Telemedicine in Critical Care: e-ICU Model

9th Annual Clinical Informatics Summit
Beckman Center
May 19, 2017

William C. Wilson, MD, MA
Interim Chief Medical Officer
UC Irvine Tele-health Physician Champion
Clinical Professor, Anesthesiology, Medicine, & Surgery
Increasing Complexity of Critical Care
Variable practices within individual units

CCU  MICU  SICU  NSCU
A Double Standard

We currently provide two levels of care:

- **Daytime**
- **Nights and weekends**

“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
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
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

Screening

Intensivist (1)

Critical Care Nurses (2)

Computer Intelligence

68+ Beds
# e-ICU Continuous Evaluation

## Combined parameters
- **HR** 175
- **MAP** 44

## Patient-specific parameters
- **HR** [130] 132
- **MAP** [100] 104

## Color coded
- **O2** [92] 90, **RR** [26] 30
### eCM Smart Alerts®

#### Message Center

- **Tasks**
- **New Log**
- **Smart Alerts**
- **Sepsis Alert**
- **Help**

---

**Smart Alerts® prompt — Web Page Dialog**

<table>
<thead>
<tr>
<th>Alert</th>
<th>Date</th>
<th>Trigger Value</th>
<th>Trigger Condition</th>
<th>Additional Information</th>
</tr>
</thead>
<tbody>
<tr>
<td>Moderate Acidosis</td>
<td>11/03/2008</td>
<td>pH (7.18)</td>
<td>pH between 7.18 and 7.28; HCO₃ ≥ 16 mEq/L and HCO₃ changed &gt; 2 mEq/L</td>
<td></td>
</tr>
<tr>
<td>Low Urine Output</td>
<td>11/02/2008</td>
<td>≤ 20 ml</td>
<td>2 consecutive hourly values &lt; 30 ml/h and &lt; 50 ml total [28, 18]</td>
<td></td>
</tr>
<tr>
<td>Creat Cl ↓ 10-49</td>
<td>11/02/2008</td>
<td>Creatinine Clearance 10-49 ml/min</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

---

- **Potassium**
- **Hemoglobin**
- **Acid Base**
- **Urine Output**
- **CrCl**
- **DVT Prophylaxis**
- **End of Life**
- **Sepsis**
Automated Acuity – Graphical Metaphor

Worsening (Red) Improving (Green)

Delta score of +/- 2 points

Hematology

Infectious Disease

Cardiovascular

CNS

Respiratory

Renal

Ventilated

Smith, Don – Bed 1
Baseline: 15, 12 hr Avg: 15 (-5)

1st 24 hr avg

Delta = 12 hr avg - Current
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
e-IICU Reporting: Tracking Process Improvement
Define, Measure, Analyze, Improve, Control & Transform Care

**Benchmark Reports**

**Performance/Process**

**Clinical Outcomes**

**Organizational Metrics**

**Daily Management Reports**

**Severity-adjusted mortality**

**Severity-adjusted LOS**

**Low risk monitor patients**

**Severity Adjusted vent days**

**Delirium & PTSD**

**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**

**VAP/VAE bundle**

**Sepsis bundle**

**Glucose control**

**MI bundle**

**Discharge readiness**

**APACHE Missing Data**

*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:

Study 2005-2007

JAMA. 2011; 305(21):2175-2183
<table>
<thead>
<tr>
<th>Clinical Practice Guideline Adherence</th>
<th>Preintervention Group</th>
<th>Tele-ICU Group</th>
<th>OR (95% CI)</th>
<th>P Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prophylaxis</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stress ulcer</td>
<td>1253/1505 (83)</td>
<td>4550/4760 (96)</td>
<td>4.57 (3.91-5.77)</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Deep venous thrombosis</td>
<td>1299/1527 (85)</td>
<td>4707/4733 (99.5)</td>
<td>15.4 (11.3-21.1)</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Best practice</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cardiovascular protection</td>
<td>311/391 (80)</td>
<td>2866/2894 (99)</td>
<td>30.7 (19.3-49.2)</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Prevention of ventilator-associated pneumonia</td>
<td>190/582 (33)</td>
<td>770/1492 (52)</td>
<td>2.20 (1.79-2.70)</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Ventilator-associated pneumonia</td>
<td>76/584 (13)</td>
<td>32/1949 (1.6)</td>
<td>0.15 (0.09-0.23)</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Catheter-related bloodstream infection</td>
<td>19/1529 (1)</td>
<td>29/4761 (0.6)</td>
<td>0.50 (0.27-0.93)</td>
<td>.005</td>
</tr>
<tr>
<td>Acute kidney injury</td>
<td>174/1452 (12)</td>
<td>540/4565 (12)</td>
<td>1.00 (0.71-1.69)</td>
<td>.38</td>
</tr>
<tr>
<td>After hours care plan review for ICU admissions, No. (%)</td>
<td>705/1529 (46)</td>
<td>2287/4761 (48)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Interventions for physiological instability</td>
<td>All bedside clinician initiated</td>
<td>483d</td>
<td>37 573e</td>
<td></td>
</tr>
</tbody>
</table>

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.

**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:

<table>
<thead>
<tr>
<th></th>
<th>ICU Mort</th>
<th>Hosp Mort</th>
<th>ICU LOS</th>
<th>Hosp LOS</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Incidence</strong></td>
<td><strong>26%</strong></td>
<td><strong>16%</strong></td>
<td><strong>20%</strong></td>
<td><strong>15%</strong></td>
</tr>
</tbody>
</table>

*Chest.* 2014; 145(3):500-507
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

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*

Study Schema

Pre-intervention ICU Beds Near Capacity
Interventions & Case Volume over time – U Mass

- Pre Intervention Group
- ICU Telemedicine Implementation
- ICU Telemedicine Group
- Logistic Center Group

Study Start: 1-10-04
Clinical Study Start: 3-13-05
Clinical Study End: 10-1-07
Logistic Center Fully Functional: 1-1-10
Study End: 1-10-04

Number of Implemented Projects:
- Task Forces: 11
- Clinical Study: 22
- Logistic Center Transition: 26
- True North QI Projects: 48
- Total: 51

Case Volume (Thousands):
- 2004: 4,752
- 2005: 5,735
- 2006: 5,735
- 2007: 5,735
- 2008: 5,735
- 2009: 5,735
- 2010: 5,735
- 2011: 5,735
- 2012: 5,735
- 2013: 5,735

Increase: 38%
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.

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.\(^{(5)}\)

---

\(^{(4)}\) Rogove et al: Barriers to Telemedicine: Survey of Current Users in Acute Care Units. TELEMEDICINE and e-HEALTH Jan/Feb 2012
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 1\(^{st}\) 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.


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.

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

(3) AHRQ “Using Telehealth to Improve Quality and Safety”
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
UC Irvine can be 1\textsuperscript{st} 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 2\textsuperscript{nd}\textsuperscript{t} academic med. center West of Mississippi with e–ICU capabilities
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

*NEHI Study: Tele ICU in California

Planning for Tele ICU in California.
Phase 1 Environmental Scan.
Report to the California HealthCare Foundation
Others in Orange County want e-ICU

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

Formed ACO 2014

Providence Health & St. Joseph Health to merge this year

Goal: e-ICU deal to be signed in Q4 2017

Have 85 ICU beds in Lubbock, Texas on board

Want outreach ASAP in Orange County & region.
UCSF & John Muir formed joint venture → ACO

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

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 = 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
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

UCI Douglas Hospital

Placentia Linda
Corona Regional

Catalina
Mammoth
Lake Arrowhead

Remote eICU Center
at UC Irvine Health
Critical Access Hospitals (CAH) are licensed general acute care hospitals certified to receive cost-based reimbursement from Medicare.

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.
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

<table>
<thead>
<tr>
<th>Programmatic Scope</th>
<th>Components and Descriptions</th>
</tr>
</thead>
</table>
| **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 |
UC Irvine Timeline Phase I: Datacenter, eICU Center, Interfaces, 68+ beds come online

**INITIATION**
- Finalize Phillips contracts
- Develop job descriptions & hire Med / OpsDirs.
- PM Project Review & Planning
- Leadership Kickoff & Team Breakouts: Clinical, Technical, & Interface Discussions
- Site Assessment

**PLANNING**
- Construction Planning & Procurement
- Clinical Program Planning
- Development of Oversight Committee
- Outcome Analysis Planning

**EXECUTION**
- Construction Underway
- Clinical Program Development
  - Policies & Procedures
  - Workflows
  - Marketing
- Interface Coding & Testing
- Acceptance Testing & Training
- Activation Planning

**ACTIVATION**
- Full VISICU Team onsite for all Activations (76/145)
- Continued Training for rollouts
- Preparation for turnover to Customer Support

**SUPPORT**
- Support & Help Desk Turnover
- Plan for next phase
- Clinical Transformation Services

**Proposed Timeline – Phase 1**

|---------------|----------|--------------------|-----------|----------|

UC Irvine Health
## Phase 2 – Expand e-ICU to Affiliate Hospitals

<table>
<thead>
<tr>
<th>Benefits to IC Irvine</th>
<th>Benefits to Remote Hospitals</th>
</tr>
</thead>
<tbody>
<tr>
<td>• New development opportunities</td>
<td>• Improve patient outcomes</td>
</tr>
<tr>
<td>• Build state wide recognition as a leader in eICU</td>
<td>• Improves operating cost – just as it will at UC Irvine Health</td>
</tr>
<tr>
<td>• Extends UC Irvine – eICU staff resources, RN, Intensivists across Orange County &amp; California</td>
<td>• Higher patient volumes</td>
</tr>
<tr>
<td>• Extend UC Irvine’s mission statewide, and beyond</td>
<td>• Lower cost per case</td>
</tr>
<tr>
<td>• Discover</td>
<td>• Increased CMI</td>
</tr>
<tr>
<td>• Teach</td>
<td>• Enhances remote hospital recognition of UC Irvine benefits</td>
</tr>
<tr>
<td>• Heal</td>
<td>• Facilitates better compliance and outcomes reporting</td>
</tr>
<tr>
<td></td>
<td>• Facilitates transfer optimization</td>
</tr>
</tbody>
</table>

Phase II can include expansion to geographies outside CA
# eICU Outreach: Potential Hospital Partners

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

FY16 Transfers as reported by the UC Irvine Transfer Center
Phase 1b – Expand tele-med services

e-lCU 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