ACEP Emergency Quality (E-QUAL) Network
Sepsis Learning Collaborative 2016

Funded by the Center for Medicare & Medicaid Innovation (CMMI)
Outline

• A Case
• Epidemiology of Sepsis
• Learn Baseline
• Protocolize Care
• Need for Early Recognition:
  — SIRS, Lactate
• Time to Antibiotics
• Follow up Care
• Conclusions
Sepsis 2016:
“What’s the problem?
What’s the solution?”

David F. Gaieski, MD, FACEP
Associate Professor, Department of Emergency Medicine
Vice Chair for Resuscitation Services
Director of Emergency Critical Care
Sidney Kimmel Medical College
Thomas Jefferson University
March 23rd, 2016
Presenters

Dr. Arjun Venkatesh

Dr. Jeramiah Schuur

Dr. David Gaieski
Objectives

• Gain a better understanding the Transforming Clinical Practice Initiative (TCPI)

• Gain a better understanding of the ACEP Emergency Quality (E-QUAL) Network Sepsis Initiative
Project Overview

CMS Transforming Clinical Practice Initiative: What is it?

• CMS seeks to help clinicians achieve large-scale health transformation
  o Support >140,000 clinician practices over the next 4 years
    o Sharing, adapting and further developing their comprehensive quality improvement strategies.
    o Preparing to adopt alternate payment methods

• ACEP is one of 39 health care organizations selected to participate in the CMMI TCPI
  o One of 10 Support and Alignment Networks (SAN)
ACEP Emergency Quality (E-QUAL) Network Focus Areas

1. Improving outcomes for patients with sepsis

2. Reducing avoidable imaging in low risk patients through implementation of ACEP’s Choosing Wisely recommendations
   - Reduce use of high-cost imaging for low back pain
   - Head CT scan after minor head injury
   - Chest CT for pulmonary embolus
   - Abdominal CT for renal colic

3. Improving the value of ED chest pain evaluation by reducing avoidable admissions in low risk patients with chest pain
Benefits to Participating – Why Join?

- Gain access to toolkits including best practices, and sample guidelines
- Submit and receive benchmarking data to guide local QI efforts
- Learn from expert national faculty
- Gain national recognition for your successes
- Get your clinicians access to high-quality eCME for free
- Earn ABEM MOC credit (LLSA and Part IV Activities)
- Meet CMS quality reporting requirement of the QCDR
What will the Learning Collaboratives provide?

**Recruitment & Enrollment**
- Enrollment Pledge
- Readiness Assessment Survey
- Participation Sign Up

**Learning Period (6-9 months)**
- Monthly Webinars
- Introduction to tool kit
- eCME & MOC
- Benchmarking data
- Office Hours

**Wrap Up**
- Data Reports
- Summary Report
- Lessons Learned
- eCEM & MOC credit
- Re-enrollment
Learning Collaborative

• Sepsis is the #1 cause of inpatient mortality
• The ED plays a key role in the early identification and treatment of patients with sepsis, and is the portal of entry to the hospital.
• E-QUAL seeks to support widespread implementation early recognition and treatment interventions that will save lives
Learning Collaborative

- Collaborative Goal: To improve the outcomes of ED patients with sepsis

Specific Aims:

1. To improve provider and nurse knowledge of early identification, treatment and reassessment of sepsis
2. To assist EDs in implementing best practices that support evidence-based sepsis care
3. To improve performance on metrics and meet regulatory requirement: CMS SEP-1 and CEDR sepsis measures
4. To develop expertise in the application of effective clinical and quality improvement methods
Who Should Participate in Learning Collaborative?

• Goal is for a small team from each participating site to participate

• Physician Lead: ED Director, QI Director, Physician champion
• Nursing Lead: Nurse Director, Nurse Educator, Nurse champion
• Administrator: assist with data gathering and dissemination to staff
• Other Providers and Staff nurses Welcome
Available Resources

• Monthly Webinars
  o Successful sepsis QI initiative
  o Screening/ Identification of Best Practices
  o Intervention and Implementation of Best Practices

• Tool Kit Materials
  o Getting Started - Facility preparedness
  o Screening/ Identification
  o Intervention
  o Implementation
  o Data Collection strategies and tools

• Office Hours
# Sepsis Webinar Schedule

<table>
<thead>
<tr>
<th>Date</th>
<th>Topic</th>
</tr>
</thead>
</table>
| **Wednesday March 23rd** | • TCPI Project and ACEP E-QUAL Overview  
                          | • Learning Collaborative  
                          | • Successful sepsis QI initiative |
| 12:00pm-12:45pm EST      |                                                                      |
| **Wednesday April 20th** | • Sepsis Tool Kit Review  
                          | • SEP-1, CEDR Provider Measures, Collecting Data Measures            |
| 12:00pm-12:45pm EST      |                                                                      |
| **Thursday May 19th**    | • Harnessing the EHR in sepsis identification  
                          | • Human elements in screening and initiation of treatment of sepsis |
| 12:00pm-12:45pm EST      |                                                                      |
| **Wednesday June 22nd**  | • Antibiotics and Source Control  
                          | • Sepsis Pitfalls and Common Barriers                                |
| 12:00pm-12:45pm EST      |                                                                      |
| **Wednesday July 20th**  | • Approaches to Resuscitation (fluids, blood)  
                          | • Complex patients                                                  |
| 12:00pm-12:45pm EST      |                                                                      |
| **Wednesday August 17th**| • Improving sepsis care in transfers and transitions (ICU and boarding)  
                          | • Office Hours                                                      |
| 12:00pm-12:45pm EST      |                                                                      |
| **Wednesday September 21st**  | • Building sustainability in your sepsis efforts  
                          | • Office Hours                                                     |
| 12:00pm-12:45pm EST      |                                                                      |
Data Collection

• One part of participation in learning collaborative is measuring improvement

• Gather Baseline Data
• Implement Changes
• Gather post-implementation data

• How gather data?
  – CEDR – ACEP’s QCDR
  – Manual data collection
  – SEP-1
Clinical emergency data registry (CEDR)

The scope of CEDR is to accept patient data from practicing emergency physicians and clinicians on the care provided to emergency department patients. These data will inform the main goals of CEDR, which are to:

1. Provide a unified method for ACEP members to collect and submit Physician Quality Reporting System (PQRS) data, MOC, Ongoing Professional Practice Evaluation (OPPE), outcome data, and other related or applicable quality and patient safety data to meet quality improvement and regulatory requirements.
2. Promote the highest quality of emergency care for our patients.
3. Demonstrate the value of emergency care.
4. Facilitate appropriate emergency care research.
CEDR Sepsis Metrics

- CEDR 28-Septic shock: lactate level measurement
- CEDR 30-Septic shock: Antibiotics ordered
- CEDR 31-Septic shock: Fluid resuscitation
- CEDR 32-Septic shock: Repeat lactate level
- CEDR 33-Septic shock: Lactate clearance rate ≥10%
Next Steps

• We need you to do 3 things!

1. Gather your team

1. Sign up – take the online Readiness Assessment
   1. Need each participating site to fill out one survey
   2. Required of ACEP by CMS

2. Look for upcoming email with tools and data collection strategies
For More Information

• ACEP E-QUAL Network Resources and More Information: www.acep.org/equal

• Contacts
  o Nalani Tarrant: (Project Manager) ntarrant@acep.org
  o Jay Schuur: (co-PI) jschuur@partners.org
  o Arjun Venkatesh: (co-PI) arjun.venkatesh@yale.edu
Sepsis 2016:
“What’s the problem? What’s the solution?”

David F. Gaieski, MD, FACEP
Associate Professor, Department of Emergency Medicine
Vice Chair for Resuscitation Services
Director of Emergency Critical Care
Sidney Kimmel Medical College
Thomas Jefferson University
March 23rd, 2016
Disclosures

• Bard Medical Division—research funding to investigate temperature burden in patients with severe sepsis
• No other relevant sepsis-related disclosures
Outline

• A Case
• Epidemiology of Sepsis
• Learn Baseline
• Protocolize Care
• Need for Early Recognition:
  – SIRS, Lactate
• Time to Antibiotics
• Follow up Care
• Conclusions
Case Vignette

- 54 year-old male
- Abdominal pain
- Triage VS:
  - $T^\circ$, 100.5° F -- BP, 128/78 mmHg
  - HR, 88 BPM -- RR, 21 breaths per minute
  - $O_2$ sat, 96%, RA -- Pain, 6/10
- Triaged as ESI 3 patient
- To waiting room along with 15 other patients
Typical sepsis patient

- How sick is he?
  - Does he have a time-sensitive infection?
  - How aggressive does his treatment need to be?
- On initial presentation:
  - no obvious signs of end organ dysfunction
  - Does not obviously have “severe sepsis”
- What does this mean?
Epidemiology of Sepsis
Figure 2a: Incidence of Severe Sepsis by Method Over 6-year Period

1 95% CI < 1% of total for all data points and cannot be represented graphically.

Gaieski et al, CCM, 2013
Figure 2b: In-hospital Case Fatality of Severe Sepsis by Method\(^1\)
Know Your Hospital’s Baseline
# Severe Sepsis Cohorts Derived From Claims-Based Strategies Appear to be Biased Toward a More Severely Ill Patient Population

Stacey-Ann Whittaker, MD\(^1\); Mark E. Mikkelsen, MD, MS\(^{1,2}\); David F. Galeski, MD\(^{1,3}\); Sherine Kosh, MHA, RHIA, CCS\(^4\); Craig Kean, MS\(^5\); Barry D. Fuchs, MD\(^1\)

## TABLE 2. Sensitivities of Two Different Code Abstraction Methods for Identifying Cases of Severe Sepsis and Septic Shock Determined by Patient-Level Data

<table>
<thead>
<tr>
<th>Code Abstraction Method</th>
<th>Sensitivity to Identify Severe Sepsis Cases ((n = 1735))(^a)</th>
<th>95% Confidence Interval</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Severe sepsis (ICD–9-specific coding method, 995.92)</td>
<td>20.5%</td>
<td>18.6% to 22.4%</td>
</tr>
<tr>
<td>2. Combining end-organ dysfunction and infection codes (the Angus coding method)</td>
<td>47.2%</td>
<td>44.8% to 49.5%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Code Abstraction Method</th>
<th>Sensitivity to Identify Septic Shock Cases ((n = 321))(^a)</th>
<th>95% Confidence Interval</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Severe sepsis (ICD–9-specific coding method, 995.92)</td>
<td>49.5%</td>
<td>44.0% to 55.0%</td>
</tr>
<tr>
<td>2. Septic shock (ICD–9-specific coding method, 785.52)</td>
<td>42.4%</td>
<td>37.0% to 47.8%</td>
</tr>
<tr>
<td>3. Combining end-organ dysfunction and infection codes (the Angus coding method)</td>
<td>75.1%</td>
<td>70.4% to 79.8%</td>
</tr>
</tbody>
</table>


\(^a\)Cases of septic shock (\(n = 321\)) were encompassed within the severe sepsis (\(n = 1735\)) population.

Categorical data are presented as proportions.
Getting Started
Rivers et al. NEJM, 2001

Algorithmic

Assessment and consent

Standard therapy in emergency department (n=133)

Randomization (n=263)

Early goal-directed therapy (n=130)

Vital signs, laboratory data, cardiac monitoring, pulse oximetry, urinary catheterization, arterial and central venous catheterization

CVP $\geq$ 8–12 mm Hg

MAP $\geq$ 65 mm Hg

Urine output $\geq$ 0.5 ml/kg/hr

Standard care

Hospital admission

Vital signs and laboratory data obtained every 12 hr for 72 hr

Did not complete 6 hr (n=14)

Did not complete 6 hr (n=13)

Follow-up

Continuous ScvO$_2$ monitoring and early goal-directed therapy for $\geq$ 6 hr

CVP $\geq$ 8–12 mm Hg

MAP $\geq$ 65 mm Hg

Urine output $\geq$ 0.5 ml/kg/hr

ScvO$_2$ $\geq$ 70%

SaO$_2$ $\geq$ 93%

Hematocrit $\geq$ 30%

Cardiac index

VO$_2$
Our patient. Next steps?

- Other easily obtainable data?
- What if lactate = 1.4 mmol/L?
- What if lactate = 4.1 mmol/L?
- EMR algorithm utilizes CC + VS to generate an automatic order for a serum lactate
- Drawn by EMT 10 minutes after triage
- Sent to the critical care laboratory for analysis
## Recognition

<table>
<thead>
<tr>
<th>Time</th>
<th>UnAtt</th>
<th>PT</th>
<th>Gender</th>
<th>Complaint</th>
<th>C</th>
<th>Age</th>
<th>BP</th>
<th>Temp</th>
<th>Pulse</th>
<th>O2Set</th>
<th>Resp</th>
<th>Re</th>
</tr>
</thead>
<tbody>
<tr>
<td>13:43</td>
<td>61</td>
<td></td>
<td>Male</td>
<td>Int, Shoul</td>
<td>2</td>
<td>56</td>
<td>157/100</td>
<td>97.9</td>
<td>99</td>
<td></td>
<td>14</td>
<td>14</td>
</tr>
<tr>
<td>13:59</td>
<td>84</td>
<td></td>
<td>Male</td>
<td>CP</td>
<td>2</td>
<td>51</td>
<td>153/90</td>
<td>96.4</td>
<td>105</td>
<td>96</td>
<td>14</td>
<td>14</td>
</tr>
<tr>
<td>14:22</td>
<td>10</td>
<td></td>
<td>Female</td>
<td>HTN</td>
<td>2</td>
<td>77</td>
<td>197/89</td>
<td>96.8</td>
<td>67</td>
<td></td>
<td>14</td>
<td>15</td>
</tr>
<tr>
<td>14:26</td>
<td>33</td>
<td></td>
<td>Female</td>
<td>Aboceas</td>
<td>2</td>
<td>77</td>
<td>128/49</td>
<td>95.1</td>
<td>81</td>
<td></td>
<td>14</td>
<td>15</td>
</tr>
<tr>
<td>15:27</td>
<td>17</td>
<td></td>
<td>Female</td>
<td>CO</td>
<td>2</td>
<td>20</td>
<td>123/77</td>
<td>96.8</td>
<td>72</td>
<td>99</td>
<td>14</td>
<td></td>
</tr>
<tr>
<td>15:34</td>
<td>11</td>
<td></td>
<td>Female</td>
<td>Sr Thrl</td>
<td>2</td>
<td>21</td>
<td>117/81</td>
<td>98.5</td>
<td>86</td>
<td></td>
<td>14</td>
<td></td>
</tr>
<tr>
<td>15:56</td>
<td>169</td>
<td></td>
<td>Female</td>
<td>HyperG</td>
<td>3</td>
<td>57</td>
<td>172/89</td>
<td>99.1</td>
<td>94</td>
<td></td>
<td>14</td>
<td></td>
</tr>
<tr>
<td>13:02</td>
<td>70</td>
<td></td>
<td>Female</td>
<td>NAV</td>
<td>3</td>
<td>18</td>
<td>113/68</td>
<td>96.7</td>
<td>70</td>
<td></td>
<td>14</td>
<td></td>
</tr>
<tr>
<td>13:05</td>
<td>70</td>
<td></td>
<td>Male</td>
<td>HTN</td>
<td>3</td>
<td>45</td>
<td>151/83</td>
<td>97.8</td>
<td>64</td>
<td></td>
<td>14</td>
<td></td>
</tr>
<tr>
<td>15:20</td>
<td>23</td>
<td></td>
<td>Male</td>
<td>HA</td>
<td>3</td>
<td>39</td>
<td>138/93</td>
<td>97.7</td>
<td>80</td>
<td></td>
<td>14</td>
<td></td>
</tr>
<tr>
<td>15:41</td>
<td>5</td>
<td></td>
<td>Female</td>
<td>GYN</td>
<td>3</td>
<td>28</td>
<td>117/81</td>
<td>101.8</td>
<td>105</td>
<td></td>
<td>14</td>
<td></td>
</tr>
<tr>
<td>15:44</td>
<td>1</td>
<td></td>
<td>Female</td>
<td>Dizzy</td>
<td>3</td>
<td>29</td>
<td>135/99</td>
<td>96.8</td>
<td>62</td>
<td></td>
<td>14</td>
<td></td>
</tr>
<tr>
<td>14:52</td>
<td>54</td>
<td></td>
<td>Male</td>
<td>Pain, Back</td>
<td>4</td>
<td>58</td>
<td>147/97</td>
<td>97.9</td>
<td>86</td>
<td></td>
<td>14</td>
<td></td>
</tr>
</tbody>
</table>
Need for Early Recognition

SIRS criteria and systolic blood pressure ≤ 90 mm Hg or lactate ≥ 4 mmol/liter
SIRS, Severe Sepsis

• Historically => very sensitive; but not specific
• Shapiro => neither sensitive nor specific
• 3102 pts, suspect infection (blood Cx drawn)
  – 34% of severe sepsis pts didn’t meet SIRS criteria
  – 24% of septic shock pts didn’t meet SIRS criteria
• Need other methods

ED Lactate in Severe Sepsis

Mikkelsen et al. CCM. 2009
ED Lactate in Severe Sepsis

Mikkelsen et al. CCM. 2009

Hypotensive

Mortality (%)

Lactate (mmol/L)

- 0-1.9: 15.4%
- 2-3.9: 37.3%
- > 3.9: 46.9%

28-day Mortality
Our Case: Changing Severity
Protocolized Care

- Lactate = 5.4 mmol/L → Treatment room
- 2 18 gauge IVs placed
- Bedside ECHO:
  - Under-filled RV; > 50% IVC collapse
- 3 L NSS in 1 hr
- WBC=16.5; Tbili=2.7; AST/ALT 335/284
- Repeat VS: BP 128/82; HR 84; RR 24
- Bedside ultrasound:
  - + Gallstones; + GBWT
Protocolized Care

- Continue volume resuscitation (I/O: 4550/20)
- Repeat Lactate: 3.2 mmol/L
- Repeat ECHO:
  - Decreased EF 45%; --IVC collapse negligible
- MAP decreased to 55 mmHg
  - A-line, L FA; CVC R IJV under US guidance
  - Started on NE and Dobut
- Vanco, Pip-Tazo, 1st, 50 min post-triage
Time to Antibiotics
• Study the relationship between time to antibiotics and mortality in patients treated with EGDT in the ED
• 261 patients
• Average time to antibiotics:
  – Triage to antibiotics: 119 minutes
  – Qual for EGDT to antibiotics: 42 minutes

Gaieski et al. Crit Care Med, 2010
Time Qual for EGDT to Appropriate Antibiotics

Galeski et al. Crit Care Med, 2010
**Pre-Antibiotic Guidelines**
Begin immediately after 2 sets of blood + other cultures drawn, lactate etc

**Broad-Spectrum Antimicrobials:**
+ Cefepime 1 gm IV (1)
+ Vancomycin 1 gm (≤ 70 kg) or 1.5 gm (> 70 kg) IV
± Amikacin 15 mg/kg or 7.5 mg/kg (CrCl < 20) IV (4)

**Community Acquired Pneumonia:**
+ Azithromycin 500 mg IV (2)

**Anaerobic Source:**
+ Metronidazole 500 mg IV (3)

**On TPN:**
+ Fluconazole 400 mg IV

**Prolonged Neutropenia ± Steroids:**
+ Caspofungin 70 mg IV
± Hydrocortisone 50-100 mg IV

**Broad-Spectrum Antimicrobials:**
+ Levofloxacin 750 mg IV
+ Vancomycin 1 gm (≤ 70 kg) or 1.5 gm (> 70 kg) IV
± Amikacin 15 mg/kg or 7.5 mg/kg (CrCl < 20) IV (4)

Gaieski et al, CCM, 2011
Preventing Readmissions
Post-Discharge Problems

“Unfortunately, discharge from a severe sepsis hospitalization is all too often the beginning of the end”

Readmissions @ Penn

- Admitted with septic shock and discharged alive to a non-hospice, 2007-2010
- 269 at-risk survivors:
  - 63 (23.4%) readmitted within 30 days of discharge
  - 16% resulted in death or d/c to hospice
  - 46% of readmits were infection-related
- Is “sepsis follow-up clinic” the answer?
  - Piloted @ Vanderbilt

Ortego et al. CCM, 2015
Case Conclusion

• Evaluated by ESS
• Went to IR for a percutaneous drain
• E. coli in blood cultures and drainage fluid
• On NE and DOBUT for 3 days
• Clinically stabilized
• Delayed cholecystectomy
• Discharged in good condition on HD-17
Sepsis Improvements @ HUP

- Baseline IHM, 2002-2004: 25.4%
- Baseline EGDT era, 2005-2007: 18.9%
- 2009:
  - 532 patients w/ SS
  - IHM: 9.8%
  - 398 pts (75%): 1st Lactate > 2.1mmol/L
  - 41% Qual EGDT; 58% Received EGDT
  - Rest modified protocol w/ US, LacClear
- Always tweaking protocol
ProCESS

### A Cumulative In-Hospital Mortality to 60 Days

<table>
<thead>
<tr>
<th>Days</th>
<th>Mortality (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>20</td>
<td>20</td>
</tr>
<tr>
<td>30</td>
<td>25</td>
</tr>
<tr>
<td>40</td>
<td>30</td>
</tr>
<tr>
<td>50</td>
<td>35</td>
</tr>
<tr>
<td>60</td>
<td>40</td>
</tr>
</tbody>
</table>

- **Protocol-based EGDT**
  - No. at Risk: 439, 373, 356, 348, 347, 347, 347
- **Protocol-based standard therapy**
  - No. at Risk: 446, 389, 376, 368, 366, 366, 365
- **Usual care**
  - No. at Risk: 456, 396, 376, 371, 371, 371, 370

*P = 0.52 by log-rank test*
**Figure 2.** Kaplan–Meier Survival Estimates.
A Survival

A graph showing survival probability over days since randomization. The graph compares EGDT and usual care groups. The survival probability decreases over time for both groups, with EGDT showing slightly better survival rates at most time points.

<table>
<thead>
<tr>
<th>Days since Randomization</th>
<th>EGDT</th>
<th>Usual care</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>1.00</td>
<td>1.00</td>
</tr>
<tr>
<td>30</td>
<td>0.85</td>
<td>0.83</td>
</tr>
<tr>
<td>60</td>
<td>0.75</td>
<td>0.73</td>
</tr>
<tr>
<td>90</td>
<td>0.65</td>
<td>0.63</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>No. at Risk</th>
<th>EGDT</th>
<th>Usual care</th>
</tr>
</thead>
<tbody>
<tr>
<td>EGDT</td>
<td>792</td>
<td>796</td>
</tr>
<tr>
<td>Usual care</td>
<td>677</td>
<td>670</td>
</tr>
</tbody>
</table>

The table shows the number of patients at risk for each group at different time points.
Conclusions

• Huge epidemiologic burden of sepsis
• Know your baseline; know your weak links
• In 2016, “standard care” = “protocolized care”
• Recognition: major hurdle
  – SIRS: Helpful but not infallible
  – Lactate: marker and screening tool; automate
• Track outcomes; modify protocol for institution
• Complications of sepsis continue post-d/c
• Details always changing/further research needed