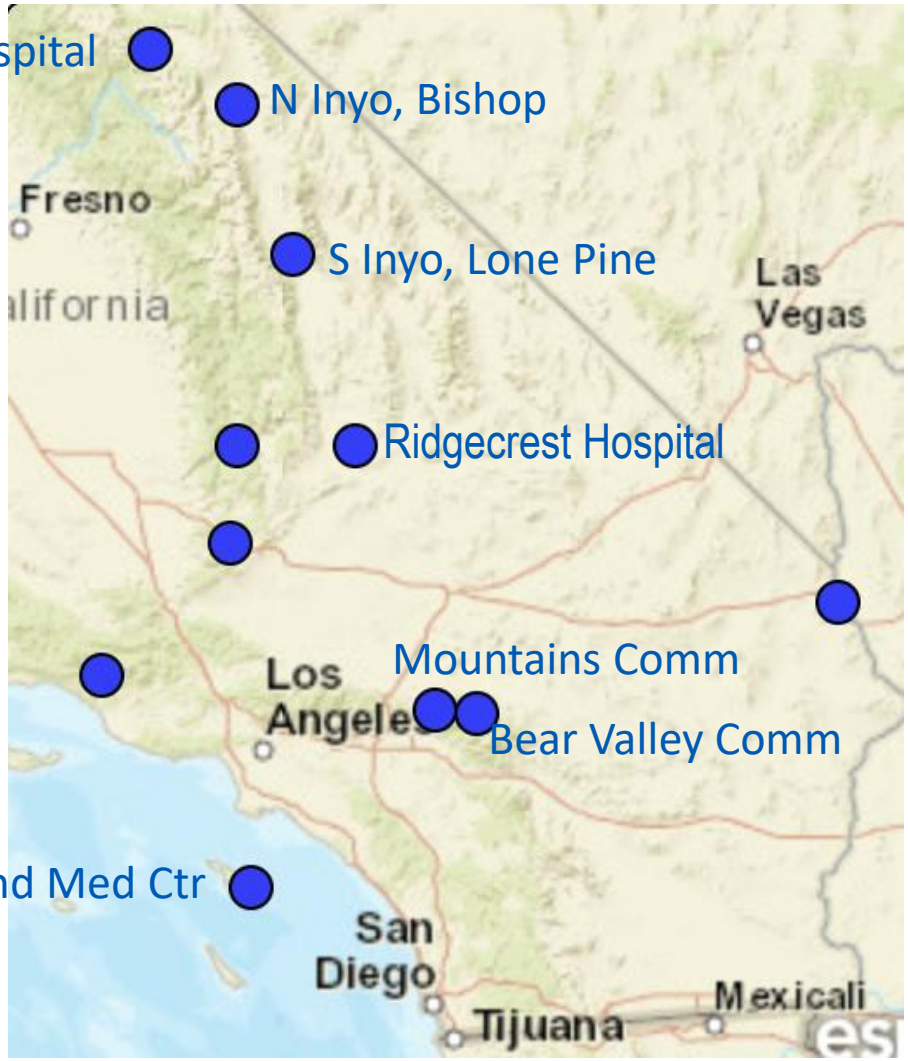
We will likely do better (i.e. > 20 beds)!!

e-ICU model envisioned by UC Irvine Health



UC Irvine Health

Critical Access Hospitals in S-E California



Critical Access Hospitals (CAH) are licensed general acute care hospitals certified to receive cost-based reimbursement from Medicare

California Health Care Foundation
HEALTH CARE THAT WORKS FOR ALL CALIFORNIANS

CHCF is working to expand the use of **telehealth** in the safety net, with an emphasis on access for the underserved in remote areas of California.

UC Irvine Health

UC Irvine Health Phase 1 – Internal e-ICU

Nurse Coverage 24/7,

MD coverage during PM & weekends

Immediately improve outcomes and revenues

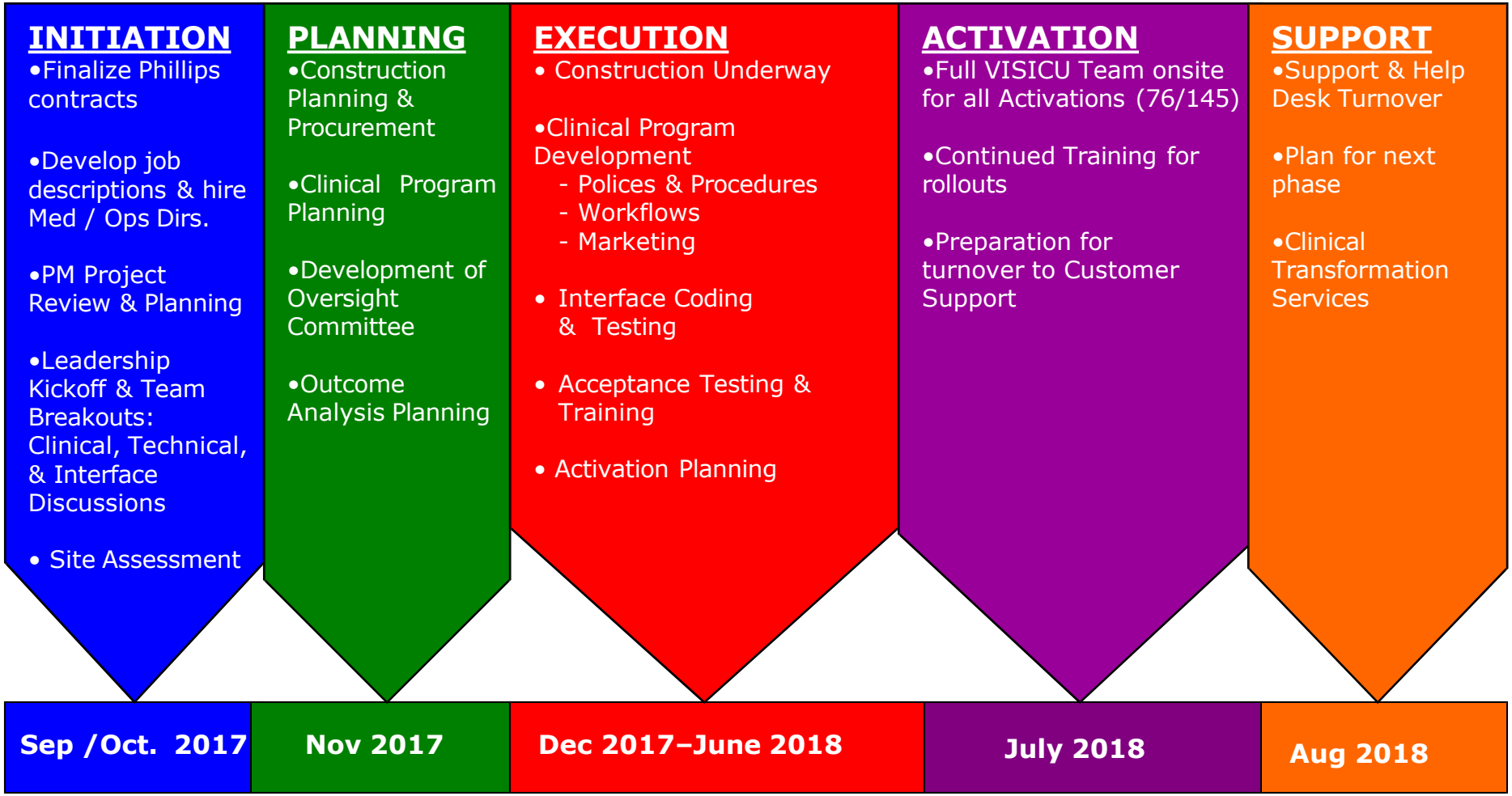
Later, expand to 24/7 MD Coverage (as we grow outreach)

e-ICU Project Scope Details

Programmatic Scope	Components and Descriptions
UC Irvine Health	• 6 Locations: CCU, MICU, SICU, NSCU, BICU, SDUs later (anticipated) • On site Orange Campus COR for Nursing and CDI / Case Mgt. • Physician Site can be same, or perhaps A-ICU COR in Irvine (if partner)
Program Leadership / Staffing	• Medical Director – William C. Wilson, MD, MA • Operations Director – Recruit experienced operative (WCW contacts) • Implementation Project Manager – working with IT (Chuck Podesta) • Performance Improvement / Technology Liaison
Coverage Model	• 24/7 coverage: At least 5 FTE physicians and 10 FTE nurses • 24/7 RN coverage with 12 hour night and 24 hour weekend MD coverage: 3.25 FTE MD and 10 FTE RN
Clinical Coverage Ratios	• CC RN : Beds Staffing Ratio – 1 CCRN for 35-40 beds • Intensivists : Staffing Ratio – 1:150 beds (days), 1:75 (nights)
Command Center / Satellites	•Data center: TBD •Phase I: 1 Rounding Theatre for 7th Floor, 6th Floor, 5th Floor UC •Phase II: 1 Rounding Theatre for each 12 Bed Unit

Proposed Timeline – Phase 1

UC Irvine Timeline Phase I: Datacenter, eICU Center, Interfaces, 68+ beds come online



UC Irvine Health

Phase 2 – Expand e-ICU to Affiliate Hospitals

Benefits to IC Irvine	Benefits to Remote Hospitals

• New development opportunities
• Build state wide recognition as a leader in eICU
• Extends UC Irvine – eICU staff resources, RN, Intensivists across Orange County & California
• Extend UC Irvine's mission statewide, and beyond
  • Discover
  • Teach
  • Heal
	• Improve patient outcomes
	• Improves operating cost – just as it will at UC Irvine Health
	  • Higher patient volumes
	  • Lower cost per case
	  • Increased CMI
	• Enhances remote hospital recognition of UC Irvine benefits
	• Facilitates better compliance and outcomes reporting
	• Facilitates transfer optimization

Phase II can include expansion to geographies outside CA

eICU Outreach: Potential Hospital Partners

Transferring Facility	Burn ICU	Coronary Care Unit	Medical Surgical ICU	ICU	NS ICU	Grand Total
Corona Regional MC - Corona	2	12	12	4	1	31
West Anaheim MC - Anaheim		3	8	4		15
Anaheim Regional Medical Center – Anaheim	1	4	3	2	3	13
St. Mary MC - Apple Valley		2	4	1	3	10
Fountain Valley Regional Hospital & MC - Fountain Valley		4	3	1	1	9
Mission Hospital Regional MC - Mission Viejo	1	4	1	1	2	9
Barstow Community Hospital - Barstow		1	3		4	8
VA Long Beach Healthcare System - Long Beach	1	3	1	2		7
Hemet Valley MC - Hemet		4	1	1		6
Long Beach Memorial MC - Long Beach		1	3	2		6
Orange Coast Memorial MC - Fountain Valley	1	3	2			6
Parkview Community Hospital - Riverside		4		2		6

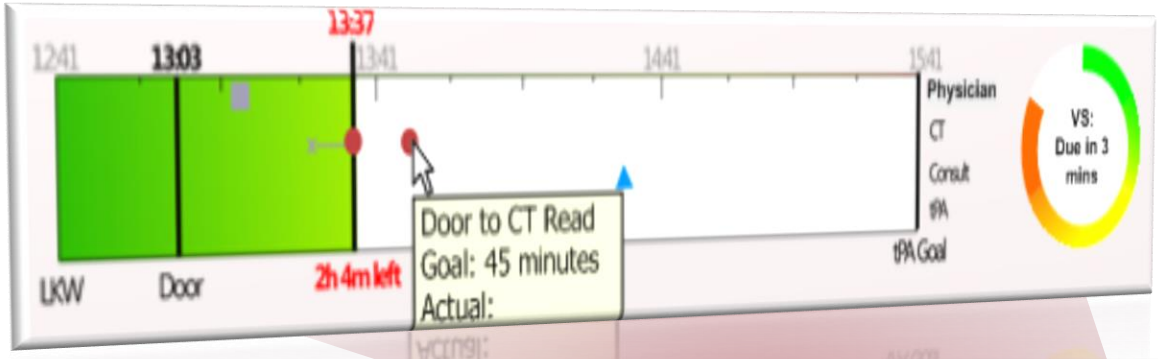
FY16 Transfers as reported by the UC Irvine Transfer Center

Phase 1b – Expand tele-med services
e-ICU serves as backbone of care across continuum

Expand coverage to other services, including:

- Telestroke (many local hospitals are in need)
  - "Hub and spoke" model, in which specialist neurologists at UCI "hub" communicate with "spoke" community hospital Emergency Departments and Stroke units via video-conference link
- eED
  - UCI eICU center intensivist and nurses will coordinate with remote Emergency Department to implement therapies such as early goal-directed sepsis care, tight blood glucose control and normalized blood pressures in neurologic patients while the patient is in the emergency department
- ePharmacy
- Telemetry services
- Safety Companion "sitter" monitoring (already used at UCI)

Remote Stroke Management Software Included



Care Process Timer

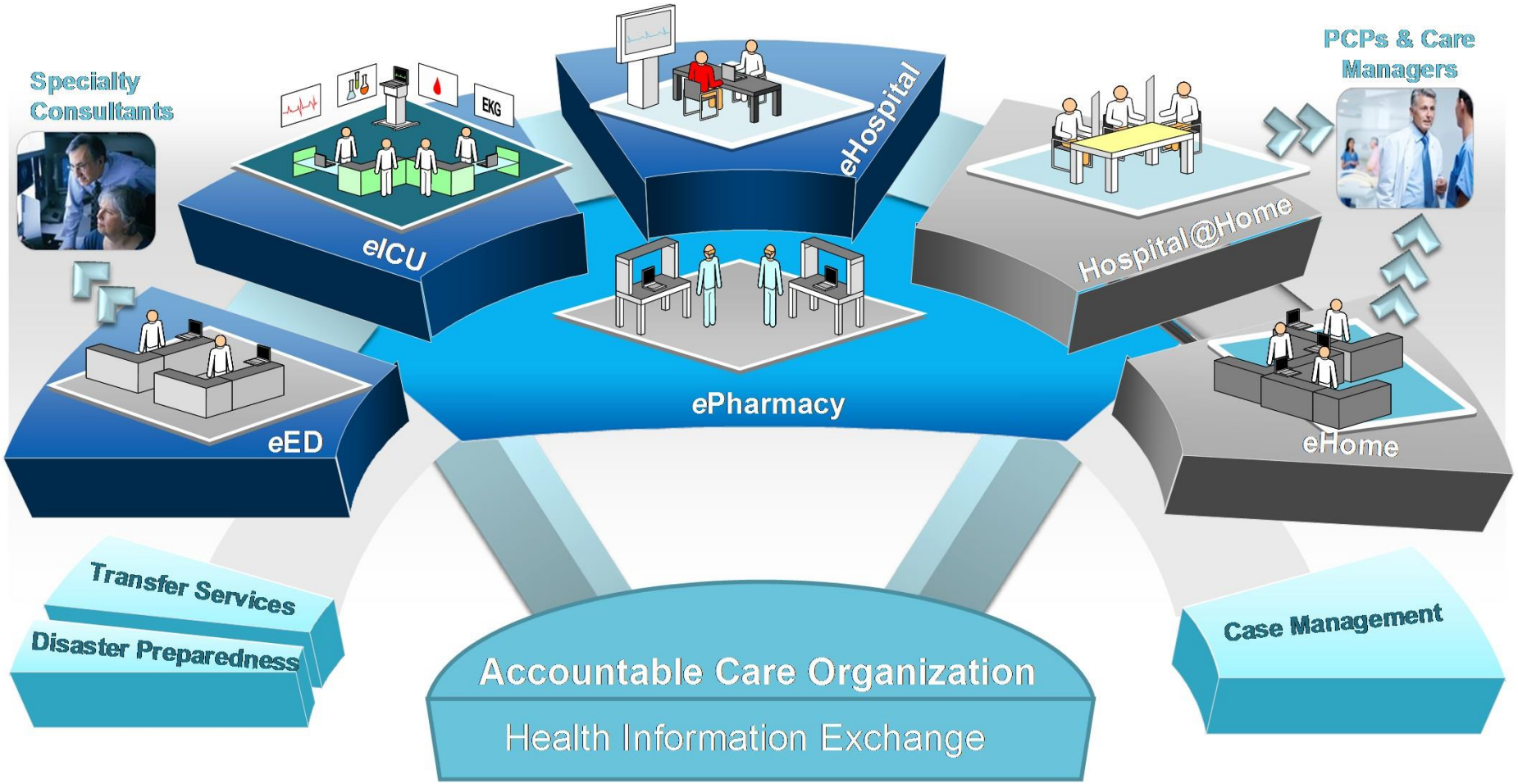
- Marks key milestones for treatments & key metrics
- At-a-glance: how much time is left
- Basic task reminders

Stroke Profile Screen

- Optimizes clinical data on one screen
- GWTG stroke guidelines for best practices collaboration
- Data integrated from the EMR
- Remote CT image viewing

Expanded Tele-Health Opportunities

The e-ICU can serve as the backbone for a System-wide Tele-Health Program



UC Irvine Health