The ACMC Sepsis Journey
Most Sincere Thanks to

The Gordon and Betty Moore Foundation

INLP and Change Agent Program
Introductions - Presenters

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The ACMC Team

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Learning Objectives

• Differentiate between Infection, SIRS, sepsis, severe sepsis, and septic shock

• Identify why sepsis is a national priority

• Communicate three clinical strategies that impact sepsis outcomes

• Communicate three team/organizational strategies to use to influence change
About ACMC - 2011

• **Mission:** ACMC is committed to maintaining and improving the health of all county residents regardless of their ability to pay - 40,500

• 475 licensed beds - Acute inpatient (Highland), acute psychiatric (JGPP), acute rehabilitation and skilled nursing care (Fairmont) - 13,649 admissions

• ACMC Regional Trauma Center-Level II served 2,246 patients

• Performed 4,933 inpatient and outpatient surgeries

• Performed 1,154 deliveries
The Impact of Sepsis

Severe sepsis and septic shock cause >200,000 deaths per year in the US

The mortality of severe sepsis is 30% to 50%; the mortality of septic shock is 50% to 80%

Annual cost to treat is about $16.7 billion

The incidence of sepsis is increasing and projected to rise at a rate of 1.5% per year
<table>
<thead>
<tr>
<th>Care Priorities</th>
<th>U.S. Incidence</th>
<th># of Deaths</th>
<th>Mortality Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>AMI (1)</td>
<td>900,000</td>
<td>225,000</td>
<td>25%</td>
</tr>
<tr>
<td>Stroke (2)</td>
<td>700,000</td>
<td>163,500</td>
<td>23%</td>
</tr>
<tr>
<td>Trauma (3) (Motor Vehicle)</td>
<td>2.9 million (injuries)</td>
<td>42,643</td>
<td>1.5%</td>
</tr>
<tr>
<td>Severe Sepsis (4)</td>
<td>751,000</td>
<td>215,000</td>
<td>29%</td>
</tr>
</tbody>
</table>

## The Path to Septic Shock

<table>
<thead>
<tr>
<th>Infection</th>
<th>SIRS</th>
<th>Sepsis</th>
<th>Severe Sepsis</th>
<th>Septic Shock</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Infection</td>
<td>• Inflammatory response to microorganisms</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Systemic Inflammatory Response Syndrome (SIRS)</td>
<td>• Core temperature &gt;38°C (100.4) or &lt;36°C (96.8)</td>
<td>• Elevated heart rate &gt;90</td>
<td>• Sepsis plus</td>
<td>• Hypotension despite fluid resuscitation, or</td>
</tr>
<tr>
<td></td>
<td>• Respiratory rate &gt;20 or PaCO₂ &lt;32 mm Hg or mechanical ventilation for acute respiratory failure</td>
<td>• WBC count &gt;12,000 or &lt;4,000 or &gt;10% bands</td>
<td>• ≥1 organ dysfunction</td>
<td>• Perfusion abnormalities</td>
</tr>
</tbody>
</table>

- Sepsis: 1991 ACCP / SCCM Definitions

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Relationship of SIRS, Sepsis, and Infection

- BACTEREMIA
- FUNGEMIA
- PARASITEMIA
- VIREMIA
- OTHER

INFECTION

- Positive Cultures?
- Suspected Infection?
- On Antibiotics?
SIRS

≥ 2 of the following:

- Heart Rate > 90
- Temperature > 38 or < 36
- RR > 20 or PCO₂ < 32
- WBC > 12,000 or < 4,000 or > 10% Bands

Relationship of SIRS, Sepsis, and Infection
Relationship of SIRS, Sepsis, and Infection

SEPSIS
Where infection and systemic inflammation meet
Severe Sepsis

Sepsis plus acute organ dysfunction
Relationship Of SIRS, Sepsis, and Infection

- Bacteremia
- Fungemia
- Parasitemia
- Viremia
- Other
- Pancreatitis
- Trauma
- Burns
- Other

SIRS - Systemic Inflammatory Response Syndrome

SEPSIS

SEPTIC SHOCK

SEVERE SEPSIS

INFECTION
Severe Sepsis Kills

![Bar chart showing the comparison of Heart Attack, Stroke, and Severe Sepsis in terms of U.S. Incidence and Deaths.]

Source: Centers for Disease Control

CDC2009
Severe Sepsis is an Emergency - Video

Trauma

Sepsis
Check out ACMCs YouTube Video
Over 22,400 Hits!

http://www.youtube.com/watch?v=mgYbIrbCFIq
Surviving Sepsis Campaign ( SSC) Guidelines for Management of Severe Sepsis and Septic Shock


_Crit Care Med_ 2004;32:858-873
_Intensive Care Med_ 2004;30:536-555
available online at
www.springerlink.com
www.sccm.org
www.sepsisforum.com

Updated January, 2008 Critical Care Medicine
Surviving Sepsis Campaign Bundles

- Sepsis Resuscitation Bundle
  - Early recognition of severe sepsis/septic shock
  - Early-Goal Directed Therapy to be completed in 6 hours

Sepsis Management Bundle (if EGDT not successful)
  - After all EGDT interventions implemented
  - Continues until patient recovers or expires
Surviving Sepsis Campaign
Sepsis Resuscitation Bundle

- Early recognition of severe sepsis/septic shock
- Fluid bolus $\geq 1000$ml crystalloid (300-500 colloid) over 30 min, then q 1 hour to achieve CVP $\geq 8$ ($\geq 12$ if ventilated)
- Superior vena cava catheter insertion within 1 hr with measurement of CVP and venous saturation
- Broad spectrum antibiotic within 1 hr of identification of severe sepsis
- Vasopressors to achieve MAP $\geq 65$
  - Norepinephrine or dopamine initial vasopressor
- Dobutamine in patients with myocardial dysfunction
- Source management

SSC Action Plan

- Build awareness of sepsis
- Improve early and accurate diagnosis
- Increase the use of appropriate treatments and interventions
- Educate HCPs about sepsis diagnosis, treatment, and management
The ACMC Journey Begins!

2008- Pre-INLP - lack of infrastructure - poor data definition, team without skills

2009- INLP Grant starts and the journey begins with the gift of wisdom and tools!

- Team Selection- Inviting front line staff to participate in improvement

- Discovering team dynamics - overcoming challenges

- The gift of leadership development - learning new tools
The gift of leadership development—learning new tools

- Project Management Skills
- Using PDSA
- Screening Tools
- Bundles
- Early Goal Directed Therapy
- Education
Assessment Tool for Screening Patients

### Patient Information
- **Name:** Merlyn Training Patient, Donotuse
- **Age:** 59 yr
- **Gender:** M
- **Attending:** Subramanian, Indhu M.
- **Fac. Dept.:** Highland - TRNG
- **DOB:** 07/11/1950
- **Admit Dt.:** 06/06/2009

### Diagnosis
- **Service:** 999
- **Rn-Bad:** 101-1
- **MPN:** 999999999

### Sepsis Screening

<table>
<thead>
<tr>
<th>Notification/Comment</th>
<th>More Results</th>
<th>11/13/2008</th>
<th>12/01/2008</th>
<th>12/04/2008</th>
<th>12/21/2008</th>
<th>01/19/2010</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sepsis Screening</td>
<td></td>
<td>11:10</td>
<td>03:30</td>
<td>11:30</td>
<td>13:52</td>
<td>14:36</td>
</tr>
</tbody>
</table>

**Step 1: Question 1**
- Any 2 New S/S?
  - Hypertension >101F
  - Hypothermia <96.8F
  - Tachycardia >90Bpm
  - New or Increased Need For O2
  - Tachypnea >20 Bpm
- Acutely Altered Mental Status
- Leukocytosis (WBC Count >12,000)
- Leukopenia (WBC Count <4,000)
- SBP <90 or >40 Below Baseline

**Step 1: Question 2**
- New Infection?
- Pneumonia/Empyema

### Action
- Yes
- No
Assessment Tool for Screening Patients
EGDT - The Six Hour Clock
Severe Sepsis Orders and Protocol
Pilot

6 HOUR BUNDLE

Time of Presentation: (lactic acid > 4 or hypotensive) Time: ___________ (RN fill in) Date: _____ / _____ / _____

Start Time for 6 Hour Bundle: Date: _____ / _____ / _____ (MD fill in) Time: _____ (24 Hr clock)

Immediately request transfer of patient to the ICU or SDU (if appropriate) and begin 6 hour bundle.

(Document start times on flow sheet. Note sequence in no particular order.)

Height _______ (feet) _______ (inches) Weight _______ (kg)

DRUG ALLERGY: ____________________________________________________________________________ (reaction: __________________)

- Draw labs:
  - Blood cultures x2, CMP, CBC, PT/PTT/INR, U/A, Lactic acid

- Administer Antibiotic within one hour of diagnosis. Please check box and fill in space(s) if needed
  - *Piperacillin/Tazobactam (Zosyn™) 4.5 gram IVPB q 6 hrs (Do Not Use in PCN allergy)
  - *Vancomycin _______________ (15 mg/kg) (actual dry body wt) IVPB q 12 hrs
    - (Each vancomycin dose should NOT exceed 1500 mg per dose or 1.5 gram per dose)
  - *Astroneum 2 gram IVPB q 8 hrs (Typical, use in penicillin allergic patient)
  - Metronidazole 500 mg IVPB q 6 hrs
  - Clindamycin 900 mg IVPB q 8 hrs
  - Doxycycline 100 mg IVPB q 12 hrs
  - *Levofloxacin 750 mg IVPB q 24 hrs (Do Not Use in patients concerned for MTB)
  - Linezolid (Zyvox™) 600 mg IVPB q 12 hrs
  - *Amikacin _______________ (15 mg/kg) (adjusted body wt if obese) IVPB q 24 hrs
    - (Adjusted body wt = Ideal body wt + 0.4 x (Total body wt – Ideal body wt))
  - *Amikacin (15 mg/kg) (adjusted body wt if obese) IVPB x 1
  - Ceftriaxone 2 gram IVPB q 12 hrs
  - Other ____________________________________________________________________________
  - Other ____________________________________________________________________________

* RENAL DOSSING for Zosyn, Levofloxacin, Vancomycin, Amikacin, please check appropriate box(es) and fill in space(s) if needed. (CrCl = "creatinine clearance")

Piperacillin/Tazobactam (Zosyn™)
- 4.5 gram IVPB q 8 hrs
- 4.5 gram IVPB x 1, then 2.25 gram IVPB q 6 hrs
- 4.5 gram IVPB x 1, then 2.25 gram IVPB q 8 hrs plus additional 0.75 gram IVPB after each hemodialysis session
  - (if CrCl = 20-40 ml/min)
  - (if CrCl = 20 ml/min)
  - (if on hemodialysis)

Vancomycin
- ____________________________ (15 mg/kg) IVPB q 24 hrs
- ____________________________ (15 mg/kg) IVPB x 1, then check Vancomycin random level 24 hrs after dose.
  - redose with same dose when level < 15 mcg/ml
  - (if CrCl = 20-40 ml/min)
  - (if CrCl = 20 ml/min, or on hemodialysis)
  - (Each Vancomycin dose should NOT exceed 1500 mg per dose or 1.5 gram per dose)

Levofloxacin
- 750 mg IVPB q 48 hrs
- 750 mg IVPB x 1, then 500 mg IVPB q 48 hrs
  - (if CrCl = 20-40 ml/min)
  - (if CrCl = 20 ml/min or on hemodialysis)

Astroneum
- 2 gram IVPB x 1, then 1 gram IVPB q 8 hrs
- 2 gram IVPB x 1, then 500 mg IVPB q 8 hrs
  - (if CrCl = 20-40 ml/min)
  - (if CrCl = 20 ml/min or on hemodialysis)
- 2 gram IVPB x 1, then 500 mg IVPB q 8 hrs plus additional 250 mg IVPB after each hemodialysis session
  - (if on hemodialysis)
Severe Sepsis Orders and Protocol

**Pilot**

*Amikacin*
(Use adjusted body wt for obese patient = Ideal body wt + 0.4 x (Total body wt – Ideal body wt))

☐ 7.5 mg/kg IVPB q12 (if CrCl= 50-80 ml/min)
☐ 7.5 mg/kg IVPB q24h (if CrCl= 30-50 ml/min)
☐ 7.5 mg/kg IVPB q48h (if CrCl< 30 ml/min)
☐ 7.5 mg/kg IVPB x 1, then check Amikacin random level 48 hours after dose or check level before next hemodialysis, redose with (5 mg/kg) IVPB when level <10 mcg/ml. (if CrCl< 10 ml/min or on hemodialysis)

Time ordered _____________ Time administered ______________

> **Start intravenous fluid bolus of Normal Saline 0.9% (20 to 40 ml/kg) (RN fill in times)**

☐ Amount of NS to be administered ______________ Patient weight in kg ______________

Time started _______________ Time completed ________________

☐ Lactate every ____________ hours (Consider serial lactates until lactate decreased to ≤ 2 mmol/L.)

> **Place Central Venous Line and obtain CVP.**

Time central line placed _______________ (RN fill in)

Document baseline CVP with goal of 8-12 mmHg. Initial CVP= _______________ (RN fill in)

Continue to bolus with Normal Saline 0.9% until CVP goal achieved.

Draw and record CVO2 Initial CVO2_______________ (RN fill in)

> **After initial bolus of Normal Saline 0.9% continue to bolus every 30 minutes at 20ml/kg to maintain:**

UOP > 0.5 ml/kg/hour

CVP goal of 8-12 mmHg Time CVP goal achieved _______________ (RN fill in)

Lactate decreased under 2 mmol/L (if applicable) Time Lactate goal achieved _______________ (RN fill in)

> **Obtain CVO2 Saturation every hours: treat if <70% and CVP goal achieved (8-12 mmHg):**

☐ If CVO2 saturation < 70%, administer Packed RBC to achieve Hemoglobin goal of 10 g/dL

☐ Repeat CVO2 saturation and if <70% with Hemoglobin goal of 10 then consider:

☐ Dobutamine infusion (conc= 2000 mcg/ml) (Range= 5-20 mcg/kg/min)

*(Dobutamine is compatible with Norepinephrine, Dopamine, Phenylephrine or Epinephrine.)*

☐ Place Foley Time _______________ ☐ N/A Foley in place

> **IF MAP<65 start vasopressors:**

**First Line Vasopressors:**

☐ Norepinephrine (Levophed®) drip (conc= 16 mcg/ml) (Range= 8-70 mcg/min)

*(Acceptable maximum dose is 1 mcg/kg/min)*

☐ Dopamine drip (concetration= 1600 mcg/ml) (Range= 5-20 mcg/kg/min)

**Second Line Vasopressors (Maximize first line pressors):**

☐ Phenylephrine (Neoephedrine®) drip (conc= 240 mcg/ml) (Range= 40-360 mcg/min) – Only use when having tachy arrhythmia’s from norepinephrine and dopamine.

☐ Vasopressin drip (concetration= 0.4 units/ml) (Range 0.01 – 0.04 units/min in addition to other vasopressors)

☐ Epinephrine drip (concetration= 4 mcg/ml) (Range= 2-10 mcg/min) – use when poorly responsive to norepinephrine or dopamine

Completion of 6 Hour Bundle: Date: ___________ Time (RN fill in) _______________

Page 2 of 3

Physician Signature/date _______________
The Twenty-Four (24) Hour Bundle.
(Within the first 24 hours initiate the following therapies)

- **Identify drainable sources of infection:**
  - CT scan _________ body part
  - MRI, if CT unavailable or clinically indicated, _________ body part
  - Ultrasound, if clinically indicated, _________ body part

- **Drain any appropriate sources of infections:** *(document source and procedure in progress notes)*

- **Lung protective strategy with plateau pressures < 30cm H2O** for mechanically ventilated patients.
  *(Recommend using ARDS Net protocol)*

- **Consider steroids for blood pressure unresponsive to fluids and vasopressors or increasing vasopressor requirements:**
  - Hydrocortisone 50mg IV every 6 hours
  - Fludrocortisone (Florinef) 50mcg PO every day *(optional)*

- **Consider glucose control to keep glucose < 180 mmol/L:**
  - Start Hyperglycemic protocol

- **Start DVT prophylaxis:**
  - Enoxaparin 40 mg SQ every day *(for patient with platelet count > 100k, CrCl > 30 ml/min, no s/s of bleeding and NOT on recent/anticipated epidural/spinal anesthesia)*
  - Heparin 5000 units SQ Q12hrs
  - Heparin 5000 units SQ Q8hrs *(for patient at high risk for DVT or obese patient)*
    *(Heparin is for patient with platelet count > 100k, no s/s of bleeding and NOT on recent/anticipated epidural/spinal anesthesia)*
  - Sequential Compression Device (SCD)

- **Start stress ulcer prophylaxis**
  - Famotidine (Pepcid) 20 mg PO/IV Q12hrs
  - Renal dosing Famotidine (Pepcid) 20 mg PO/IV every day *(if CrCl < 50 ml/min)*
  - Esomeprazole (Nexium) 40 mg PO every day

- **Consider Activated Protein C (Xigris) per ACMC guidelines:**
  - APACHE II score ________

- **Consider serial lactates to document improvement:**
  - Lactate every ____ hours until ≤ 2 mmol/L.

**Completion of 24 hour bundle**

Date ___________ Time ___________ (24 hour clock)

Page 3 of 3  Physician Signature/date ___________
Severe Sepsis/Septic Shock Mortality and Organ Failure

The more organs affected the higher the mortality

The goal of the protocol is to identify and intervene early to prevent the cascade of organ failure

Who Is The First To See It?

RN

Surviving Sepsis Campaign Protocol
A New Twist
Harm Reduction Initiative
included Sepsis
July 2010-December 2011
Board of Trustees & Chief Exec Officer Initiate HRT Effort

Medical Staff Accepts Challenge and Sets Goal

Chief Medical Officer and Quality Dept. Launch the Effort

July 2010

Dr. Sang-ick Chang
Chief Medical Officer
What was new about this effort?

- Clear and compelling goal
- Leadership attention
- Involvement of all hospital communities
- Data focus
What the Teams Did

- Developed new cross-discipline problem solving tools
- Educated themselves about data
- Researched and selected promising strategies
- Initiated 49 new change efforts
- Planned, tested and implemented 77 new ways of doing things
Harm Reduction Team- Reducing Mortality Due to Severe Sepsis

Strategies

- Standardizing clinical pathways for diagnosing and treating sepsis
- Raising awareness to improve early diagnosis
- Empowering nurses to act on suspicion of sepsis
- Moving critical tests from lab to point of care
- Speeding up access to appropriate antibiotics

What We Did

- Added sepsis bundle elements to Smart Orders
- Developed nurse early diagnosis screening protocol used at admission and transfer
- Developed lab ordering pathway for nurses to begin diagnosis independent of MDs
- Put point of care lactate testing on floors
- Added broad spectrum antibiotics to stock in ED and ICU
- Created innovative and fun Sepsis Diagnosis video on YouTube

Is Anyone Better Off (and how do we know)?

- Reached or exceeded 50% reduction goal in past 3 out of 6 months
- Smart Orders data shows increased use of bundle elements

Next Steps

- More monitoring of adherence to bundle to be certain of change
- Audit rates of use of screening protocol and POC testing
- Broaden effort to include more departments

For Further Information Contact: Indhu Submaranian
isubmaranian@acmedctr.org
Sepsis screening

ACMC Sepsis Screening 2010 to 2012

ACMC Sepsis Screening 2010 to 2012

ACMC Sepsis Screening 2010 to 2012

ACMC Sepsis Screening 2010 to 2012
ACMC Bundle Compliance

- Lactate
- Blood Culture
- ABX
- Fluid Bolus
- Bundle

- 2010
- 2011
Accomplishments:

- Baseline data
- Daily screening for Sepsis at 0800, 1600, 2400 in MERLIN
- Multidisciplinary Education
- Sepsis Protocol
- Standardized Procedure for nursing
- Sepsis Video
Where we are now:

- Streamlined resources: Antibiotics, POC Lactic Acid, Lactic Acid “Panic Value”
- Sepsis Protocol in SMART (standard) orders
- Sepsis education embedded into unit competencies
- Proactive Rapid Response model
Goals moving forward...

- **Improved Bundle Compliance**
  - Continue to work on improving compliance - hardwire

- **Improve Process and Protocols**
  - “sepsis nurse / “code sepsis trial to begin
  - Re-energize the HRT. Reach a consensus on the controversial components of the 6 hr treatment bundle
  - Critical Care Nurse Coordinator
  - Real-time sepsis case review

- **Data Management**
  - Data collection and data base beginning to form
  - Compare ICD-9 with non-coded vs APACHE data
  - Evaluation of data to keep process evidence based and fluid and transparent
ACMC Results for Integrated Nurse Leadership Program

### Alameda Hospital Sepsis Improvement

**Alameda Hospital**  
**08 Annlz**  |  **09 Annlz**  |  **2010**  |  **2011 Annlz**
---|---|---|---
**Total Sepsis Cases** | 358 | 238 | 231 | 198
**Total Sepsis Mortalities** | 116 | 32 | 70 | 50
**Percent Mortality** | 32% | 13% | 30% | 25%
**Cost of Sepsis Mortalities** | $2,067,419 | $566,883 | $1,252,444 | $903,571
ACMC-Sepsis Mortality Trending Downward

ACMC - Sepsis Mortality Averages Totaled by Month Each Year - Past 6 years 2007-2012
(Trended)
Thank You....... Questions?