The Digital ICU: Return On Innovation

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May, 2017
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Disclosure/Disclaimer

• Speaker has no financial interests or other conflicts relevant to this talk

• All opinions are personal and do not represent those of Emory or Philips
Talk Map

Care quality improvements attributable to tele ICU

Calculating the value of tele ICU

Collaborative design of bedside clinician interaction with remote teams

Principles of remote care and implications on patient outcomes
Since we went live in 2014

In the COR:
55,432 eRN hours
11,900 eMD hours

8,373 Intervention Care Hours
7,195 eMD Interventions

On Camera
1,948 eMD Hours
3,225 eRN Hours

22,000 unique patients
84,000 patient days
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, MSiPH; John McWhiney, DO; M. Willis Chandler, MBA; Richard S. Irwin, MD, for the University of Massachusetts Memorial Critical Care Operations Group

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 6090 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, 2006, through September 30, 2007. Electronically supported and monitored processes for best practice adherence, care plan creation, and clinicians response times to alarms were evaluated.

Main Outcome Measures  Case-mix and severity-adjusted hospital mortality. Other outcomes included hospital and ICU length of stay, best practice adherence, and complication rates.
Care Quality Improvements

- Decrease in severity-adjusted/actual mortality
- Decrease in severity-adjusted/actual LOS
- Increase in adherence to best practice i.e. VTE prophylaxis
Emory eICU Results:
Community-Centered Hospital

Mortality Ratios (Actual over Predicted) of eICU Monitored Patients
Emory eICU Results: Community-Centered Hospital

LOS Ratios (Actual over Predicted) of eICU Monitored Patients

- ICU LOS Ratio (All Pts)
- ICU LOS Ratio (Excludes High Risk Stays)
- Hospital LOS Rate (All Pts)
- Hospital LOS Rate (Excludes High Risk Stays)

eRNs

eMDs
Resources Conserved

Cumulative Hospital Days Saved (Predicted - Actual LOS)
VTE Best Practice Compliance

% of Patients on VTE Prophylaxis within 24 hours of ICU Admit

eMDs
The People
And the nurses concerns...

Cheryl,
I feel like a broken record, but at 0220, Ms. XXXX in A 412 pointed to the camera and asked why it was moving. The screen was going off and the camera was going back toward the wall. She is not happy.
Colleen

Coleen,
I would like to invite you to shadow one of our nurses for two hours on an evening of your choice. I am happy to pay you for your time. That way you can directly communicate with the our team and see how things work.
Cheryl
What helped?

- Ongoing education of bedside staff
- Ongoing inclusion of eRNs in staff meetings of the ICUs to facilitate conversation
- eICU funded opportunities for bedside staff to shadow in the eICU COR
- Adjusting eICU workflows based on feedback from nurses at the bedside
Cheryl,
We are having a UPC meeting next Wednesday and I would really appreciate it if you and possibly a couple of your staff members could come and discuss the program and how it works. After visiting the site I feel like I have a much better understanding of how both sides do their work and really see the benefits. Please let me know.

Coleen

Coleen,
I would be more than happy to come to the meeting. I do feel however that it might be better if the eICU nurses come instead. I do not want to be an obstruction to your team voicing their honest concerns or questions because management is there. Rick and Terri have agreed to come and participate in the meeting.

Cheryl
### Transfer of Care Checklist

<table>
<thead>
<tr>
<th></th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-1</td>
<td>Bedside RN will ensure that the patient bed is locked and secured</td>
</tr>
<tr>
<td>1-2</td>
<td>Bedside RN will ensure that the arterial line is connected to room monitor and reading correctly</td>
</tr>
<tr>
<td>1-3</td>
<td>Bedside RN will ensure that the Foley and chest drainage system are positioned per the room diagram</td>
</tr>
<tr>
<td>1-4</td>
<td>RN “Two minute call” Bedside RN will alert the team that in two minutes the time out will begin</td>
</tr>
<tr>
<td>1-5</td>
<td>Bedside RN will press the EICU button</td>
</tr>
<tr>
<td>1-6</td>
<td>Verify that all essential personnel, CTS, anesthesia, RN, RT, EICU, CCM are in the room and ask the team to take their place per diagram</td>
</tr>
<tr>
<td>1-7</td>
<td>Bedside RN ensures that all personnel each have a checklist in hand and that CCM has the blue sheet in hand</td>
</tr>
<tr>
<td>2-1</td>
<td>RN “TIME OUT”</td>
</tr>
<tr>
<td>3-1</td>
<td>RN “I am <em>name</em> the nurse taking care of this patient”</td>
</tr>
<tr>
<td>3-2</td>
<td>CTS “I am <em>name</em> the CTS resident/fellow who performed the operation”</td>
</tr>
<tr>
<td>3-3</td>
<td>Anesthesia “I am <em>name</em> the anesthesiologist/anesthetist”</td>
</tr>
<tr>
<td>3-4</td>
<td>CCM “I am <em>name</em> the CCM representative who will be taking over care of this patient”</td>
</tr>
<tr>
<td>3-5</td>
<td>RT “I am <em>name</em> the RT who will be taking over respiratory care of this patient”</td>
</tr>
<tr>
<td>3-6</td>
<td>EICU “I am <em>name</em> the EICU representative”</td>
</tr>
<tr>
<td>4-1</td>
<td>RN “What is the patient name and age?”</td>
</tr>
<tr>
<td>4-2</td>
<td>RN “What is the patients pertinent PMHX?”</td>
</tr>
<tr>
<td>4-3</td>
<td>RN “What surgery was performed?”</td>
</tr>
<tr>
<td>4-4</td>
<td>RN “Were there any intraoperative issues or events?”</td>
</tr>
<tr>
<td>4-5</td>
<td>RN “Is there any concern about bleeding?”</td>
</tr>
<tr>
<td>4-6</td>
<td>RN “Are there any expected post op issues or concerns?”</td>
</tr>
<tr>
<td>4-7</td>
<td>RN “What are the MAP/BP goals?”</td>
</tr>
<tr>
<td>4-8</td>
<td>RN “What are the vasopressor weaning goals?”</td>
</tr>
<tr>
<td>4-9</td>
<td>RN “What are the inotrope weaning goals?”</td>
</tr>
<tr>
<td>4-10</td>
<td>RN “Are there chest tubes and if so where are they positioned?”</td>
</tr>
<tr>
<td>4-11</td>
<td>RN “Are there pacing wires and if so where are they attached?”</td>
</tr>
<tr>
<td>4-12</td>
<td>RN “Is there anything information you wish to add that the checklist did not address?”</td>
</tr>
</tbody>
</table>
A key step in management is the family meeting, in which caregivers and family members convene to discuss the situation, elucidate the patient’s values and perspective on heroic interventions that are intrusive and have low likelihood of benefit, and reach consensus on the goals of care.

Often the family assembles in the evening or at night or on weekends when the bedside intensivist is not immediately available.

We now use the audio-video capabilities of the tele-ICU resource to enable the eIntensivist to conduct the meeting with family, NP/PA and nurse present.

Typically we will have the first part of the meeting at the bedside, and then invite the family to join in an adjacent empty patient room (there is typically a room maintained open for an emergency admission, and we make it available for these meetings.)
Tim

I want to take this opportunity to thank you from the bottom of my heart for the support that the eICU provided to Scott and me during his recovery following his triple bypass surgery at Emory University Hospital in February. It was obvious to both of us that your team contributed greatly to the safety, continuity and effectiveness of his care, and it certainly allowed me to sleep at night knowing that you and your team were there to work with his on-site ICU team. I have been following your work in Australia, watching you build a universal eICU network through hospitals across the globe, and I am excited to know that so many other families will be able to experience the support that we did. If you ever need testimony to the effectiveness of the eICU, please do not hesitate to give me a call. It is a remarkable development in treatment, and it should be heralded.

Thank you again for everything, and best wishes going forward.

Pat
Hon. Patricia Killingsworth
Quantitative findings:

• Decrease of roughly $1,486 in average Medicare spending per episode (p<0.01) for a total of 4.6 million over the 15 month period

• Decrease in the rate of 60-day inpatient readmissions of 2.14% (p<0.10)

• Decrease in discharges to SNF and LTCHs of 6.9% (p<0.01)

• Increase in discharges to home health of 4.9%

• Declining trend in inpatient LOS for the two most recent quarters
**Qualitative findings**

- This monitoring was credited with numerous “saves” when problems were brought to the attention of bedside staff that might otherwise have gone undetected, endangering patient safety.

- The timeliness of intensivist-directed care during the night (rather than waiting for ICU physicians to return in the morning) was reported by ICU staff as the most important benefit of the eICU.
Continued

• Rapid attention to patient needs was the most important improvement credited to the eICU by physicians who worked there and by bedside ICU physicians, APPs and nurses

• Intervention respondents were more likely than their comparison peers to be satisfied with the care they received in the hospital

• Outcomes for Emory program survey respondents were generally more favorable than for their counterparts in the comparison group
Impact of Night Shift on Nurses

According to the Australian Journal of Advanced Nursing, 45% of nurses worked a rotating shift in 2015. As nurses make up the largest group of health workers in Australia, they are also the most at risk to the deleterious consequences that come with working night shifts on a routine basis.

Adverse effects of night shifts

Health effects
Clearly disrupting the body’s natural clock has adverse consequences on an individual’s health and well-being. Studies have shown shift work can be detrimental to the body’s circadian rhythm resulting in carcinogenic effects on numerous body systems.

This is due to suppression of melatonin — a critical hormone regulating the body’s sleep-wake cycle. It is the reason behind an increasing tendency to sleep, and consequently decreased alertness, that results from increased duration of wakefulness. Along with inadequate night sleep, getting enough sleep during the day is also sometimes a challenge for nurses working night shifts as they struggle to carry out family responsibilities.

There is also emerging evidence supporting a strong connection between shift work and breast cancer in females, as well as prostate cancer in males. The effects of shift work also have a negative impact on the gastrointestinal tract (GIT).

The GIT relies on adequate gastric secretions to function optimally. The disruption in the circadian rhythm caused by shift work alters these gastric secretions. Overall, the result is a range of bowel and acidity problems that can increase with time.

Insufficient sleep has also been linked to an impaired immune response. Sleep deprivation diminishes our body’s ability to fight off infections such as colds and flu. Proper sleep is required for immune cells to carry out their functions.

In 2015 the Australian Health Survey (AHS) found that 40% of men and 45% of women working night shifts were suffering from chronic health conditions, including back pain, diabetes and chronic obstructive pulmonary disease, in comparison to 36% and 39% of the remaining population. As well, a higher incidence of obesity has been observed amongst shift workers.

Impact on family life and wellbeing
Domestic disruption has been shown to be a key consequence of night shift work affecting relationships with partners, children and friends. One study found that 53% of people were not happy due to the nature of their partner’s shift work.

- Sleep disruption
- Circadian Rhythm disturbances
- ↑ In risk of certain cancers
- ↑ in GI disorders
- Impaired immune response
- Higher incidence of chronic health conditions
- Higher incidence of obesity
- ↓ Quality of life
- ↑ Domestic disruption
Turning Night into Day
July-December 2016
Turning Night into Day Metrics

- **Work-related assessments**
  - Number of camera sessions
  - Duration of camera sessions
  - Number and complexity of notes

- **Well-being performance measures**
  - Well being surveys
  - Mood surveys

- **Physiologic monitoring**
  - HR variability
  - Sleep patterns

- **Stanford Sleepiness Scale**

- **Salivary stress markers**
  - Salivary cortisol

- **Cognitive testing**
  - Trail-making tests
“Turning Night into Day”
“Turning Night into Day”

Hospital trial turns night into day for US doctors, patients

Picture: Dr Timothy Buchman talks to a colleague in Atlanta from the ‘Turning Night Into Day’ centre at Macquarie University

Night has become day for a group of US doctors and critical care nurses, who are using new technology to remotely monitor their intensive care patients in hospitals in Atlanta from a Sydney health campus.

The intensivists and nurses from US health provider Emory Healthcare are part of a clinical trial to assess the health benefits for both patients and doctors of having highly experienced clinicians available to provide senior support around the clock.

Taking advantage of remote intensive care unit (ICU) technology and the 14-hour time difference, the medical teams are essentially working the Atlanta night shift during the day in Sydney.
Questions????