IMPROVING ICU QUALITY OF CARE AND REDUCING LENGTH OF STAY IN THE ED

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Memorial Hermann Hospital - TMC
1050 Bed Level 1 Trauma Center
65,000 Emergency Department visits per year
  ▪ 37% admitted to hospital
  ▪ 10% of admitted patients admitted to ICU
    ▫ 150 ICU Beds
    ▫ 16 MICU Beds
      ▪ 1100 admissions/year
      ▪ > 95% capacity winter months
Admission Delays to the ICU

Delayed ICU transfer (>4 hours from care complete to ICU arrival)

▪ Increased hospital mortality
▪ Increased hospital LOS
▪ Increased ICU LOS

Decreasing Admission Delays
Spin Faster
Improving ICU Quality, Length of Stay and Mortality

- Reducing EC to ICU time < 4 hours
- Integrating Sepsis Care from EC to ICU
- Hospital Acquired Infections to Zero
- Standardize Ventilator Weaning Process
- Improve End of Life Communication
- Use Waste Tool to Identify Opportunities

- UT Clinical Safety and Effectiveness program graduates
## Baseline Data

March 08 - February 09

Pratik Doshi MD

### Care Complete to Depart MICU Admits

<table>
<thead>
<tr>
<th></th>
<th>&lt;4 hours</th>
<th>&gt;4 hours</th>
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</thead>
<tbody>
<tr>
<td>Patients</td>
<td>345</td>
<td>314</td>
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<tr>
<td>% of total patients</td>
<td>52%</td>
<td>48%</td>
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<tr>
<td>Mortality Rate</td>
<td>14%</td>
<td>17%</td>
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<tr>
<td>Hospital LOS</td>
<td><strong>9.10</strong></td>
<td><strong>10.30</strong></td>
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<tr>
<td>CMI</td>
<td>2.33</td>
<td>2.60</td>
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<tr>
<td>Age</td>
<td>55</td>
<td>58</td>
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<tr>
<td>% Male</td>
<td>52%</td>
<td>48%</td>
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<tr>
<td>% Female</td>
<td>48%</td>
<td>52%</td>
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<tr>
<td>30 day readmits</td>
<td>40</td>
<td>32</td>
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<tr>
<td>30 day readmits-- Same DRG</td>
<td>12</td>
<td>7</td>
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</tbody>
</table>

**Mortality**

18% higher

**Length of stay**

11% higher
Overview

Largest Variation: Care complete to departure
Reducing EC – ICU transfer times

Patients to MICU
Care Complete to depart <4 hours

Before: 53%
After: 74%
Reduced LOS by Reducing Admission Delays

Patients to MICU
Arrival to Depart <4 hours

Before: 9.1 days
After: 7.8 days

Series 1
Improving ICU Quality, Length of Stay and Mortality

- Reducing EC to ICU time < 4 hours
- **Integrating Sepsis Care from EC to ICU**
- Hospital Acquired Infections to Zero
- Standardize Ventilator Weaning Process
- Improve End of Life Communication
- Use Waste Tool to Identify Opportunities
Incidence of Severe Sepsis/Septic Shock

Leading cause of death in the ICU
10th most common cause of death in the US
Increasing by 1.5% per year (additional million by 2020)
1. Serum lactate measured
2. Blood cultures prior to antibiotic administration
3. Broad-spectrum antibiotics administered
   - Within 3 hours of ED arrival or 1 hour non-ED admission
4. Treat hypotension with fluids +/- vasopressors
   - Initial minimum of 20 mL/kg of crystalloid
   - Vasopressors to keep MAP $\geq$ 65 mm Hg
5. Persistent hypotension
   - Maintain central venous pressure $> 8$ mm Hg
   - Central venous $O_2$ saturation (Scvo2) $> 70\%$
Percent Incorrect per Bundle Item

<table>
<thead>
<tr>
<th>C2</th>
<th>ScVO2</th>
<th>CVP &gt;8</th>
<th>Antibiotics</th>
<th>Fluids/Vaso</th>
<th>Lactate</th>
<th>Blood</th>
<th>Cultures</th>
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</thead>
<tbody>
<tr>
<td>C3</td>
<td>97.2</td>
<td>81.0</td>
<td>65.4</td>
<td>59.0</td>
<td>40.4</td>
<td>35.2</td>
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<tr>
<td>Percent</td>
<td>25.7</td>
<td>21.4</td>
<td>17.3</td>
<td>15.6</td>
<td>10.7</td>
<td>9.3</td>
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<tr>
<td>Cum %</td>
<td>25.7</td>
<td>47.1</td>
<td>64.4</td>
<td>80.0</td>
<td>90.7</td>
<td>100.0</td>
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DIAGNOSIS OF SEPSIS REQUIRING ICU ADMISSION

MICU ADMISSION
CONFIRM SEPSIS

6 HOUR BUNDLE

24 HOUR BUNDLE
STERIODS DROTRECOSIN ALPHA
GLYCEMIC CONTROL
PLATEAU PRESSURE

POLICY FOLLOWED

NO
CONTACT MICU MD

YES
EGDT
MONITOR AND GUIDE TREATMENT

ScVO2>70

HYPOTENSION

BLOOD CX
AB WITHIN 1 HOUR

BLOOD
LACTATE

RESIDENT FELLOW ATTENDING

SCREENING TOOL

EC DIRECT FLOOR

RRT

BLOOD CULTURES LACTATE ABG EGDT

SEPSIS NURSE

EC
DIRECT
FLOOR

BLOOD CULTURES LACTATE ABG EGDT

SEPSIS NURSE

HYPOTENSION

YES
EGDT
MONITOR AND GUIDE TREATMENT

ScVO2>70

NO
BLOOD DOBUTAMINE

CONTACT MICU MD

POLICY FOLLOWED

NO
CONTACT MICU MD
Evaluation for Severe Sepsis Screening Tool

Instructions: Use this optional tool to screen patients for severe sepsis in the emergency department, on the wards, or in the ICU.

1. Is the patient’s history suggestive of a new infection?
   - Pneumonia, empyema
   - Urinary tract infection
   - Acute abdominal infection
   - Meningitis
   - Staphylococcal infection
   - Other

Option: Yes □ No □

2. Are any two of the following signs & symptoms of infection both present and new to the patient? Note: Laboratory values may have been obtained for inpatients but may not be available for outpatients.
   - Hypothermia > 36.3°C (100.3°F)
   - Fever > 38°C (100.4°F)
   - Tachypnea > 20 bpm
   - Tachycardia > 90 bpm
   - Acute altered mental status
   - Leukopenia (WBC count < 4000 μL⁻¹)
   - Hyperglycemia (plasma glucose > 120 mg/dL) in the absence of diabetes

Option: Yes □ No □

3. Are any of the following organ dysfunction criteria present at a site remote from the site of the infection that are not considered to be chronic conditions? Note: the remote site stipulation is waived in the case of bilateral pulmonary infiltrates.
   - SBP < 90 mmHg or MAP < 65 mmHg
   - SBP decrease > 40 mmHg from baseline
   - Bilateral pulmonary infiltrates with a new (or increased) oxygen requirement to maintain SpO₂ > 90%
   - Bilateral pulmonary infiltrates with PaO₂/FiO₂ ratio < 300
   - Creatinine > 2.0 mg/dL (176.8 mmol/L) or Urine Output < 0.5 ml/kg/hour for > 2 hours
   - Bilirubin > 2 mg/dL (34 μmol/L)
   - Platelet count < 100,000
   - Coagulopathy (INR > 1.5 or aPTT > 60 secs)
   - Lactate > 2 mmol/L (18.0 mg/dL)

Option: Yes □ No □

If suspicion of infection is present AND organ dysfunction is present, the patient meets the criteria for SEVERE SEPSIS and should be entered into the severe sepsis protocol.

Date: __/__/____ (circle dd/mm/yy or mm/dd/yy)
Time: ____: ____ (24 hr. clock)

MICU 6 HOUR SEPSIS COUNTDOWN

Start time _________ (EC arrival or ICU admission if from floor)
FINISH TIME ________

Bundle Element 1:
- Serum Lactate Measured

Bundle Element 2:
- Blood Cultures Obtained Prior to Antibiotic Administration

Bundle Element 3:
Administer broad-spectrum antibiotic within 3 hours of ED and within 1 hour of non-ED admission
- Broad Spectrum Antibiotics Administered

Bundle Element 4:
Hypotension and/or serum lactate >15 mmol/L
- IV FLUIDS: Delivered an initial minimum of 20 mL/kg of crystalloid

MICU 24 HOUR SEPSIS MANAGEMENT

Bundle Element 1: Steroids in Septic Shock (Hydrocortisone 100 mg IV every 8 hours)
- Not indicated
- Cortisol level adequate
- Administered with refractory shock awaiting results
- Administered/Continued: Corticotropin stimulation test using 250 mg ACTH with > 9 μg/dL increase 30-60 minutes post administration

Bundle Element 2: Administer Cytosporin Afla (Activated) by a Standard Policy
- Administered meeting MHICU criteria
- Did not meet MHICU criteria

Bundle Element 3: Maintain glucose control ≥70, but ≤150 mg/dL
- Maintained Adequate Glycemic Control (insulin drip if glucose > 150 mg/dL)

Bundle Element 4: Inspiratory plateau pressure
- Maintained Inspiratory Plateau Pressures (IPP) <30 cm H2O for mechanically ventilated patients

Interventions: Education

- Education of multidisciplinary staff including nurses, physicians, nutritionists, respiratory therapists on the resuscitation bundle
- National experts invited to provide optimal dialogue for change
- Interdepartmental meetings for team building
- Sepsis screen checklist placed in each chart for physician screening
- Appointed unit champions to assure education was available 24/7 in the ICU and EC
- Implemented **standardized Sepsis Order Sets** to improve compliance
- **Posted compliance rates** in the unit for staff and MDs to see
- Posted posters explaining process in ICUs for staff reference
Sepsis - Illness Risk 4 - Mortality Rate Reduction

Jan-04
EGDT - began Jan-07

Tests performed with unequal sample sizes

Sample

Proportion

P = 0.398

UCL = 0.887

LCL = 0

 EGDT - began Jan-07
Mortality Rates
APR-DRG 720 Septicemia

Illness Risk 4
Before: 49%
After: 40%

Illness Risk 3
Before: 14%
After: 10%
# Length of Stay

<table>
<thead>
<tr>
<th>APR-DRG</th>
<th>Illness Risk</th>
</tr>
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<tbody>
<tr>
<td>1-Mild</td>
<td>2-Mod</td>
</tr>
<tr>
<td>Before</td>
<td>4.7</td>
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<tr>
<td>After</td>
<td>3.5</td>
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<table>
<thead>
<tr>
<th>Decrease</th>
<th>% Decrease</th>
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<tr>
<td>1.2</td>
<td>25%</td>
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<tr>
<td>1.5</td>
<td>22%</td>
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<tr>
<td>0.9</td>
<td>12%</td>
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<tr>
<td>1.4</td>
<td>11%</td>
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</tbody>
</table>
Improving ICU Quality, Length of Stay and Mortality

- Reducing EC to ICU time < 4 hours
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## Failure Mode and Effects Analysis

**Data Source:** Review of VAPs in MICU that occur in spite of high compliance rates with Ventilator Bundles  
**Completed:** March 2005

RCA of VAP showed three major causes of remaining VAPs:
- 1. Aspiration during transport
- 2. Endotracheal cuff leaks
- 3. Unplanned extubations requiring reintubation

<table>
<thead>
<tr>
<th>Failure Mode for MICU VAP</th>
<th>Occurrence</th>
<th>Detection</th>
<th>Severity</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aspiration during transport</td>
<td>8</td>
<td>5</td>
<td>5</td>
<td>200</td>
</tr>
<tr>
<td>Endotracheal cuff leak</td>
<td>7</td>
<td>5</td>
<td>3</td>
<td>230</td>
</tr>
<tr>
<td>Unplanned extubations requiring reintubation</td>
<td>6</td>
<td>8</td>
<td>5</td>
<td>240</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Action taken</th>
<th>Occurrence</th>
<th>Detection</th>
<th>Severity</th>
</tr>
</thead>
<tbody>
<tr>
<td>All high risk patients transported with HOB elevated; Feeding stopped two (2) hours prior to transport</td>
<td>2</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>Changed how cuff pressures are measured and increased pressure</td>
<td>2</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Risk Factors: PRN nurses working in unit &amp; Shift Change; PRN nurses are closely supervised by charge nurse. Surveillance increased during shift change</td>
<td>2</td>
<td>8</td>
<td>5</td>
</tr>
</tbody>
</table>

| Total Risk Priority Score | 720 |
| “After” Risk Priority Score | 162 |
VAPs to Zero for 39 months

MICU VAPs per 1000 Vent Days Reduction from 2.34 to 0.10

Baseline July05-April07
Implementation May07-Aug10

VAPs per 1000 vent days

Jul05 Jan06 Jul06 Jan07 Jul07 Jan08 Jul08 Jan09 Jul10 Dec10 May10 Aug10

UCL = 0.35 
X̄ = 0.10
Central Line Blood Stream Infections

MICU CVC-Related BSI Rates

*This information is privileged and confidential from discovery under the Hospital Committee Privilege contained in the Texas Health and Safety Code §161.031.032 and the Medical Practice Act. Tex. Civ. stat. Ann. Chapter 388 Occupation Code, Subtitle B Physicians Sections 151.001 et. seq. and in particular sections 160.005 through 160.010 and the Medical Peer Review privilege provided by Federal law, the Health Care Quality Improvement Act 42 U.S.C. 11101 et. seq.*
<table>
<thead>
<tr>
<th>Infection</th>
<th>Increased LOS</th>
<th>Added cost</th>
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<tbody>
<tr>
<td>Pneumonia</td>
<td>6</td>
<td>$57,000</td>
</tr>
<tr>
<td>Bacteremia</td>
<td>7</td>
<td>$63,000</td>
</tr>
<tr>
<td>Wound</td>
<td>7</td>
<td>$3,100</td>
</tr>
<tr>
<td>UTI</td>
<td>1</td>
<td>$700</td>
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</table>
Improving ICU Quality, Length of Stay and Mortality

- Reducing EC to ICU time < 4 hours
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- **Standardize Ventilator Weaning Process**
- Improve End of Life Communication
- Use Waste Tool to Identify Opportunities
Increasing Compliance to Ventilator Weaning

Brandy McKelvy MD

MICU - Compliance with Vent Weaning Protocol

Baseline 66.37%

Training

Computer

\[ \bar{X} = 93.57\% \]

LCL = 83.06\%
Reduction in Ventilator Days

MICU-Vent Days by C1

Baseline 5.411

Observation

Mean Vent Days

UCL=6.516

X̄=4.452

LCL=2.388
Reduction in LOS

MICU LOS

Baseline 5.04

Training

Computer

Mean MICU Length of Stay in Days

Jun08 Sep08 Nov08 Jan09 Mar09 May09 Jul09 Sep09 Nov09 Jan10 Mar10 May10 Jul10

UCL=4.916

X̄=4.028

LCL=3.139
Improving ICU Quality, Length of Stay and Mortality

- Reducing EC to ICU time < 4 hours
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Patient admitted to the MICU → Treatment

No process for organizing conferences
Inconsistency among MDs

Delays in family conferences
High risk of death

? Family conference

No structure to conferences
Not multidisciplinary; no attending

Palliative care
Ethics

Delays in palliative care
High risk-of-death patients identified

Schedule family conference

Team members notified

Patient admitted to the MICU

Family conference

Nurse manager

Nurse manager or Social worker

Decisions

Future meetings

Documentation

Nurse manager
MICU deaths -- Before and After Family Meeting Intervention

Before- Jan07 to Jun08

After--- Jul08 to Jun10

Baseline 10.1 days

Mean=7.76 days
**Improved Communication Decreased LOS**

**Mortality Rate - MICU Patients**

- Baseline: 19.0%
- Intervention: 19.2%

**Mortality Rate -- Medicine Patients**

- Baseline: 5.34%
- Intervention: 5.04%

**Length of Stay MICU deaths - Medicare Only**

- Baseline: 9.39
- Intervention: 6.04

**Length of Stay MICU Deaths >2 days**

- Baseline: 14.3
- Intervention: 12.2
Reducing EC to ICU time < 4 hours
Integrating Sepsis Care from EC to ICU
Hospital Acquired Infections to Zero
Standardize Ventilator Weaning Process
Improve End of Life Communication
Use Waste Tool to Identify Opportunities
ICU Resource Utilization Worksheet

<table>
<thead>
<tr>
<th>Date</th>
<th>Faculty initials</th>
<th>Comments:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Consider previous 24 hours. Please indicate if any of the following reasons contributed to an extra patient day in the ICU or inappropriate utilization of resources.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Bed</th>
<th>ICU Type</th>
<th>M or T</th>
<th>VAP, HAP, BSI, UTI, Wound Infection</th>
<th>Delay to Extubation</th>
<th>Adverse Drug Event/ or Oversedation</th>
<th>Procedure Complication</th>
<th>End-of-Life Discussion</th>
<th>Awaiting Procedure</th>
<th>Awaiting Imaging</th>
<th>Awaiting Other Test or Results</th>
<th>Awaiting Consult</th>
<th>Pending transfer - Downgraded LTAC Home</th>
<th>Unnecessary Utilization</th>
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Conclusions

- Improving ICU Quality of care
  - Improves Mortality
  - Reduces Cost
  - Reduces Length of Stay
    - Improves Admission Delays from the Emergency Department
      - Further Improves Mortality
      - Further Reduces Cost
      - Further Reduces Length of Stay