

# It's Sepsis and You Know It

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## Program Objectives

1. Define sepsis across the continuum
2. Understand your role, as a progressive/critical care nurse, in the recognition and management of sepsis
3. Describe at least 3 interventions included in the Surviving Sepsis Campaign Resuscitation Bundle
4. List additional resources for improving sepsis recognition and management at your organization

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Defining Sepsis

## THE SEPSIS CONTINUUM

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### Brief History of Theory of Sepsis




(460-370 B.C.) Hippocrates first introduced the word "sepsis"





(1818-1865) Ignaz Semmelweis was the first researcher who developed a modern view of sepsis – studied the OB population in search of ways to impact "puerperal fever", a bacterial infection during childbirth . He advocated for the use of gloves and hand hygiene. He died of a septic wound infection.



(1822-1895) Louis Pasteur discovered that tiny single cell organisms cause putrefaction – decay or rotting. He called them bacteria/microbes and correctly deduced that these microbes could be causing disease and researched sterilization.



(1904) Sir William Osler - "Humanity has but three great enemies: fever, famine and war; of these by far the greatest, by far the most terrible, is fever...except on a few occasions, the patient appears to die from the body's response to infection rather than from it (infection itself)", probably the most influential physician in the English-speaking world, wrote this quotes in his famous textbook, The Evolution of Modern Medicine.



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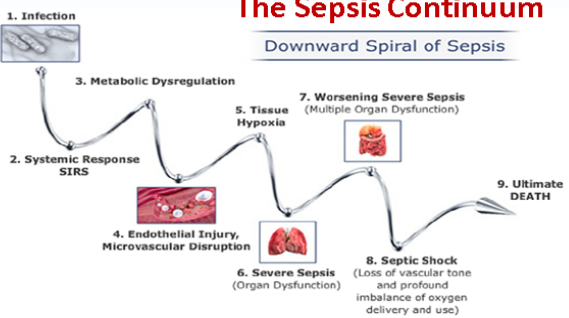
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### The Sepsis Continuum

Downward Spiral of Sepsis





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### Systemic Inflammatory Response Syndrome (SIRS)

- A clinical response arising from a non-specific insult resulting in  $\geq 2$  of the following:
  - Temperature  $> 38^{\circ}\text{C}$  or  $< 36^{\circ}\text{C}$
  - HR  $> 90/\text{min}$
  - RR  $> 20/\text{min}$
  - WBC  $> 12$  or  $< 4$  or Bands  $> 10\%$





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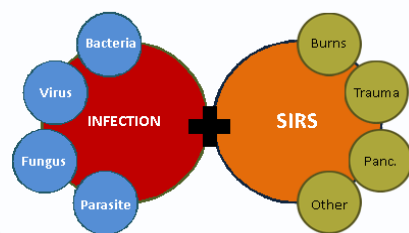
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### What is Sepsis?

- Persistent SIRS caused by an infection (suspected or confirmed)



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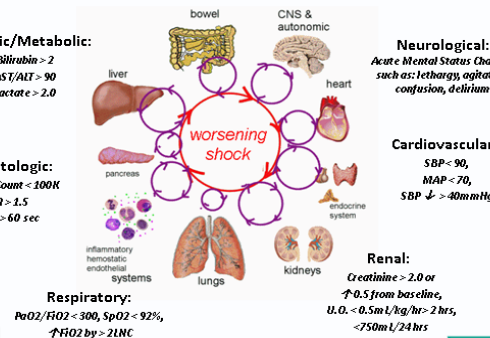
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### Organ Dysfunction as a Marker of Severe Sepsis



**Hepatic/Metabolic:**  
Bilirubin > 2  
AST/ALT > 90  
Lactate > 2.0

**Hematologic:**  
Platelet Count < 100K  
INR > 1.5  
aPTT > 60 sec

**Respiratory:**  
PaO2/FiO2 < 300, SpO2 < 92%,  
↑ FiO2 by > 21%

**Renal:**  
Creatinine > 2.0 or  
↑ 0.5 from baseline,  
U.O. < 0.5 mL/kg/hr > 2 hrs,  
< 750 mL/24 hrs

**Cardiovascular:**  
SBP < 90,  
MAP < 70,  
SBP ↓ > 40 mmHg

**Neurological:**  
Acute Mental Status Changes  
such as: lethargy, agitation,  
confusion, delirium

**CNS & autonomic**

**worsening shock**

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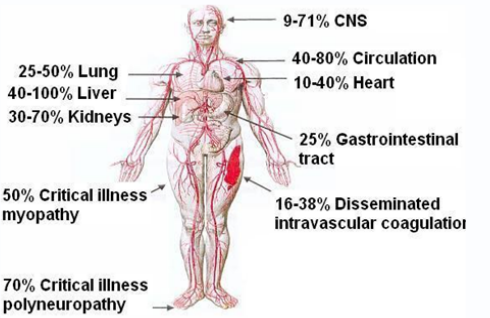
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### Organ Systems Involved in Sepsis



9-71% CNS

25-50% Lung

40-100% Liver

30-70% Kidneys

50% Critical illness myopathy

70% Critical illness polyneuropathy

40-80% Circulation

10-40% Heart

25% Gastrointestinal tract

16-38% Disseminated intravascular coagulation

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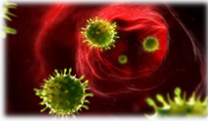
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### Septic Shock

- Sepsis induced acute circulatory failure, resulting in persistent hypotension – **despite adequate fluid resuscitation**
  - ✓ SBP <90 mmHg
  - ✓ MAP <70 mmHg
  - ✓ Decrease in SBP > 40 mmHg
  - ✓ Lactate ≥ 4.0\*




Surviving Sepsis Campaign: 2012 International Guidelines





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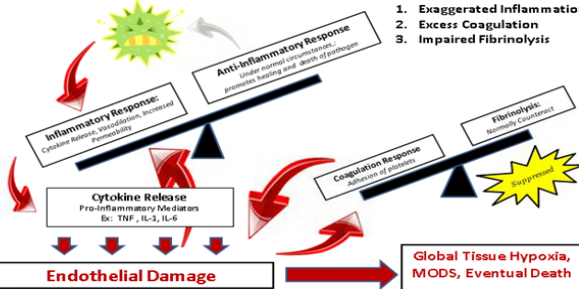
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### Sepsis Pathophysiology: Extremely Simplified




1. Exaggerated Inflammation  
2. Excess Coagulation  
3. Impaired Fibrinolysis

**Global Tissue Hypoxia, MODS, Eventual Death**





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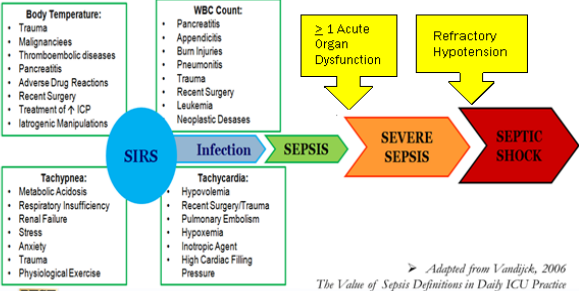
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### Summary: The Sepsis Continuum



**SIRS** → **Infection** → **SEPSIS** → **SEVERE SEPSIS** → **SEPTIC SHOCK**

**Body Temperature:**  
• Trauma  
• Malignancies  
• Thromboembolic diseases  
• Pancreatitis  
• Adverse Drug Reactions  
• Recent Surgery  
• Treatment of a ICP  
• Iatrogenic Manipulations



**WBC Count:**  
• Pancreatitis  
• Appendicitis  
• Burn Injuries  
• Pneumonitis  
• Trauma  
• Recent Surgery  
• Leukemia  
• Neoplastic Diseases


**Tachypnea:**  
• Metabolic Acidosis  
• Respiratory Insufficiency  
• Renal Failure  
• Stress  
• Anxiety  
• Trauma  
• Physiological Exercise

**Tachycardia:**  
• Hypovolemia  
• Recent Surgery/Trauma  
• Pulmonary Embolism  
• Hypoxemia  
• Inotropic Agent  
• High Cardiac Filling Pressure


**≥ 1 Acute Organ Dysfunction** → **SEVERE SEPSIS** → **SEPTIC SHOCK** (Refractory Hypotension)

Adapted from Vandijck, 2006  
The Value of Sepsis Definitions in Daily ICU Practice





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### Why Focus on the Basics?

- Sepsis Knowledge Survey

Participant Detail	2011	2013
Total # of Participants	947	493
Nursing Participants	673	404
% Nursing	71.1%	81.9%

SIRS Recognition	2011	2013
SIRS: Temp <30	83.1%	86.4%
SIRS: PaCO2 <32	79.0%	81.9%
SIRS: WBC <4	80.2%	83.3%
SIRS: Bands >10%	80.3%	81.7%

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### Why Focus on the Basics?

- Sepsis Knowledge Survey

Sepsis Recognition	2011	2013
Cellulitis+ Temp 35.7, RR 22, WBC 11.8		
Sepsis	58.2%	61.6%

Severe Sepsis Recognition	2011	2013
Cystitis+ T 38.4, HR 125, BP 85/40, RR 32, Low UO		
Sepsis	11.0%	11.1%
Severe Sepsis	87.4%	88.4%

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### Sepsis Mortality Across the Continuum

Systemic inflammatory response syndrome (≥2 of the following)  
Temperature, >38°C or <36°C  
Pulse, >90/min  
Respirations, >20/min  
White cells, >12,000 or <4000/mm<sup>3</sup> or >10% band forms

Septic shock  
(severe sepsis plus refractory hypotension)  
200,000 cases

Severe sepsis  
(sepsis plus organ failure)  
300,000 cases

Sepsis  
(systemic inflammatory response syndrome plus evidence of infection)  
400,000 cases

	Crude mortality	Number of deaths annually
Septic shock	45%	90,000
Severe sepsis	20%	60,000
Sepsis	15%	60,000
Total:		210,000

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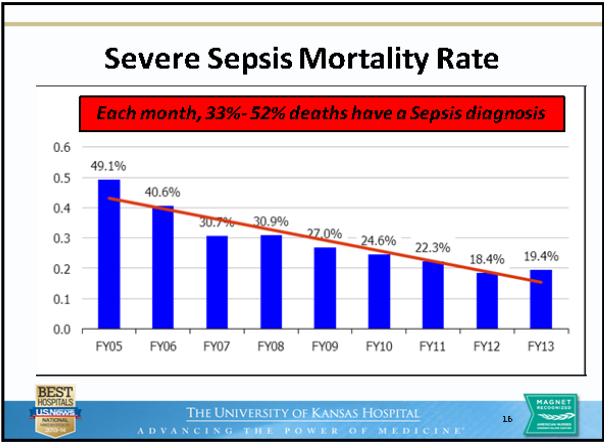
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### Organ Dysfunction and Mortality

- The most common organs that fail are those in the cardiovascular and pulmonary systems
- Mortality rates significantly increase as more organs are involved:
  - 1 organ dysfunction ~ 21% mortality
  - 2 organ dysfunctions ~ 44% mortality
  - 3 organ dysfunctions ~ 65% mortality
  - 4 organ dysfunctions ~ 76% mortality

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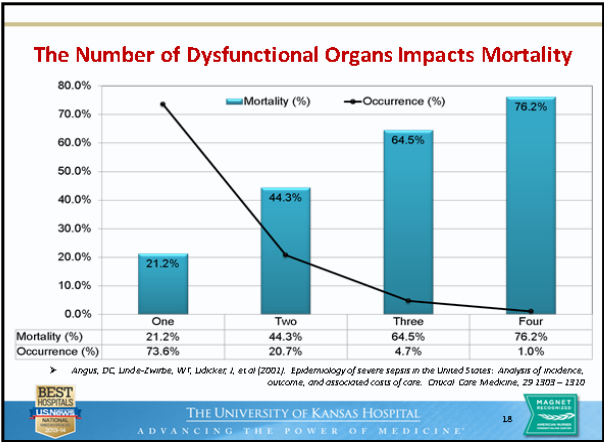
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### What is Your Role?

- 1) Recognize Subtle Changes
  - ✓ Be vigilant at all times for early signs of sepsis
  - ✓ Infection? SIRS? Acute Organ Dysfunction?
- 2) Anticipate Interventions
  - ✓ Blood Cultures, Lactate, IV Access, Antibiotics, Fluids
- 3) Communicate Concerns
  - ✓ Package your message using ISBARR
- 4) Treat Sepsis with the same sense of urgency as a Stroke or MI.

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Top 20 Discharge Physician Specialties for Discharge APR-DRG:  
720 SEPTICEMIA & DISSEM INFECT  
Mar 2012 through Feb 2013

General Internal Med

Pulmonary/Crit Care

Internal Med Heme/Onc

Family Practice

Neurology/Neurocritical Care

Oncologic Surg

Orthopedic Surg

Otolaryng/Head&Neck

Sepsis is not just an ICU Problem!

Keep in Mind: Every patient is at risk of infection and developing sepsis

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### A Note about Severe Sepsis

- The patient with severe sepsis is already quite ill, but can still look okay due to the body's amazing capacity to compensate for failing systems.

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### What is Your Role?


#### Maintain an Index of Suspicion

- Subtle changes may indicate systemic compensatory mechanisms
  - Heart Rate (Tachycardia)
  - Respiratory Rate (Tachypnea)
- Early indicators of patient deterioration
  - Increasing oxygen needs
  - Altered Mental Status (Confusion, Lethargy, Agitation)



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### Understanding Risk Factors

- Recent surgery or trauma
- Indwelling medical device
- Elderly or very young
- Immunocompromised
- Recent hospitalization
- Currently receiving antibiotics or recent history of infection



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### Diagnostic Challenges of Early Recognition


1. There is NO sepsis-specific diagnostic marker
2. SIRS – NOT specific to infection
3. Confirming an infection diagnosis relies on Lab/ Radiographic systems with slow turn around time
4. Strong compensatory mechanisms result in cryptic shock (elevated lactate with normal vital signs)
5. Clinical symptoms frequently manifest in the absence of a positive culture

**THESE BARRIERS AND OTHERS CONTRIBUTE TO A DELAYED SEPSIS DIAGNOSIS AND ANTIBIOTIC THERAPY**



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### What is Your Role?

**Maintain an Index of Suspicion**  
Think Sepsis until proven otherwise

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### Normalization of Risk: Migration of Safety Boundaries

**ACCIDENT**

Driving 80, the “illegal – illegal” speed

Driving 70, the “illegal – normal” for almost all of us

The posted speed limit is 60 mph

Life Pressures

Perceived Vulnerability

Belief Systems

Individual Benefit

Performance

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### Normalization of Risk: Migration of Safety Boundaries

**PREVENTABLE HARM**

SBP > 70

SBP > 80

SBP > 90

Life Pressures

Perceived Vulnerability

Belief Systems

Individual Benefit

Performance

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### Real Life Examples of Normalization

- Varying thresholds of acuity can contribute to
  - Delays in timeliness of diagnosis
  - Delays in RRT activation
  - Patient placement considerations whether from ED, RRT, Transfers, or Direct admit
  - Expected physiological signs and symptoms can mask deterioration (post-op sepsis)
  - Ultimately treatment delayed or inadequate

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### Questions About Sepsis Definitions?



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Early and Aggressive Sepsis Management

## THE SURVIVING SEPSIS CAMPAIGN GUIDELINES

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### Severe Sepsis

- The most feared and most severe consequence of infection
- Early recognition is **KEY** to preventing a patient's progression through the continuum

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### Surviving Sepsis Campaign

- SSC Goals
  - Improve diagnosis and treatment of sepsis
  - Develop evidence-based guidelines for sepsis
- Resuscitation Bundle
  - Early Recognition
  - Early Antibiotics and Cultures
  - Early Goal Directed Therapy

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### Early Goal Directed Therapy (EGDT)

- EGDT Reduces Mortality by 16%
  - Control Group: 46% Mortality
  - EGDT Group: 30% Mortality

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### Basic Sepsis Management

- **Sepsis Presentation**
  - Suspicion of infection and at least 2 SIRS criteria
- **Goal**
  - Prevent Evolution to Severe Sepsis
- **Treatment**
  - ✓ Assess serum lactate
  - ✓ Obtain appropriate cultures
  - ✓ Assess for acute organ dysfunction
  - ✓ Administer broad spectrum antibiotics within **1 hour**

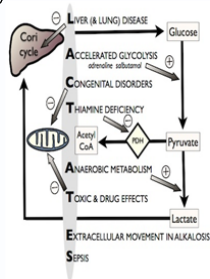


### A Bit About Lactate ...

- An end-product of anaerobic cellular metabolism
- May indicate global tissue hypoxia – even in the presence of normal vital signs (*Cryptic Shock*)
- Lactate is a lagging indicator and must be evaluated over time
- In sepsis, early lactate clearance is associated with resolved global tissue hypoxia and decreased mortality


### An Elevated Lactate Doesn't Always Mean Sepsis

- In the presence of an elevated lactate, consider additional indicators of acidosis (gap, base deficit, decreased bicarbonate)
- Additional causes of elevated lactate
  - ✓ Hypoxia (Anemia, Pulmonary Hypoxia)
  - ✓ Hypoperfusion (Cardiac Arrest, Shock)
  - ✓ Drugs/Toxins
  - ✓ Malignancy
  - ✓ Seizures
  - ✓ HIV



### Identify and Eliminate the Source: Appropriate Cultures and Antibiotic Therapy


- **Goal:** Broad Spectrum IV Antibiotics within 1 hour
  - ✓ Ideally administered within first hour of recognition
  - ✓ Each hour delay results in an increase in mortality
- Cultures should be obtained 1<sup>st</sup>, but do **NOT** delay antibiotic administration
  - ✓ Sterilization of blood cultures can occur within a few hours following the first antibiotic dose



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### Broad Spectrum Antibiotics

- Which antibiotic should I administer first?
  - Zosyn or Cefepime**
    - Gram negative coverage, including Pseudomonas
    - Gram positive coverage, except for MR Staph
  - Vancomycin**
    - Gram positive, including MRSA
  - Levaquin or Tobramycin**
    - Used in combination with **Zosyn** or **Cefepime** for double coverage for Pseudomonas
    - Additional Pseudomonas coverage provided:
      - Tobramycin ~20%
      - Levaquin ~5%



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### Severe Sepsis/Septic Shock Management

- All basic sepsis interventions apply
  - ✓ Assess serum lactate and other acute organ dysfunction
  - ✓ Obtain appropriate cultures
  - ✓ Administer broad spectrum antibiotics within **1 hour**
- Additional interventions include
  - ✓ Evaluate and Resuscitate Tissue Perfusion
  - ✓ Support Underlying Organ Failure

**Deliver an initial fluid bolus of at least 1 Liter to achieve a minimum of 30mL/kg over 1 hour or less**

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### Fluid Resuscitation

- Initial IV Fluid resuscitation** is key to preventing the progression of sepsis
  - Administer a 30mL/kg bolus
  - Not the same as setting the pump at 999mL/hr
- Who needs a Fluid Bolus?
  - Patient may be normotensive
- Did your patient respond to fluids?
  - Reassess!
  - Reassess Lactate!
  - Reassess Blood Pressure!



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### Early Goal Directed Therapy

- EGD is indicated in the event of persistent sepsis-induced hypoperfusion
  - **Hypotension:** SBP <90, MAP <70, ↓ SBP >40
  - **Tissue Hypoxia:** Lactate ≥ 4
- **Goal:** CVP 8 – 12
- **Goal:** MAP > 65 or SBP > 90
- **Goal:**  $S_{cVO_2}$  >70%



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### EGDT Goals to Be Met Within 6 Hours

- **Optimize Preload:** Maintain CVP 8 – 12
  - ✓ Insert a central line with oximetry capabilities
  - ✓ Incremental fluid boluses should continue as long as the patient continues to improve hemodynamically
- **Optimize Perfusion:** Maintain MAP > 65, SBP > 90
  - ✓ Consider vasopressors if not responsive to fluids
  - ✓ Norepinephrine (Levophed) – 1<sup>st</sup> choice for vasopressor therapy
- **Optimize Oxygen Delivery:** Maintain  $ScvO_2$  >70%
  - ✓ Consider PRBCs or Dobutamine



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### Adjunctive Therapies

- **Protective Lung Strategies**
  - ✓ Maintain Plateau Pressure < 30 cmH<sub>2</sub>O for ventilated patients
- **Glycemic Control**
  - ✓ Glycemic Control per Protocol
- **Low – Dose Steroids**
  - ✓ If vasopressor dependent and baseline cortisol <25






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### Management Summary

- **Recognize Sepsis Early**
  - ✓ Screen Often – at least every 12 hours
  - ✓ Assess Acute Organ Dysfunction
  - ✓ Assess Serum Lactate
- **Identify and Eliminate the Source**
  - ✓ Obtain Appropriate Cultures
  - ✓ Administer Antibiotics within 3 hour
- **Fluid Resuscitate and Evaluate Response**
- **Implement EGDT When Indicated**
  - ✓ CVP 8 – 12
  - ✓ MAP > 65, SBP > 90
  - ✓  $S_{cvo_2}$  > 70%



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### Questions About Sepsis Management?





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### A FEW TOOLS TO CONSIDER



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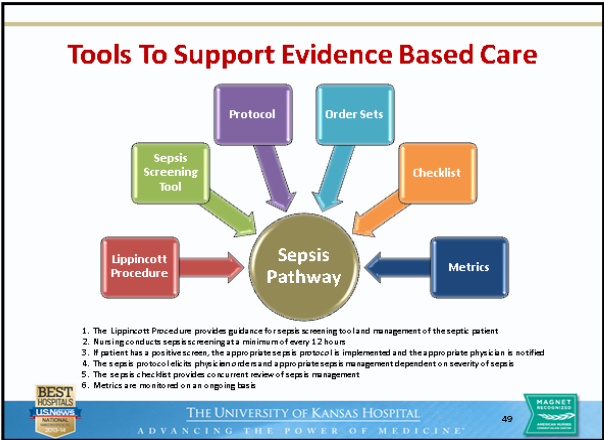
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### Sepsis Screening Tool

#### Baseline (Old Tool)

Sepsis Screening Tool	
What SIRS Criteria Does Patient Have?	
Does Patient Have 2 SIRS Criteria?	
Does Patient Have Any Organ Dysfunction?	
Is Patient Being Treated For or Suspect?	
Physician Notification	
Name of Physician Notified	

**How does it work?**

- 344 charts reviewed, documentation occurred **77%** of the time
- If documented, accurate **59%** of the time

#### 10/2/13 (New Tool)

**NOTE:** Actual screening tool, not part of medical record

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### Sepsis Screening Tool

**Sepsis Screening Tool**  
Does your patient have any risk factors, signs or symptoms of infection?

**Signs/Symptoms**

- ☐ Skin/mucocutaneous infection – wound, abscess, cellulitis
- ☐ Urinary tract infection – decreased urine output, dysuria, frequency, odor
- ☐ Abdominal infection – pain, guarding, nausea, vomiting, rebound tenderness, rigidity
- ☐ Chest infection – cough, shortness of breath, pneumonia/empyema, endocarditis
- ☐ Neurological infection – meningitis
- ☐ New onset of confusion, decreased level of consciousness

**Risk Factors**

- ☐ Indwelling medical device other than peripheral IV (PICC line, dialysis catheter, urinary catheter, drain, etc...)
- ☐ Recent surgery or invasive procedure (>48 hours)
- ☐ Readmission within 48 hours from hospital discharge
- ☐ Recently or currently receiving antibiotics for a confirmed/documented infection

**AND**

Does your patient have 2 or more Yellow Criteria?

- ☐ Heart Rate > 90
- ☐ Respirations > 20 or PaCO<sub>2</sub> < 32 mmHg
- ☐ Temperature > 38 or < 36
- ☐ WBC > 12,000 or < 4,000 or Bands > 10%

OR

Does your patient have 1 or more Red Criteria?

- ☐ SpO<sub>2</sub> < 92% on room air/baseline home oxygen or increased requirements of PO<sub>2</sub> (100%) supplemental oxygen (adult) or PaO<sub>2</sub>/FiO<sub>2</sub> < 300
- ☐ Lactate > 2.0

**POSITIVE SCREEN: Risk factors, signs or symptoms of infection AND 2 or more Yellow Criteria**

**POSITIVE SCREEN: Risk factors, signs or symptoms of infection AND 1 or more Red Criteria**

**Negative Screen:**  
No signs/symptoms or risk factors identified above and no qualifying SIRS or organ dysfunction present.  
✓ Reassess every 12 hours and PRN as condition warrants

**Positive Screen:**  
✓ Implement ED Sepsis Protocol or Emergent Situations Protocol  
✓ Notify Physician within 30 minutes  
✓ Look for other causes of deterioration  
✓ Anticipate Sepsis/Severe Sepsis Order Set

**Positive Screen:**  
✓ Implement ED Sepsis Protocol or Emergent Situations Protocol  
✓ Notify Physician immediately and consider RRT activation  
✓ Anticipate Severe Sepsis/Septic Shock Order Set if patient remains unstable on Lactate > 4.0

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## Protocols

[illegible]

### Point of Care Lactate

- Immediate results
- Available in the ED and RRT






## Communicating a Positive Screen

- Paper tool as a reference to package your conversation using ISBARR format
- Smart Text coming soon
  - Template for documentation of your notification

[illegible]



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### Additional Considerations for Progressive Care and Critical Care Nurses

- Device Associated Infection Prevention
  - VAP Bundle
  - Catheter Removal Protocols
  - Central Line Insertion and Management Bundle
- Preventing Surgical Site Infections

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### Additional Considerations

- Toolkits/Websites
  - Midwest Critical Care Collaborative, [www.mwcritcare.org/](http://www.mwcritcare.org/)
  - Surviving Sepsis Campaign, [www.survivingsepsis.org](http://www.survivingsepsis.org)
  - Sepsis Alliance, [www.sepsisalliance.org](http://www.sepsisalliance.org)
  - AHRQ Innovation Exchange, [www.innovations.ahrq.gov](http://www.innovations.ahrq.gov)
- Interactive Sepsis Education
  - Septris, [www.med.stanford.edu/septris](http://www.med.stanford.edu/septris)

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### Additional Considerations

- Celebrate World Sepsis Day
  - September 13
- Adult Learning Theory...Make it Memorable!
  - It's Sepsis and You Know It
  - Bundle, Bundle, Bundle

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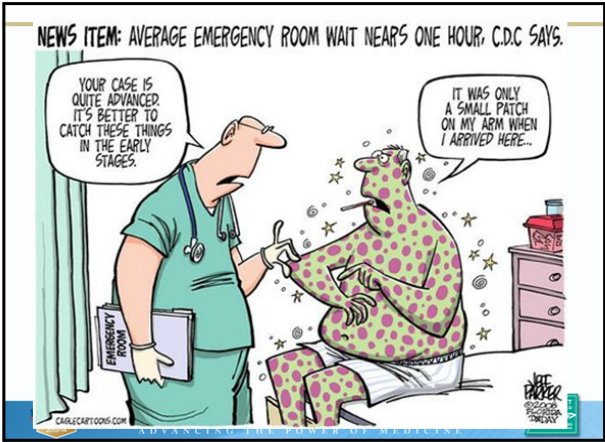
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