Optimizing Sepsis Care at Dartmouth Hitchcock

Sam Shields, MBA, LSSBB, CPHQ
Director of Operational Excellence
Dartmouth Hitchcock Value Institute
‘Culture eats strategy for breakfast’
- Peter Drucker

“Make continuous improvement part of the very fabric of DH.”
HVHC Triple Aim Targets

• **Improve care**: 5% improvement in optimal adherence to sepsis bundled care (3 years)
  - **INTERVENTION**: Sepsis bundled care implementation via Lean

• **Improve health**: Reduce burden of chronic morbidity from sepsis-associated chronic organ dysfunction

• **Reduce cost**: $12.24M cost savings
  - **IMPACT**: 5% relative rate reduction in number of patients with sepsis requiring long term acute care or sub-acute nursing care after an incident episode of severe sepsis*

  *where episode refers to events that are bracketed by the admission and discharge from an inpatient acute care facility
Dartmouth Hitchcock Medical Center

- Level 1 Trauma Center
- 396-beds
- 28 OR Suites (Main Campus)
- 18,000 Surgical Procedures per Year
- 16 Surgical Services
Value Institute

Chief Quality and Value Officer

George Blike MD, MHCDS
Louis Shelzi MBA; Value Institute Business Manager

Director:
Lori Key RN, MBA
Quality & Safety

Director:
Sam Shields MBA, CPHQ, LSSBB
Operational Excellence

- Performance Improvement
- Project Management
- VI Learning Center

- World Class Lean Six Sigma training program (started in 2011)
- 2000+ trained Yellow Belts
- 200+ trained Green Belts
- 27 Black Belts

Director: Evelyn Schlosser RN, MBA, MPH, CPHQ
Network Integration

Associate Chief Quality Officers
Sam Casella MD, MPH
Pam Hofley MD
Steve Surgenor MD, MPH

D-HH Epidemiologist
Antonia Altomare DO, MPH

http://med.dartmouth-hitchcock.org/value_institute.html
Define the opportunity or business problem. Understand the scope to be considered and collect the ‘voice of the customer.’

Measure the current performance of the process. Collect baseline data, map the process, and determine process capability.

Analyze the root cause of the problem. Use statics and process analytics to determine the ‘critical few.’

Improve the process to eliminate root causes. Apply change concepts and organizational wisdom to define and test improvement ideas.

Control the process to sustain the gains. Install quality management system elements to ‘hardwire’ the gains and then track performance.
## DMAIC – Typical Application of Tools

### Process Improvement Standard Tools

<table>
<thead>
<tr>
<th>Define</th>
<th>Measure</th>
<th>Analyze</th>
<th>Improve</th>
<th>Control</th>
</tr>
</thead>
<tbody>
<tr>
<td>Charter</td>
<td>Detailed Process Map</td>
<td>Value Stream Review/Analysis</td>
<td>Brainstorming</td>
<td>SOP’s/ Documentation</td>
</tr>
<tr>
<td>High-Level Process Map</td>
<td>Data Collection Plan</td>
<td>Spaghetti Chart</td>
<td>Benchmarking/EBP</td>
<td>Training Documentation</td>
</tr>
<tr>
<td>SIPOC</td>
<td>(Who, What, Where, When)</td>
<td>Value Add / Non-Value Add Chart</td>
<td>Change Concepts</td>
<td>Training Documentation</td>
</tr>
<tr>
<td>VOC</td>
<td>Data Collection Form</td>
<td>Problem Statements</td>
<td>Decision Matrix</td>
<td>Training Plan</td>
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<tr>
<td>Affinity Diagram</td>
<td>Run Charts/ Time Plots</td>
<td>Brainstorming</td>
<td>Solution Selection matrix</td>
<td>Control Plan</td>
</tr>
<tr>
<td>CTQ Tree</td>
<td>Frequency Plots</td>
<td>Root Cause Analysis</td>
<td>Pilot Testing (PDSA)</td>
<td>Process Management Chart</td>
</tr>
<tr>
<td>Elevator speech</td>
<td>Histograms</td>
<td>5 Why's</td>
<td>Statistical verification</td>
<td>Visual Controls/ Reporting</td>
</tr>
<tr>
<td></td>
<td>Pareto Charts</td>
<td>Cause &amp; Effect (Fishbone)</td>
<td>Process Map (Future)</td>
<td>Storyboards</td>
</tr>
<tr>
<td></td>
<td>Data Validation</td>
<td>5 Why's</td>
<td>Risk Analysis</td>
<td>Lessons Learned</td>
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<td></td>
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<td>Cause &amp; Effect (Fishbone)</td>
<td>Implementation Plans</td>
<td>Project Documentation</td>
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<td></td>
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<td>Scatter Plots</td>
<td>Gantt Charts</td>
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<td></td>
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<td>Frequency Plots</td>
<td>SWOT</td>
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<td>Matrix Plots</td>
<td>Force Field Analysis</td>
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<td></td>
<td></td>
<td>Regression Analysis</td>
<td>Commitment Scale</td>
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<td>Box Plots</td>
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<td></td>
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<td>Failure Mode &amp; Effect Analysis</td>
<td></td>
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<td></td>
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<td>Experimentation/ Simulation</td>
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**Value Institute**

Dartmouth-Hitchcock
Our status as of Fall 2013
(We were sick!)

- Performance far below expectations
- 1 to 2 years behind other member hospitals
- Needed to show improvement within 90 days
- Work had to be done in a way that allowed rapid diffusion across the system
Sepsis Initiative Timeline

**3rd Qtr 2013**
- DH Project Charter
- Current state compliance analysis
- Orderset development

**4th Qtr 2013**
- Identify key stakeholders and process owners
- Agree on implementation approach with key leaders

**1st Qtr 2014**
- ED Team kick off
- ED Team quick wins
- ED Nursing Work Group
- ICU implementation planning
- ICU Team kick off

**2nd Qtr 2014**
- ED Go Live
- ED Scorecard Finalized
- ICU Go Live
- Pharmacy process optimization
- Engage regional groups
- Formal training development

**3rd Qtr 2014**
- Regional locations Go Live
- CREST Activation
- Inpatient planning sessions and change package

**4th Qtr 2014**
- Inpatient roll out through Team Care
- Formal training program roll-out
Sepsis Initiative Mapping

Outside Hospital Transfer

Change package

Emergency Department

Modular RPIW

ICU Department

Modular RPIW

In Patient Units

Team Care

Discharge
ED Team Goal
Cross-functional team including ICU Nursing, Lab & Pharmacy

3 hr Bundle compliance goals:

- **6%** Current Performance
- **20%** By May 2014
- **30%** By end of Q3 2014
ED Improvement Approach

- Modular RPIW – 4 sessions
  - Cross-functional team
  - Define, Measure & Analyze
- Implementation Team – 1 hr per week
  - Physicians, Nurses & Residents
  - Analyze, Improve & Control

- Jan 22nd
- Feb 10th
- Feb 20th
- Thru Oct
- April 1 “Go Live”
ED 3hr Sepsis Bundle Charter

Description/Problem Statement
Over the past 3 years, our 3 hour sepsis bundle compliance has been 6% with mortality rates of 38% and an average length of stay in the ICU of 9.1 days.

Business Case
Severe sepsis is a major public health challenge that effects over 1 million patients per year in the United States. At DH, a 5 day reduction in ICU length of stay would free up resources to increase revenue by over $1.6 million per year.

Project Scope
In Scope: Adult patients entering the ED via walk-in or ambulance. Out of Scope: Patients transferred to DH from another healthcare institution.

Goal/Metric | Measure Description
--- | ---
Improve 3 hour sepsis bundle compliance from 6% to 20% by end of May 2014. | % of sepsis bundle delivered within 3 hours.
Track sepsis bundle compliance and accuracy. Streamline data collection. (Stat Tool Option) | Tools and reports are in place to quickly analyze sepsis bundle performance.

Resource Plan
Project Lead: Sam Shields
Project Sponsors: Jim Weinstein, MD George Blike, MD Andreas Taenzer, MD Scott Rodi, MD Patricia Lanter, MD Karen Clements, RN

Team Members
Jennifer Norris, RN Amy Curley, RN
Frank Polito, Lab Supervisor Karen Chandler, RN
Miriam Dowling, RN ED Residents (Float based on schedule)
Katelin Engerer, MD

Contact Information for Project Lead: Samuel.N.Shields.Jr@hitchcock.org 603-653-1093

Timeline
Start Date 1/22/2014
End Date 4/19/2014
Initial Challenges

Buy In - 1 patient per week

Data that was actionable and easily attained
ED 3hr Bundle Compliance Cause & Effect

Why is 3hr bundle compliance low?

Provider
- Provider Delay
- Provider hand off

Staff
- Allocation of skillset
- Initiation of therapy
- Resource allocation

Patients
- Vascular Access
- Difficult identification

Policies/Procedures
- No sepsis protocol

Environment
- Triage wait time
- Service variation
- Room allocation
- Communication gaps

Machine/Equipment
- Fluid volume tracking
- No effective measurement
- No order set

Expectations
- Change in triage
- Culture timing
- Blood cx

Resources
- Allocation of skillset

Dartmouth-Hitchcock Value Institute
ED Quick Wins

Lactate changes - 50 minute decrease

Added “Super SIRS” as Chief Complaint
   Activated appropriate resources quickly

Decreased room to IV start by 50%

Utilized existing resources for improved patient flow/time

Increased team communication
ED – Level 2 Room to IV Times

Background
The ED Sepsis team is trying to understand the current capability of door to IV time for our Level 2 patients. This data represents the average time from when a patient is roomed until an IV is started.

Data Collection
Each point represents the daily average door to IV time. This data excludes ambulance patients, psych patients and any patient not requiring an IV. This data is manually collected each week by nurse managers. The data is reviewed for accuracy and then averaged by day for posting.

Goal
- Understand our current performance.
- Create awareness among staff that will help us improve our performance to future goal of 10 minutes.

Average Daily Door to IV Times
- The control limits tell us that the Door to IV time will be between 2 minutes and 59 minutes 99.7% of the time.
- Lower is better
- This is a stable process that needs to be shifted downward.

Goal = 10 minutes
Lower Control Limit = 2 minutes
Upper Control Limit = 59 minutes
Avg = 30 minutes
## PDSAs

### Round 1

<table>
<thead>
<tr>
<th>Title</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>Triage Criteria Tool</td>
<td>Test criteria tool with key users</td>
</tr>
<tr>
<td>Door to IV Time</td>
<td>Understand challenges</td>
</tr>
</tbody>
</table>

### Round 2

<table>
<thead>
<tr>
<th>Title</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>Room to IV Time</td>
<td>Understand challenges</td>
</tr>
<tr>
<td>Epic alert</td>
<td>Test ways to alert staff</td>
</tr>
<tr>
<td>Sepsis Bundle checklist</td>
<td>Test validity of tool</td>
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</tbody>
</table>
## ED Communication Tactics

<table>
<thead>
<tr>
<th>Stakeholders (Audience)</th>
<th>Information Needed</th>
<th>Communication Medium (How)</th>
<th>Message Sender (Responsibility)</th>
<th>When (Date)</th>
</tr>
</thead>
<tbody>
<tr>
<td>ED Staff</td>
<td>Inform staff of Sepsis kickoff and board posting</td>
<td>Email</td>
<td>Tricia, Karen, Amy</td>
<td>By 1/28</td>
</tr>
<tr>
<td>ED Staff</td>
<td>Mtg outputs, request for feedback, project update</td>
<td>ED Sepsis Team Board</td>
<td>Sam to update with Amy and Jen</td>
<td>Weekly board update</td>
</tr>
<tr>
<td>ED Nurses</td>
<td>Inform nurses of current work &amp; next steps by team</td>
<td>Nursing huddles</td>
<td>Jenn &amp; Nurse Leads</td>
<td>Weekly</td>
</tr>
<tr>
<td>ED Residents</td>
<td>Residents update group on team progress and plans</td>
<td>Weekly meetings</td>
<td>Resident &quot;Leads&quot;</td>
<td>Weekly resident meetings</td>
</tr>
<tr>
<td>ED Leadership</td>
<td>Updated actions, feedback and next steps</td>
<td>Leadership meeting</td>
<td>Sam</td>
<td>Every Monday</td>
</tr>
</tbody>
</table>
ED Go Live Achievements

• Go Live on April 1, 2014
  • Criteria Tool in Triage
  • Sepsis Order set
  • Primary Complaint Alert
  • Staff trained
## ED Scorecard (Control Phase)

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<tr>
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</tr>
</thead>
<tbody>
<tr>
<td>All Patients</td>
<td>Number of Lactates Ordered</td>
<td>39</td>
<td>32</td>
<td>50</td>
<td>54</td>
<td>59</td>
<td>45</td>
<td>53</td>
<td>54</td>
<td>54</td>
</tr>
<tr>
<td>Admitted Adults with Lactate &gt;3</td>
<td>Number of Patients</td>
<td>6</td>
<td>0</td>
<td>8</td>
<td>12</td>
<td>11</td>
<td>9</td>
<td>7</td>
<td>9</td>
<td>4</td>
</tr>
<tr>
<td>All Staff</td>
<td>Avg Door to Lactate Time</td>
<td>136</td>
<td>231</td>
<td>161</td>
<td>86</td>
<td>104</td>
<td>50</td>
<td>112</td>
<td>114</td>
<td></td>
</tr>
<tr>
<td>All Staff</td>
<td>Avg Order to Abx Given Time</td>
<td>61</td>
<td>209</td>
<td>39</td>
<td>26</td>
<td>47</td>
<td>13</td>
<td>63</td>
<td>12</td>
<td></td>
</tr>
<tr>
<td>All Staff</td>
<td>% Patients with Fluid Orders</td>
<td>93%</td>
<td>100%</td>
<td>75%</td>
<td>91%</td>
<td>78%</td>
<td>100%</td>
<td>89%</td>
<td>100%</td>
<td></td>
</tr>
<tr>
<td>All Staff</td>
<td>% Patients with Blood Culture</td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Physicians</td>
<td>Avg Room to Doc Time</td>
<td>20</td>
<td>13</td>
<td>18</td>
<td>20</td>
<td>19</td>
<td>8</td>
<td>14</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Physicians</td>
<td>Avg Room to Abx Ordered Time</td>
<td>178</td>
<td>186</td>
<td>322</td>
<td>67</td>
<td>212</td>
<td>98</td>
<td>178</td>
<td>154</td>
<td></td>
</tr>
<tr>
<td>Nursing</td>
<td>Avg Arrival to Room Time</td>
<td>5</td>
<td>6</td>
<td>4</td>
<td>2</td>
<td>3</td>
<td>2</td>
<td>7</td>
<td>5</td>
<td></td>
</tr>
</tbody>
</table>

Owned by nursing team. Drives weekly reviews (now monthly)

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VALUE INSTITUTE

Dartmouth-Hitchcock
ED - Key Learnings

• Leadership alignment & commitment

• Breakthrough goal setting – Leadership clears a path
  • “This needs to happen in 90 days”

• Strong sponsorship was critical

• Staff want regular feedback on how they are performing
  • Floor staff engagement

• Needed a Force Field analysis
  • Metrics and data
  • Accountability
ED Results
ED 3hr Bundle Compliance
ED Time to Antibiotics

Average time to antibiotics in ED
Tracking & Handoffs
# Sepsis Inclusion and Bundle Checklist

### Patient Identification
- Unique ID ____________

Patients suspected of sepsis per institution screening procedures

### Bundle Inclusion Criteria
- **Clinically Suspected Infection**
- **SIRS Criteria Positive**
  - two or more of:
    1. Temp <36°C OR >38°C
    2. Heart Rate >90/min
    3. Respiratory Rate >20/min OR PaCO2 <32 mmHg
    4. WBC <4k OR >12k OR >10% bands

AND:
- **Hypotension**
  - $\text{SBP} < 90\text{ mmHg}$ OR decrease $\geq 40\text{ mmHg}$ from baseline
- **Elevated Serum Lactate**
  - $\geq 4\text{ mmol/L}$

### Severe Sepsis 3 Hr Bundle
- **1 Measure Lactate Level**
  - If not previously measured
  - mmol/L ____________
  - Time ____________ hh:mm (24 HR)
  - Date ____________ mm/dd/yy

- **2 Blood Cultures Before Antibiotics**
  - Time ____________ hh:mm (24 HR)
  - Date ____________ mm/dd/yy

- **3 Broad Spectrum Antibiotics**
  - record start time of antibiotics
  - Time ____________ hh:mm (24 HR)
  - Date ____________ mm/dd/yy

- **4 Crystalloid Bolus (30mL/kg)**
  - record start time of IV fluids
  - Time ____________ hh:mm (24 HR)
  - Date ____________ mm/dd/yy
  - Volume ____________ mL at 3 Hours

### Septic Shock 6 Hr Bundle
- **Eligible for 6 Hr Bundle**
- **Initiate Vasopressors**
  - N/A

For hypotension not responding to initial fluid resuscitation to maintain $\text{MAP} \geq 65\text{ mmHg}$

- **Measure Central Venous Pressure (CVP)**
  - mmHg ____________
  - Time ____________ hh:mm (24 HR)
  - Date ____________ mm/dd/yy

- **Measure Central Venous $O_2$ Saturation (ScvO2)**
  - % ____________
  - Time ____________ hh:mm (24 HR)
  - Date ____________ mm/dd/yy

- **Remeasure Lactate**
  - N/A

If $\text{SBP} < 90\text{ mmHg}$, $\text{MAP} < 65\text{ mmHg}$ or initial lactate elevated, PROCEED to 6 hr Bundle

### Resuscitation Detail & Response Upon Completion of 3 Hr Bundle
- **Height** ____________ cm
- **Age** ____________
- **SBP** ____________ mmHg
- **MAP** ____________ mmHg
- **Volume Crystalloid** ____________ mL
- **Volume Colloid or Blood Product** ____________ mL

**Height** ____________ cm
- **Weight** ____________ kg
- **Gender**
  - ☐ Male
  - ☐ Female

**Volume Crystalloid** ____________ mL

**Volume Colloid or Blood Product** ____________ mL

**Height** ____________ cm
- **Weight** ____________ kg
- **Gender**
  - ☐ Male
  - ☐ Female

**Volume Crystalloid** ____________ mL

**Volume Colloid or Blood Product** ____________ mL
Checklist Tracking

- Began pilots in ED and ICU
  - Limited success in ED
- ICU began pilot testing
  - Revised form to meet needs (simplified)
  - Color coded forms for ED and ICU
- Broader adoption to ambulance services
ICU Implementation
ICU Improvement Process

- Modular RPIW
  - Cross functional team including lab and pharmacy

- Break out groups of staff nurses for key processes
  - Pharmacy, Transfer to unit

- Increased physician pre-engagement

- Utilized force field analysis based on ED work
ICU Quick Wins

- Revised SBAR tool to include Sepsis Criteria
- Pharmacy operations partnership
ICU Antibiotic Order Fulfillment - Current

Pharmacy

- Pharmacy verifies orders
- STAT order?
  - Yes: Goes to the front of the line
  - No: First in, First out
- Pharmacy QCs order
- Is drug in area Accudose?
  - Yes: Has delivery run left yet?
    - Yes: End Process
    - No: Send in tube system
  - No: Hand deliver to department

- Order acknowledge pops up in eDH
- RN acknowledges order
- Stocked in Accudose? (3N Only)
  - No: Wait for delivery
  - Yes: Source of antibiotic is unknown
    - No: Administer Antibiotic
    - Yes: Get antibiotic

Proposed: Create pharmacy process to deliver antibiotics as STAT verification if sepsis order set.
ICU Go Live Achievements

- GO Live on May 6th
  - Criteria Tool
  - Sepsis Order set (3hr & 6hr Bundle)
  - Pharmacy Process Optimization
  - Bundle Checklist
ICU - Key Learnings

- Cross functional team membership key (ED/ICU)
  - Floor staff engagement

- Skill gap in recognizing “sick” patients

- Area Champion is critical

- Coordination of care through our system remains a big challenge

- Staff accountability / Leadership
In-patient Implementation
In-Patient Sepsis Bundle Activation Workflow - DRAFT

Identification


HVHC SIRS Criteria

End

Actions:
- Number patients meeting criteria in inpatients area?
- Assign area champions
- Assign surgical resident & medical resident to life safety team?
- Andreas to check with HVHC members on "suspected infection" criteria use

Change Management
- Physicians & Fellows engagement
- Resident engagement and understanding (cross service support interns)

Activate Order Set?

Physician Decision & Patient Placement

Team & Life Safety Arrives

Review Data
Activate the Nursing Per Protocol Orders
Click Add Order
Sepsis Power Hour

Every minute matters...
One hour delay in recognition and delay of the 3 hour bundle increases Mortality by 8%

Here is what YOU can DO:

SUPER SIRS CRITERIA

REQUIRES SUSPECTED INFECTION AND 2 OR MORE:

- Temp < 36.0 or > 38.3
- SBP < 90 mm Hg
- RR > 24
- HR > 120
- New Unexplained Altered Mental Status

NOTIFY:

- Life Safety #5310
- Covering Team

GET IV IF NEEDED

(text page vascular access: “SIRS: Room #” #9260)

- Draw Lactate
- Draw Cultures
- Start 500ml NS

RECOGNIZE

Infection + 2 Super SIRS

NOTIFY

Life Safety + Primary Team

START BUNDLE

Start Bundle

Dartmouth-Hitchcock
Updated Results
Sustaining the Gains…

Sepsis Initiative Mapping

Change package

Modular RPIW

Outside Hospital Transfer

Modular RPIW

Team Care

Affiliate projects supported by VI

Emergency Department → ICU Department

In Patient Units → Discharge

Sepsis Coordinator Role

e-Learning for Physicians & Nurses
Success Factors

Leadership alignment & commitment

Active and engaged sponsors

Breakthrough goal setting – Leadership clears a path
  “This needs to happen in 90 days”

Feedback to staff on performance / engagement
Lessons Learned

• Leadership alignment & commitment is critical

• Anticipation - charting the course paid off

• Breakthrough goal setting – Leadership clears a path
  “This needs to happen in 90 days”

• Communication & Marketing plan

• Cross functional team membership

• Floor staff engagement and feedback
Thank you!