



University
HOSPITAL

Newark, NJ

**Sepsis Management:
A Team Effort**

2023-2024



Newark, NJ

Objectives



Upon completion of this activity, the learner will be able to:

1. Discuss the definition of Sepsis, Severe Sepsis, and Septic Shock
2. Discuss the pathophysiology, signs, and symptoms of sepsis and septic shock
3. Discuss SIRS criteria, qSOFA, and associated assessments
4. Identify the criteria for Sepsis, Severe Sepsis, and Septic Shock
5. Review the role and responsibilities of the clinician related to the UH Sepsis guidelines
6. Discuss the CMS Sepsis Core Measure Requirements

What is Sepsis?

- Sepsis is the body's overwhelming and life-threatening response to infection, which can lead to tissue damage, organ failure, and death.
- Sepsis is a clinical syndrome characterized by systemic inflammation due to infection. Although wide-ranging and dependent upon the population studied, mortality from sepsis has been estimated to be $\geq 10\%$, and $\geq 40\%$ when septic shock is present

Why the focus?

▶ Rising Volumes

- Approximately 1 million patients are admitted for sepsis annually
- The rate of sepsis continues to rise by close to 8.7% annually
- 65% of sepsis patients are over 65 years of age

▶ Worsening Outcomes

- Inpatient Hospital **death rates** for sepsis have **increased 17%** over the past decade
- Mortality Rates for severe sepsis is 20-40% and for septic shock is 40% - 80%
- Sepsis accounts for >50% of all hospital deaths

▶ Negative Contribution

- Average **direct cost per case** borne by hospital for primary sepsis diagnosis - **\$18,500**
- Sepsis accounts for 13% of total U.S. hospital costs, yet only represents 3.6% of hospital stays

▶ Heavy Readmission Costs

- Readmission Rates: CHF 23.6%, **Sepsis 20.4%**, AMI 17.7%
- Annual cost for **sepsis readmission exceeds \$3.5 billion**

Why the focus?

▶ Rising Volumes

- Approximately 1 million patients are admitted for sepsis annually
- The rate of sepsis continues to rise by close to 8.7% annually
- 65% of sepsis patients are over 65 years of age

▶ Worsening Outcomes

- Inpatient Hospital **death rates** for sepsis have **increased 17%** over the past decade
- Mortality Rates for severe sepsis is 20-40% and for septic shock is 40% - 80%
- Sepsis accounts for >50% of all hospital deaths

▶ Negative Contribution

- Average **direct cost per case** borne by hospital for primary sepsis diagnosis - \$18,500
- Sepsis accounts for 13% of total U.S. hospital costs, yet only represents 3.6% of hospital stays

▶ Heavy Readmission Costs

- Readmission Rates: CHF 23.6%, **Sepsis 20.4%**, AMI 17.7%
- Annual cost for **sepsis readmission exceeds \$3.5 billion**

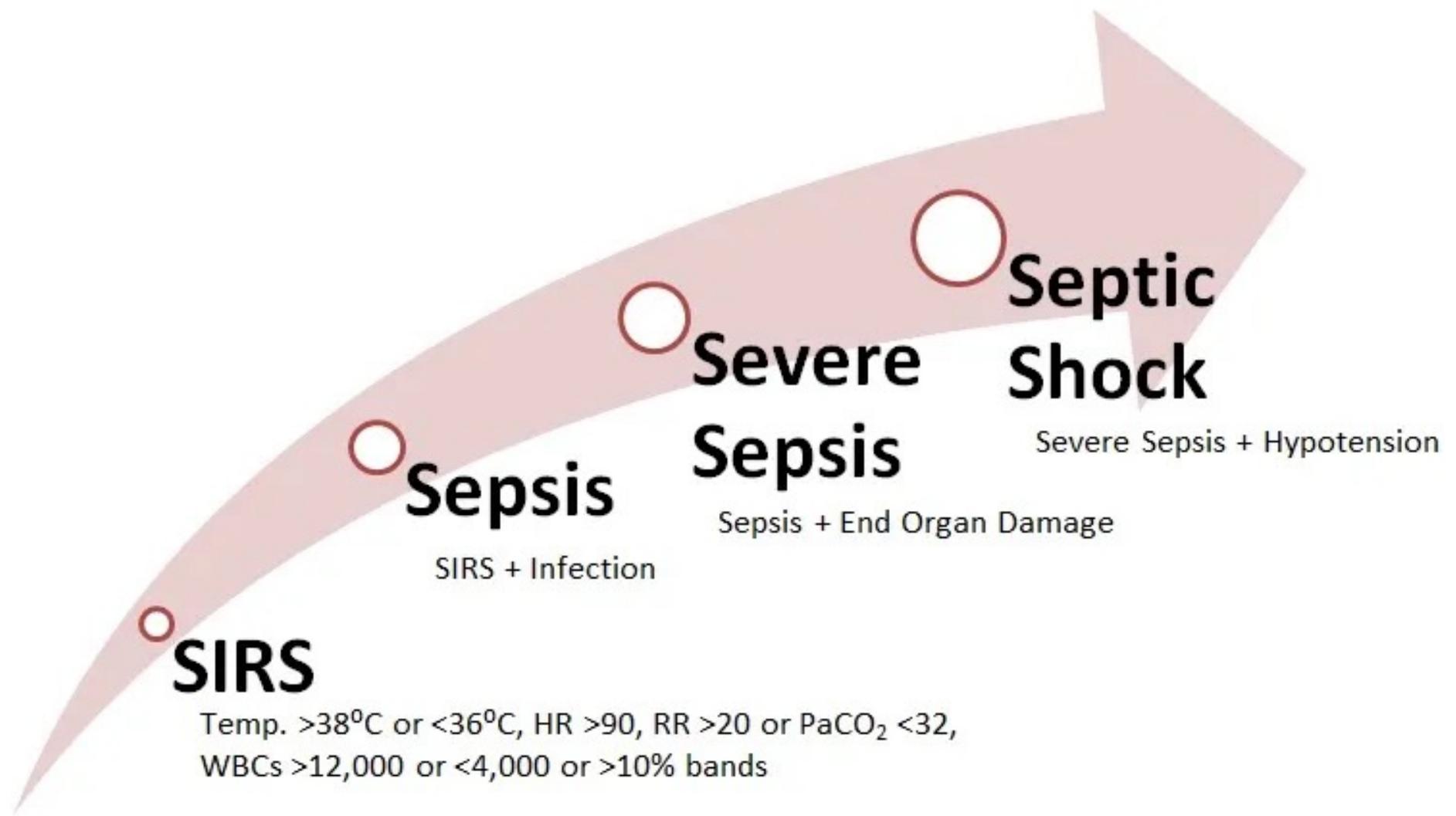
SIRS criteria

Systemic Inflammatory Response Syndrome (SIRS)

- 2 or more of the following:
 1. T >38 C (100.4) or <36 C (96.8)
 2. HR >90 beats/min
 3. RR >20 breaths/min
 4. WBC <4000 or >12000 or >10% immature bands

What is sepsis?

- **Sepsis**: SIRS criteria + Suspected Infection
(SIRS = Systemic Inflammatory Response Syndrome)
- **Severe Sepsis**: Sepsis + Organ Dysfunction
- **Septic Shock**: Sepsis-Induced hypotension despite adequate fluid resuscitation



Signs of Organ Dysfunction

- Hypotension (SBP <90 mm Hg or MAP <65 mm Hg, or a SBP decrease of more than 40 points below the baseline)
- Elevated Creatinine >2.0 mg/dl (for CKD: an increase of 0.5mg/dl from baseline)
- Decreased urine output <0.5 ml/kg/hour for 2 hours
- Elevated Bilirubin >2 mg/dL
- Decreased Platelets <100,000/mm³
- INR >1.5 or aPTT >60 seconds (*not on anticoagulation*)
- Elevated Lactate >2.0 mmol/L

qSOFA SCORE:

Quick Sepsis-Related Organ Failure Assessment Score

- Scoring system to determine extent of organ function or rate of failure
- The idea behind the novel qSOFA score is to provide quick bedside criteria to help identify adult patients with suspected infection in out-of-hospital, emergency department and medical surgical unit settings who are likely to have poor outcomes

Presence of 2 or more qSOFA points near the onset of infection was associated with greater risk of death and need for ICU care

Assessment	q SOFA points
Hypotension (SBP \leq 100mmHg)	1
Altered mentation (GCS <15)	1
Tachypnea (\geq 22 breaths/minute)	1

Note: qSOFA is **NOT** a sepsis screening tool

SIRS versus qSOFA

As per the Surviving Sepsis 2021 guidelines:

- “We recommend **against** using qSOFA compared with SIRS, NEWS, or MEWS as a single screening tool for sepsis or septic shock.”
- “Although the presence of a positive qSOFA should alert the clinician to the possibility of sepsis in all resource settings; given the poor sensitivity of the qSOFA, the panel issued a strong recommendation **against its use as a single screening tool.**”

2016 Sepsis Definitions

- **Sepsis** = Life-threatening organ dysfunction caused by a dysregulated host response to infection
 - Suspected or documented infection and an acute increase of ≥ 2 qSOFA points
- **Septic shock** = Sepsis with circulatory and cellular/metabolic abnormalities profound enough to substantially increase mortality
 - Sepsis and vasopressor therapy needed to elevate MAP ≥ 65 and lactate < 2.0 after adequate fluid resuscitation

Examples of Potential Sources of Infection

- Respiratory
 - Pneumonia is the most commonly identified infection leading to sepsis
- GU
 - UTI is the 2nd most common cause of infections
- GI
 - Peritonitis, appendicitis, diverticulitis
- Blood Stream Infections (Bacteremia)
 - Through lines such as PICCs, CVCs, tunneled catheters, IVs
- Skin
 - Wounds
- CNS
 - Meningitis, Encephalitis

What Can We Do?

Early recognition and early aggressive treatment are key!



University Hospital – Sepsis

Triggers for Considering Sepsis/Septic Shock Protocol:
2 or more of the following with a suspected infection:

1. Temp >100.4 F or <96.5 F or rigors
2. HR >90 beats/min
3. O₂ sat <92%
4. WBC <4000 or >12000 or >10% immature bands

In addition, any of the following combined with suspected infection should prompt consideration of sepsis:

- SBP <100 mm Hg, or decrease of 40 mmHg from baseline (Hypotension)
- Altered Mental Status
- RR >22 breaths/min (Tachypnea)

After Sepsis is recognized – treatment needs to start immediately

Essential components to be completed by 3 hours after the recognition of sepsis:

- IV Fluid bolus (30cc/kg for hypotension or lactate >2)
- Antibiotics
- Labs – particularly *lactate* and *blood cultures* (drawn prior to antibiotics)

Essential Components to be completed by 6 hours after the recognition of sepsis

- Repeat lactate if the initial lactate was ≥ 2.0
- Sepsis re-evaluation: documenting that the patient was re-evaluated after the fluids were administered
- Consider starting early pressors if the SBP remains <100 (or MAP <65) or the lactate is not decreasing appropriately despite IVF

0 - 3 Hour Bundles

- Send lactate level as VBE (for rapid results)
- Obtain blood cultures prior to administration of antibiotics
- Administer broad spectrum antibiotics within 1-3 hours
- Administer 30 mL/kg approved IV fluids for hypotension or lactate ≥ 2.0 *
- Close re-assessment of patient mental status

*If not administering 30mL/kg bolus, must document clinical indication for such (e.g., ESRD on HD, CHF, etc). Ideal body weight may be utilized to calculate IVF bolus for significant obesity.

Labs: Hours 0 - 3

- 2 sets of blood cultures, prior to antibiotic administration
 - Obtaining blood cultures should not delay initiation of antibiotics
 - Blood cultures should preferably be obtained from different sites
- **Lactate** – 2 ways to order at UH
 - Lactate in the gray top tube ('Lactic Acid')
 - **Preferred Method:** Venous Blood Gas with Electrolytes – this is drawn in a blood gas syringe and has a quick turnaround time which can expedite treatment

What are the metrics? (best practices)

▶ Initial and repeating of Lactate levels

- An initial Lactate level needs to be drawn at the onset of suspected sepsis **AND** a repeat lactate needs to be re-drawn within the initial 6 hours if the initial lactate level was ≥ 2.0
 - The repeat lactate should typically be drawn 3 hours after initial lactate performed
- The second VBE can be ordered simultaneously with initial VBE, with instructions to draw if initial lactate ≥ 2.0
 - The sepsis order set incorporates both the initial and reflex follow up VBE

Blood Culture Collection

A blood culture needs to be collected at the onset of suspected sepsis

AND

Before IV Antibiotics are administered

*Again, note that collection of blood culture should not
delay administration of antibiotics*

Antibiotics: Hours 0-3

- Broad spectrum antibiotics need to be given no later than hour 3 after recognition, however ideally this should be done by the first hour
- Use the empiric antibiotic guideline outlined in the sepsis order set to assist with selection of appropriate antibiotic coverage
- As applicable, review previous cultures to determine if patient might have resistance to the first-line antibiotic selections
- Ideally, plan for source control if an identified source is present
 - e.g., remove an infected central line, remove an old foley, drain an abscess, etc.

Fluids: Hours 0 - 3

- Patients with a SBP <100 or Lactate ≥ 2.0 secondary to sepsis need to receive 30 mL/kg of IV fluids by hour 3 after recognition of sepsis
 - *Fluid dosing can be based on ideal body weight*

UNLESS:

- If a patient is unable to receive a 30mL/kg bolus of IV fluids, documentation must support the clinical basis for this decision
 - Examples include significant CHF, ESRD, obesity
 - Sample documentation: “Patient has a history of CHF with EF of 20%, and thus will receive smaller fluid boluses as clinically tolerated, with close re-assessment of fluid status”

Choice of IV Fluids

Initial fluid choice should be *Lactated Ringer's*.

In some circumstances clinicians may choose other fluids at their discretion.

- Note that LR does not appreciably increase the serum potassium concentration.
- Note that LR does not contain lactic acid, it contains sodium lactate which is not harmful to patients and does not raise lactic acid levels.

Recent clinical trials demonstrating superiority of LR vs. NS:

- SMART trial (2018): 15,082 adults randomized - primary outcome of MAKE30 (composite metric of death, new renal replacement therapy, or persistent renal dysfunction) of 14.3% (LR) vs 15.4% (NS) [OR 0.91, p=0.04; NNT 91]
- SALT-ED trial (2018): 13,347 adults randomized - reduction in secondary outcome MAKE30 of 4.7% (LR) vs. 5.6% (NS) (aOR 0.82, p=0.01; NNT 111)
- Subgroup analysis of septic patients in the SMART trial (2019): 1,641 patients, 30 day mortality of 26.3% (LR) vs 31.2% (NS) (aOR 0.74, p=0.01; NNT = 20)

3 - 6 hour bundle

- Documentation of a sepsis re-assessment within 6 hours of sepsis recognition must be performed
- Repeat lactate within 3 hours if initial lactate is elevated (≥ 2.0)
- Monitor fluid status & administer additional IV fluids as needed, with target MAP of ≥ 65
- *Consider the use of early vasopressors if patient remains hypotensive and is not fluid responsive*

Consider the use of early pressors in septic patients:

- If a patient is not responding appropriately to IV fluids, consider the use of early IV pressors
 - e.g., persistent / significant hypotension s/p initial IV fluid bolus of 30mL/kg
 - e.g., failure to reduce lactate >10% s/p initial IV fluid bolus
- Pressors can be initiated via peripheral IV
- Target MAP of >65
- Initial vasopressor choice can be dictated by clinical context, however norepinephrine is the first line agent for undifferentiated sepsis / hypotension
 - 2nd line vasopressor: epinephrine or vasopressin

A repeat assessment of volume status and tissue perfusion is required for patients with septic shock.

- This is required when a patient has persistent hypotension after fluid resuscitation.
- The volume assessment can be done using either a focused physical exam or using some physiologic parameters.

Focused physical exam must include:

- Vital signs
- Cardiopulmonary exam
- Capillary refill
- Peripheral pulse evaluation
- Skin exam

OR any two of the following:

- Central venous pressure
- Central venous oxygen
- Bedside cardiovascular ultrasound
- Passive leg raise or fluid challenge

Delays in antibiotic administration after 1 hour increases mortality

Ferrer. CCM. 2014

Time to Antibiotics (Hr)	OR ^a	95% CI	<i>p</i>	Probability of Mortality (%) ^b	95% CI
0–1 ^c	1.00			24.6	23.2–26.0
1–2	1.07	0.97–1.18	0.165	25.9	24.5–27.2
2–3	1.14	1.02–1.26	0.021	27.0	25.3–28.7
3–4	1.19	1.04–1.35	0.009	27.9	25.6–30.1
4–5	1.24	1.06–1.45	0.006	28.8	25.9–31.7
5–6	1.47	1.22–1.76	< 0.001	32.3	28.5–36.2
> 6	1.52	1.36–1.70	< 0.001	33.1	30.9–35.3

OR = odds ratio.

^aHospital mortality odds ratio referent group is 0–1 hr for the time to antibiotics and is adjusted by the sepsis severity score (SSS), ICU admission source (ED, ward, vs ICU), and geographic region (Europe, United States, and South America).

^bProbability of hospital mortality is estimated using the generalized estimating equation population averaged logistic regression model and is based on the subject having the following characteristics: from the United States, admission source is the ED, and the SSS is 52 (median of all observations).

^cAntibiotics administered in the first hour are the referent group and thus the odds ratio by definition is 1.00 while the 95% CI and the *p* value are not generated by the regression model.

Please utilize the appropriate Epic sepsis order set to ensure all required labs, fluids, antibiotics are ordered

**Emergency
Department
sepsis order set**

**Type in
"ED Sepsis"**

ED Sepsis Order Set 

- ▼ Sepsis Orders
 - ▼ Nursing Orders
 - Initial Nursing Orders
 - ▼ Labs & Studies
 - Initial Labs and Studies (Pre-checked)
 - Add-On Labs and Studies (Not Pre-checked)
 - ▼ IVF Management
 - Initial IVF Orders
 - ▼ Antibiotics - Source Based
 - Unknown/Critically Ill
 - Respiratory
 - Urinary
 - Intra-abdominal
 - CNS
 - ▼ Antipyretics
 - Antipyretics
- ▼ Additional Orders

 Search for additional order set orders

Med IP Adult Sepsis/Septic Shock Order Set in Epic

MED IP ADULT SEPSIS/SEPTIC SHOCK INITIAL ORDERS

Do you need help with antibiotic selection? If yes please see the following:

- [EMPIRIC ANTIBIOTIC GUIDE FOR SEPSIS/SEPTIC SHOCK](#)

▼ General

▼ Vital Signs

Vital signs

ROUTINE, See Comments, Starting today at 1745, Until Specified, Every 15 minutes until SBP greater than 100 mmHg, then every 30 minutes unless hemodynamically UNSTABLE.

Pulse oximetry

ROUTINE, UNTIL DISCONTINUED, Starting today at 1745, Until Specified

▼ Nursing Instructions

Strict intake and output

ROUTINE, UNTIL DISCONTINUED, Starting today at 1745, Until Specified

Insert IV

STAT, One time, today at 1745, For 1 occurrence, Large Bore peripheral IV access line # 1.

Insert IV

STAT, One time, today at 1745, For 1 occurrence, Large Bore peripheral IV access line # 2.

Transduce CVP

STAT, See Comments, If upper CVC present.

Notify physician

ROUTINE, One time, today at 1745, For 1 occurrence, if SBP less than 100 mmHg after fluid challenge, call prescriber.

▼ Respiratory Interventions

Nasal cannula oxygen

STAT, CONTINUOUS, To keep oxygen saturation between 92 - 96.

▼ Diet/Nutrition

Regular diet

Clear liquid diet

Diabetic controlled diet

Diet NPO

DIET EFFECTIVE NOW

Diet NPO - Except for Medications

Medications

Advance diet as tolerated

ROUTINE, Starting 5/6/21

▼ Activity

...

Case Scenario 1

- 71 y.o. female with 1 day of nausea, vomiting, and temp of 101 F at home. Decreased appetite for 3 days. No improvement with Acetaminophen. Son brought patient due to concern for possible altered mental status / near syncope.
 - **PMHx:** HTN
 - **ALLERGIES:** PCN
 - **Meds:** Telmisartan
 - **Vitals:**
 - **BP:** 133/63 mmHg; **P:** 139; **Resp:** 24; **Pulse Ox:** 98% on 4L; **Tmax:** 102.7 F; **Weight:** 60 kg; **POCT Glucose:** 108
 - **Focused physical Exam:**
 - **Gen:** Ill appearing, diaphoretic, moderate distress
 - **Lungs:** Crackles at right base
 - **CV:** Tachycardic

Case Scenario 1

1. Does the patient have Sepsis?
2. Does the patient have Septic Shock?

Case Scenario 1

Answer: The patient meets SIRS criteria, with high suspicion for sepsis – the patient has an elevated HR (>90), elevated resp rate (>20), and an elevated temperature (>100.4). The patient also has a qSOFA score of 2 due to possible AMS as well as tachypnea.

What do you do next?

- Utilize the sepsis order set!
 - Lactate
 - CBC/Diff, CMP, Coags, Blood Cxs (and other cultures as appropriate)
 - Antibiotics prior to cultures
 - Portable chest x-ray
 - Empiric antibiotics (broad spectrum, as per UH antibiotics guidelines)
 - Maintain SpO₂ of 92% or more

Case Scenario 2

- 59 y.o. male noted to have AMS at home and brought to ED via EMS. Patient was altered, in acute respiratory distress, intubated in ED. Afebrile while in ED. Patient had an episode of PEA arrest, with ROSC obtained. Noted to be hypotensive s/p ROSC. The patient was taken to cath, and then admitted to the CCU s/p negative cath. You have now taken over care of this patient after admission to the CCU.
- **PMHx:** Dementia, Recent Admission for Decub Ulcer tx, Hep C, Catatonia, Hx of IVDA/Etoh use, wheel chair dependence.
- **Allergies:** NKDA
- **Vitals:** BP: 88/46 P: 124; Resp: 18 on vent; Pulse Ox: 100% on vent (FiO2 of 100%); T: 100.6 Weight: 63.6 kg.
- **Focused physical exam:**
 - **Lungs:** B/L rhonchi, intubated
 - **CVS:** Tachycardic
 - **Extremities:** cold, clammy

Test Results

- Repeat CXR in CCU: Concerning for a new LLL opacity
- WBC: 20.2
- K: 8.1
- BUN/Creat: 161/8.86
- Repeat lactate: 7.9 (initial lactate 1.8)
- Repeat BP after initial 30ml/kg fluid bolus: 92/63 mmHg
- Urine output x 3 hours: minimal

Case Scenario 2

1. Does the patient have Sepsis?
2. Does the patient have Septic Shock?

Case Scenario 2

Answer: The patient is likely in septic shock, with numerous markers concerning for end-organ dysfunction. This patient is critically ill, with a high risk for morbidity and mortality.

Next clinical steps:

- Initiate IV pressors in addition to additional IV fluids (as tolerated)
- Initiate stat empiric broad-spectrum antibiotics, if not already initiated
- Obtain cultures prior to antibiotics, if not already obtained
- Repeat lactate within 3 hours

Summary:

- Recognize sepsis!
- Use the order sets
- IV fluids – 30mL/kg (or document if not)
- Blood cultures, and begin empiric antibiotics
- Repeat lactate (if initial > 2.0)
- Early use of IV pressors as needed
- Document appropriate sepsis re-assessment