Reducing Sepsis Mortality: Bundling Strategies for Success

Karin Molander, MD
Charles Pitkofsky, RN, MS
Mills Peninsula Health Services

- Mills-Peninsula Health Services
  - General medical and surgical hospital in Burlingame, CA,
- 393 licensed beds, includes:
  - SNF
  - Behavioral Health
  - Family Birth Center
- 44,738 ED visits 2012.
- 14,819 admissions
- 3444 inpatient surgeries
It Takes a Village
The Sepsis Committee

<table>
<thead>
<tr>
<th>Name</th>
<th>Department</th>
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</thead>
<tbody>
<tr>
<td>Sheryl Anderson, RN</td>
<td>ICU</td>
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<tr>
<td>Liz Bauer, RN Manager</td>
<td>ED</td>
</tr>
<tr>
<td>Alan Brody, MD</td>
<td>ED</td>
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<tr>
<td>Mary Ann Button, RN</td>
<td>ED</td>
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<tr>
<td>Lawrence Coskey, MD</td>
<td>ICU</td>
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<tr>
<td>Eileen Donlon, RN</td>
<td>ICU</td>
</tr>
<tr>
<td>Bonnie Holland, RN</td>
<td>QM</td>
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<tr>
<td>Lynda Hooper, RN</td>
<td>Grants</td>
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<tr>
<td>Kyoko Lok, RN</td>
<td>QM</td>
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<tr>
<td>Julie MacDougall, RN mgr</td>
<td>TCU</td>
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<tr>
<td>Lorraine Massa, MD</td>
<td>Chief of Staff</td>
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<tr>
<td>Sammie Quon</td>
<td>ED</td>
</tr>
<tr>
<td>Isabel Rink, RN</td>
<td>DON</td>
</tr>
<tr>
<td>Debra Risdon-Green RN</td>
<td>ICU</td>
</tr>
<tr>
<td>Kristina Ruiz-Coppola</td>
<td>QM</td>
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<tr>
<td>Tom Shaughnessy, MD</td>
<td>ICU</td>
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<tr>
<td>Lyudmilla Shvartz, RN</td>
<td>M/S</td>
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<tr>
<td>Stuart Venook, PharmD</td>
<td>Pharm</td>
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<tr>
<td>Vicki White, RN</td>
<td>CNO</td>
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</tbody>
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Co-Chairs
- Karin Molander, MD
- Chuck Pitkofsky, RN
MPHS Sepsis Team Members

- MPHS Sepsis Committee members accepting Patient Safety First award at November 2013 Beacon conference for reducing sepsis mortality by > 30% for > 6 months
## 2012 Sepsis EGDT Guidelines

### To be completed within 3 hours

- Measure lactate level
- Obtain blood cultures prior to administration of antibiotics
- Administer broad spectrum antibiotics*
- Administer 30 mL/kg crystalloid within 3 hours for septic shock

* **MPHS goal is to administer broad spectrum antibiotics within one hour**

### To be completed within 6 hours

- Remeasure lactate if initial lactate was elevated
- insert CVP for persistent arterial hypotension despite volume resuscitation OR initial lactate ≥ 4 mmol/L
- Apply vasopressors for hypotension not responsive to initial fluid resuscitation

<table>
<thead>
<tr>
<th>Process</th>
<th>Outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td>MAP</td>
<td>MAP ≥ 65 mmHg</td>
</tr>
<tr>
<td>CVP</td>
<td>CVP ≥ 8 mm/Hg</td>
</tr>
<tr>
<td>ScVO2</td>
<td>ScVO2 goal &gt; 70%</td>
</tr>
<tr>
<td>Lactate level</td>
<td>Lactate level normalized</td>
</tr>
</tbody>
</table>
Surviving Sepsis Campaign Timeline

MPHS Septic Shock and Severe Sepsis Mortality

- 2007 Rate (Baseline)
- 2008 Rate
- 2009 Rate
- 2010 Rate
- 2011 Rate
- Q1 2012 Rate
- Q2 2012 Rate
- Q3 2012 Rate

Events:
- EHR Go Live
- ED RN SIRS Protocol
- Hospital-wide RN SIRS Protocol
Organizational Change and Decreasing Sepsis Mortality

“If you always do what you always did, you will always get what you always got.”
Organizational Change and Decreasing Sepsis Mortality

- Separate your issues
Organizational Change and Decreasing Sepsis Mortality

• Systems
  – A group of related things or parts that function as a whole
  – i.e. respiratory system, EHR system

• Process
  – A systematic sequence of actions used to produce something or achieve a result
  – i.e. breathing, admission procedure

• People
The Sepsis Screen
The Sepsis Screen

• An accurate sepsis screen is the most critical first step in the recognition and treatment of the septic patient

• EHR can lead to “checklist dementia”  
  – EHR checklists can foster a task mentality with negative impact on critical thinking  
  – RN can copy forward… copy forward… copy forward…

• ED triage vital signs were not complete set (P, O₂ sat)
The Sepsis Screen

### Braden Risk Assessment
- Sensory Perception (Response To)
- Moisture (Degree Skin Exposed To)
- Activity (Ability To Walk) (Braden)
- Mobility (Amount/Control Of Body)
- Nutrition (Quality Of Food Intake)
- Friction and Shear (Braden)
- Braden Score (If 17 Or Less Activate)

### Fall Risk Assessment (Adult, Obstetrics)
- Indicators Fall Risk
- Fall Risk Score (If 4 Or Greater, Activate)

### Sepsis Screen Notes
1. 2 or more new SIRS Criteria met?
2. Actual/Potential source(s) of infection
3. 1 or more new signs of severe sepsis
   - If yes to any 1 of the above 3

### Additional Note
- Abuse
The Sepsis Screen
Communicating the Results

• Nurses had varying levels of confidence and competence when communicating a positive sepsis screen to the MD

• Implemented education for the use of **SBAR** as the standard tool for communicating clinical information
You’re Positive?

• What happens when the sepsis screen is positive?
  – RN reluctance to call MD
  – Lack of standard communication

• Common responses from MD
  – “Let’s just wait and see…”
  – “I’m not giving a fluid bolus to a (CHF, chronic renal disease) patient”
  – “You’re taking away my clinical judgment!” – (in response to sepsis bundles)
  – “Why would I want to order a (WBC, lactate, blood cultures)?”
Overcoming Screening and Positive Screen barriers

• Training for nursing staff and physicians – Back To The Basics for Sepsis Screening
  – Clarify the criteria for SIRS, Sepsis, Severe Sepsis and Septic Shock
  – New badge cards, posters and newsletters
  – Interdisciplinary simulation training with pre/post test
Overcoming Screening and Positive Screen barriers

• Data, Data and more Data!!!
  – It is difficult to make a compelling case for change without data on our process and outcomes
  – Performed intensive chart review on all septic shock patient
  – Resulted in the Sepsis Compliance Extremely Large Spreadsheet (SCELS)
You can’t change what you don’t measure

• Data on septic shock patients allowed us to capture the time of positive sepsis screen to:
  – Antibiotic order time >>>> start of Antibiotic time
  – Lactate draw time >>>> lactate result time
  – Start time of fluid bolus and amount of fluid bolus

• A physician question regarding the utility of getting lactate levels in the ED led to a chart audit of all lactates ≥ 2
  – Epic Reporting Workbench report run daily for several months
• Septic shock database identified
  – Delays in getting antibiotic ordered and/or administered
  – Fluid administration delayed, inadequate or not administered as bolus
  – Delays in lactate draw and/or result
  – Patients admitted to wrong level of care
Results of Intensive Chart Review

MPHS Severe Sepsis Mortality and Fluid Resuscitation Compliance

- Total ED/ICU Fluid Compliance
- Severe Sepsis Mortality Rate
“Give him a 250 mL bolus...”
There is still risk with a "normal" lactate.

First Lactate Value vs. Mortality Rate
Septic Shock Jun 2012 - Sept 2013
Severe Sepsis/Septic Shock Oct 2013 - Jan 2014

<table>
<thead>
<tr>
<th>First Lactate Value</th>
<th>0 - 0.9</th>
<th>1.0 - 1.4</th>
<th>1.5 - 1.9</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mortality numerator</td>
<td>3</td>
<td>10</td>
<td>11</td>
</tr>
<tr>
<td>Mortality denominator</td>
<td>82</td>
<td>63</td>
<td>71</td>
</tr>
<tr>
<td>mortality rate</td>
<td>12.9%</td>
<td>14.5%</td>
<td>15.5%</td>
</tr>
<tr>
<td>percent of total # pts</td>
<td>23.4%</td>
<td>33.9%</td>
<td>19.0%</td>
</tr>
</tbody>
</table>

X septic shock pts with initial lactate ≥ 2.0 78.6%
mortality rate for lactate ≥ 2.0 22.1%
### Results of Intensive Chart Review

<table>
<thead>
<tr>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total number of pts with Lactate ≥ 2.0 (D)</td>
<td>654</td>
</tr>
<tr>
<td># of patients with Lactate ≥ 2.0 and sepsis, severe sepsis or septic shock (N)</td>
<td>499</td>
</tr>
<tr>
<td>% of patients with Lactate ≥ 2.0 and sepsis, severe sepsis or septic shock</td>
<td>76%</td>
</tr>
</tbody>
</table>

**Normal WBC and Sepsis**

<table>
<thead>
<tr>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td># pts with lactate ≥ 2 and sepsis</td>
<td>499</td>
</tr>
<tr>
<td># pts with lactate ≥ 2, normal WBC and sepsis</td>
<td>189</td>
</tr>
<tr>
<td>% pts with sepsis and normal WBC</td>
<td>37.9%</td>
</tr>
</tbody>
</table>
3 Hour Bundle
Lactate
Lactate

• Lactate not seen by physicians as valuable test to identify possible signs of organ failure •
  – Lactate went through a period of high use in 1980s, then fell out of favor in clinical training in 1990s
  – There are cohorts of physicians with limited experience using lactate results
3 Hour Bundle
Lactate - Barriers

• POC lactate results needed to be entered manually into Epic
  – Led to inaccurate time of result
  – POC results can appear in different place in EHR than serum lactate

• Initially there were delays in getting lab lactate results
  – Excel spreadsheet identified gaps
3 Hour Bundle
Lactate PI Actions

• Worked with lab to implement test cover sheet to fast track test
• Streamlined lab workflow to prioritize lactate processing
• Lactate ≥ 3 considered critical result, called to floor RN
• Epic BPA created to remind clinician to draw lactate if blood cultures are drawn.
3 Hour Bundle
Fluid Bolus
3 Hour Bundle
Fluid Bolus Issues

• Physicians reluctant to give fluid bolus, especially with CHF or chronic renal disease patients ●

• Fluids are ordered in inadequate amounts or administered over prolonged time ● ● ●
  – Order set defaulted to 500 mL bolus

• Pressure bags not on inpatient unit crash carts, inadequate number of pressure bags in ED ●
• Pressure bags stocked on all inpatient crash carts, added more pressure bags to ED stock
• Data related to fluid administration and mortality presented in medical committees
• Bundle compliance spreadsheet posted in ED sleep room
3 Hour Bundle
Blood Cultures
• Identified issues related to RN/Lab communication for timing of second blood culture draw
  
  – Education for MDs/RNs and lab staff regarding communication and hand-offs for drawing blood cultures
3 Hour Bundle
Antibiotics
Barriers

• Issues with antibiotic availability in Pyxis

• Pharmacy delays due to process to check/approval order

• Broad spectrum antibiotic not listed first in MAR
Barriers

• Antibiotics not ordered through sepsis order set resulted in delay of treatment
  – Antibiotics are ordered “Once”, “Now” or timed instead of STAT
  – Problems with handoffs from ED to floor, antibiotics fall through cracks
3 Hour Bundle
Antibiotic PI Actions

• Worked with pharmacy to have commonly used antibiotics stocked in Pyxis
• Education blitz for physicians and nurses
• Order set developed with anti-infective recommendations based on source of infection (ID MD buy-in)
• Antibiotic fast track validation in pharmacy
6 Hour Bundle
Measure MAP

![Graph showing blood pressure over time]

\[
\text{Mean Arterial Pressure} = \frac{(2 \times \text{Diastolic Pressure}) + \text{Systolic Pressure}}{3}
\]
• In monitored setting, MAP pulled automatically from monitor when RN documents.

• For med/surg unit, automated BP cuff displays MAP, but not charted.

• MAP not computed from BP in EHR.
  – Fix will be implemented with sepsis EHR pilot.
6 Hour Bundle
Measure CVP
6 Hour Bundle
Measure CVP Issues

• Key issue to start with: Who puts in the central line? ● ○
  – No clear owner for CVP insertion
  – Lack of clarity regarding owner of first 3 hours of bundle vs. 6 hour bundle

• Equipment issues with catheter change ●
  – Update to Edwards catheter
  – Problems with bad lots of catheters
  – Dilator difficult to use ○
6 Hour Bundle
Measure CVP Issues

- Difficult to abstract actual insert time of CVP
  - Buried in narrative of physician note without time stamp

- CVP inserted, but not measured immediately by RN
  - Competency issues in ED and ICU
  - Calibration/measurement of CVP seen as too time consuming in ED
6 Hour Bundle
Measure CVP PI Actions

• ED identified as responsible for 3 hour bundle and insertion of CVP for all ED patients
• Trained hospitalists and ED physicians to insert CVP lines
• Tried training ED RNs to calibrate catheter – too many competing priorities in emergency setting
  – ICU RNs responsible for first measurement of CVP on arrival
6 Hour Bundle
Measure ScVO₂ Issues

- Physicians complacent about value of ScVO₂ – leads to RN complacency on measuring ScVo2
- Need mixed venous blood gas for calibration
- Monitor/sensor malfunction/upkeep
• Education for ICU RNs on importance of ScVO$_2$
• Visual aides to assist with equipment issues and calibration
• Plan to continue educating MDs and RNs on the clinical value of monitoring ScVO$_2$
6 Hour Bundle
ReMeasure Lactate

\[
\text{HOCH}_2\text{COOH}
\]

3.2

\[
\text{HOCH}_2\text{COOH}
\]

??

Power Point Template 3
• Drop-outs occur when physicians do not use the order set.
  – Order sets include serial lactate.
• Normalization of lactate not seen as useful indicator of EGDT interventions.
General Strategies for Success
Multiple Education Fronts

- Hospitalists
- Intensivists
- RN champions
- Sepsis simulation training
- SCC Webinars
- Case histories
- QA committees
- Hospital and medical staff newsletters
- Guest speakers
- MPHS Quality website
- Badge cards
- World Sepsis Day
- Sepsis “Jeopardy”
• Constant reinforcement of best practice for managing septic patients
  – Notes sent through Epic mail with positive feedback and opportunities for improvement
  – Individual feedback appears to be more effective than standard OFI letters
General Strategies for Success

• Get the patient to the right level of care!
  – Patients who have been successfully resuscitated in ED are still at high risk for physiologic demise

• Physicians reluctant to admit patients from ED to TCU/ICU
  – Education to show that InterQual supports higher level of care for severe sepsis patients
  – If patient hypotensive at any point in hospitalization = 3 x increase in mortality
General Strategies for Success
RRT and Sepsis Alert

• Incorporated sepsis screen into RRT response
  – RRT RN performs sepsis screen as part of initial assessment
  – Validates positive sepsis screen

• RRT team calls Sepsis Alert for patients that meet septic shock criteria
  – Sepsis Alert introduced June 2013
RRT/Sepsis Alert – Mobilize Resources!
General Strategies for Success
RRT and Sepsis Alert

• RNs reluctant to call RRT due to concerns about physician reaction
  – Reinforced use of SBAR to organize case presentation

• Physicians perceive Sepsis Alert as reflection on their competence
  – “Pit Crew” analogy – the physician is still the driver
General Strategies for Success
Making The Business Case

• Calculating lives saved and cost saved for sepsis mortality reduction can support requests for resources

• Identify baseline period for sepsis patients:
  – Length of Stay
  – Mortality

• \textbf{ROI} = \text{Expected LOS/Mortality} – \text{Actual LOS/Mortality}
Ongoing Struggles

- Inadequate fluids
- Patient placement
- Handoffs
- EHR changes
- Physician and nursing staff turnover
- Equipment changes
Future State

• Sutter Health RPIW to develop system wide improvements for early recognition and treatment of sepsis
  – Sepsis BPA
  – Revised sepsis screen
  – Revised standard order sets
  – Standard work for management of septic patient
Questions?

"That's all folks!"

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