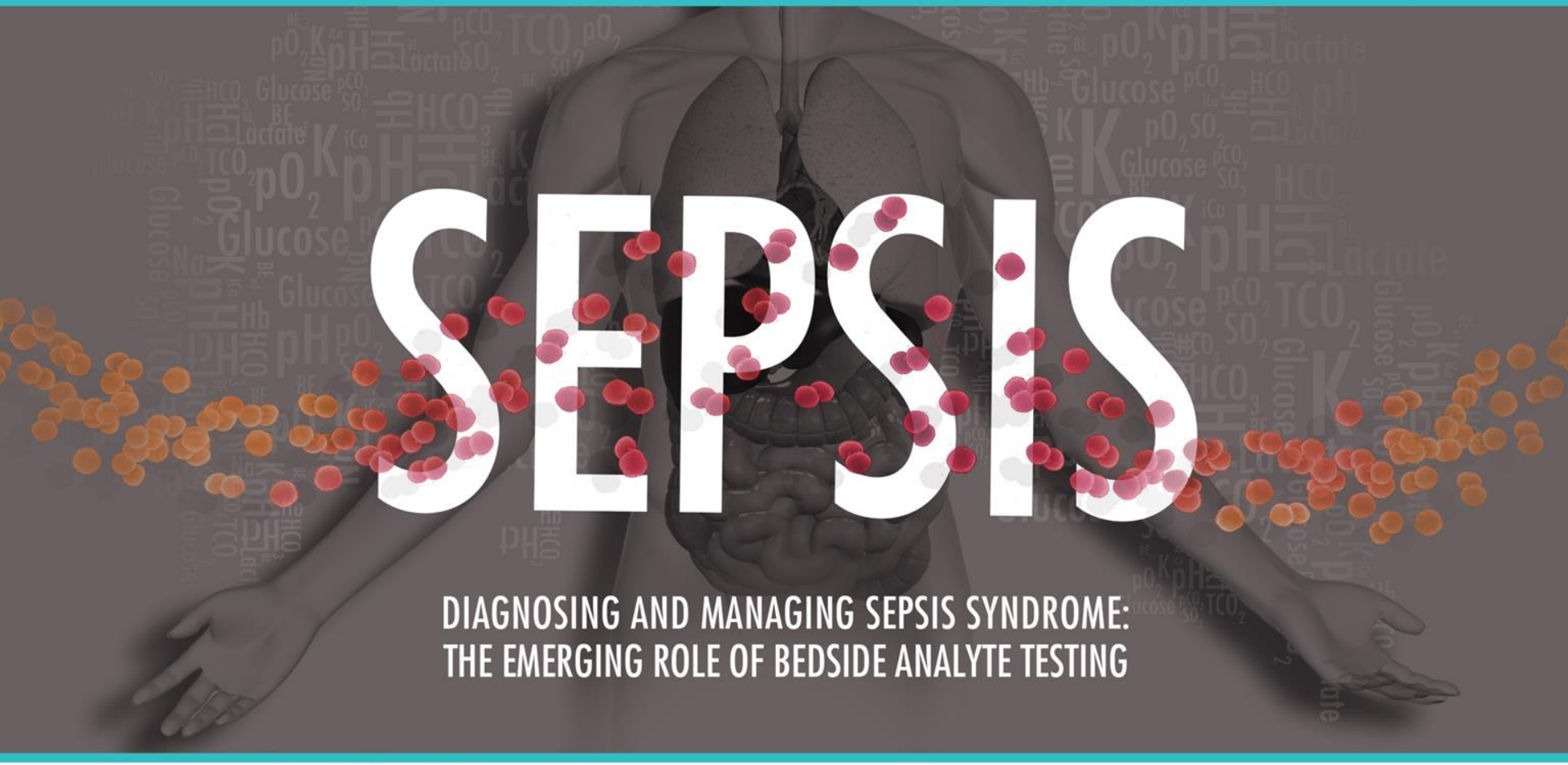
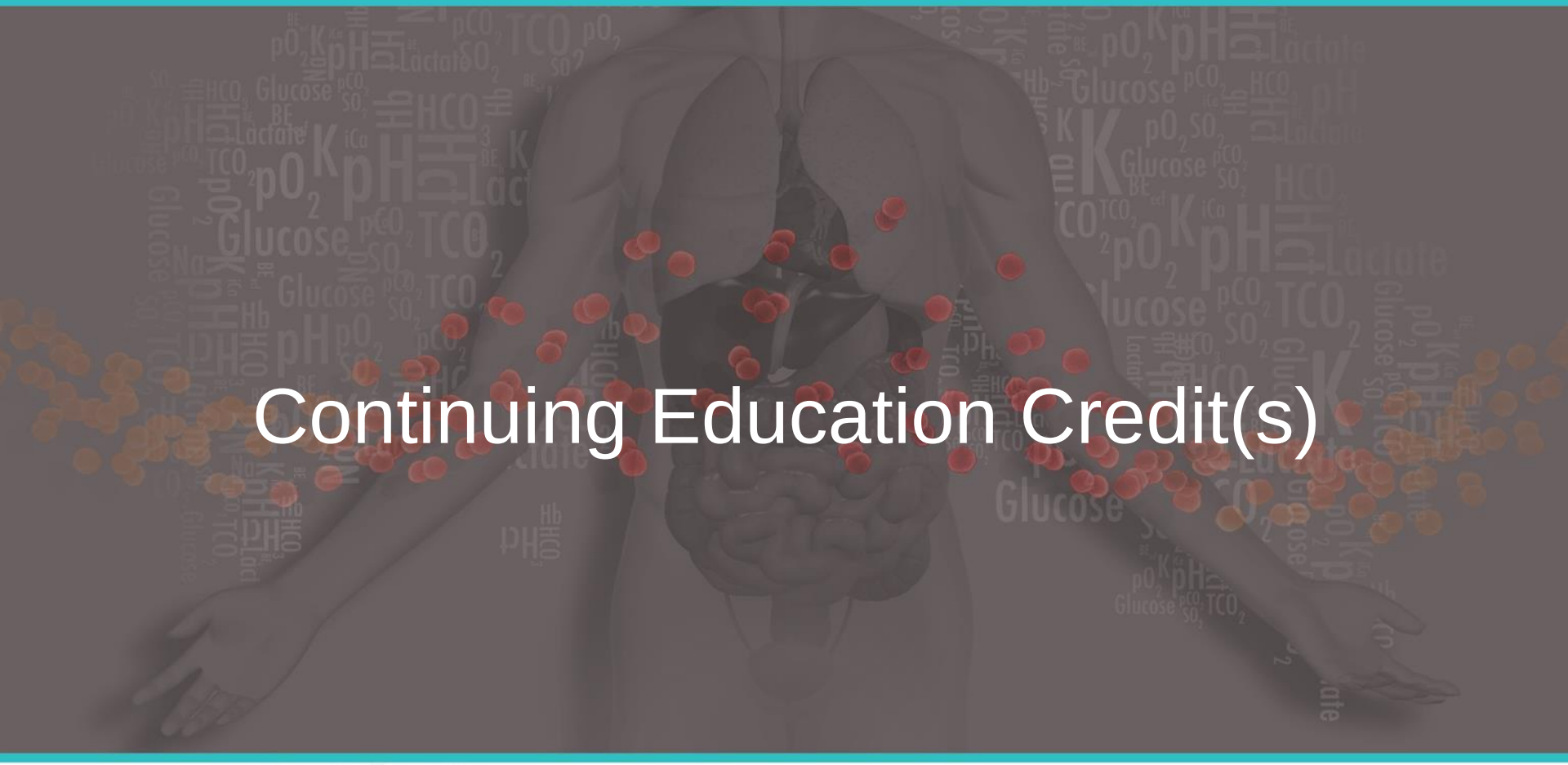


DIAGNOSING AND MANAGING SEPSIS SYNDROME: THE EMERGING ROLE OF BEDSIDE ANALYTE TESTING

A SELF STUDY
COURSE FOR CREDIT
FIND OUT MORE AT SEPSISMARKERS.COM



Continuing Education Credit(s)

Date of Release: 7/1/2023

Date of Expiration: 7/1/2025

Estimated time to complete this educational activity: 1.5 hours

Continuing Education Credits

Physicians - This activity has been planned and implemented in accordance with the Essential Areas and Policies of the Accreditation Council for Continuing Medical Education through Synativ. Synativ is accredited by the ACCME to provide continuing medical education for physicians. Synativ designates this educational activity for a maximum of 1 AMA PRA Category 1 Credit(s)™ toward the AMA Physician's Recognition Award. Physicians should only claim credit commensurate with the extent of their participation in the activity.

Nursing - Educational Review Systems is an approved provider of continuing education in nursing by ASNA, an accredited provider by the ANCC/Commission on Accreditation. Provider #5-115. This program is approved for one and a half (1.5) hours. Educational Review Systems is also approved for nursing continuing education by the State of California and the District of Columbia.

Respiratory Therapy - This program has been approved for 1.5 contact hours Continuing Respiratory Care Education (CRCE) credit by the American Association for Respiratory Care, 9425 N. MacArthur Blvd., Suite 100, Irving, TX 75063 Course # **213078000**

Laboratory Technicians - One PACE credit will be provided for this self-study program. This session is approved for 1.5 Florida CE credits. Florida Board of Clinical Laboratory Personnel approved number: 50-12563.

Statement of Need

Sepsis kills more than 270,000 Americans each year and is becoming more common, especially in the hospital setting.

Sepsis is a medical emergency that can be difficult to define, diagnose, and treat, but every minute counts in the effort to save lives.

This learning activity will describe how bedside analyte testing could aid therapeutic decision-making and improve the prognosis for patients with sepsis.

Intended Audience

The primary audience for this learning activity is healthcare professionals (physicians and nurses) who are involved in the testing, diagnosis, treatment, and management of sepsis, and are interested in the role of biomarkers to improve the care for these patients.

Learning Objectives

After completing this activity, the participant should be able to:

1. Review the epidemiology of sepsis
2. Describe biomarkers used in the diagnosis and treatment of sepsis
3. Explain how to evaluate sepsis tests and results
4. Identify the benefits of point-of-care analyte testing in sepsis patients

Medical Advisement

We would like to acknowledge the following medical experts who served as advisors to this educational program:

Thomas Ahrens
DNS, RN, PhD

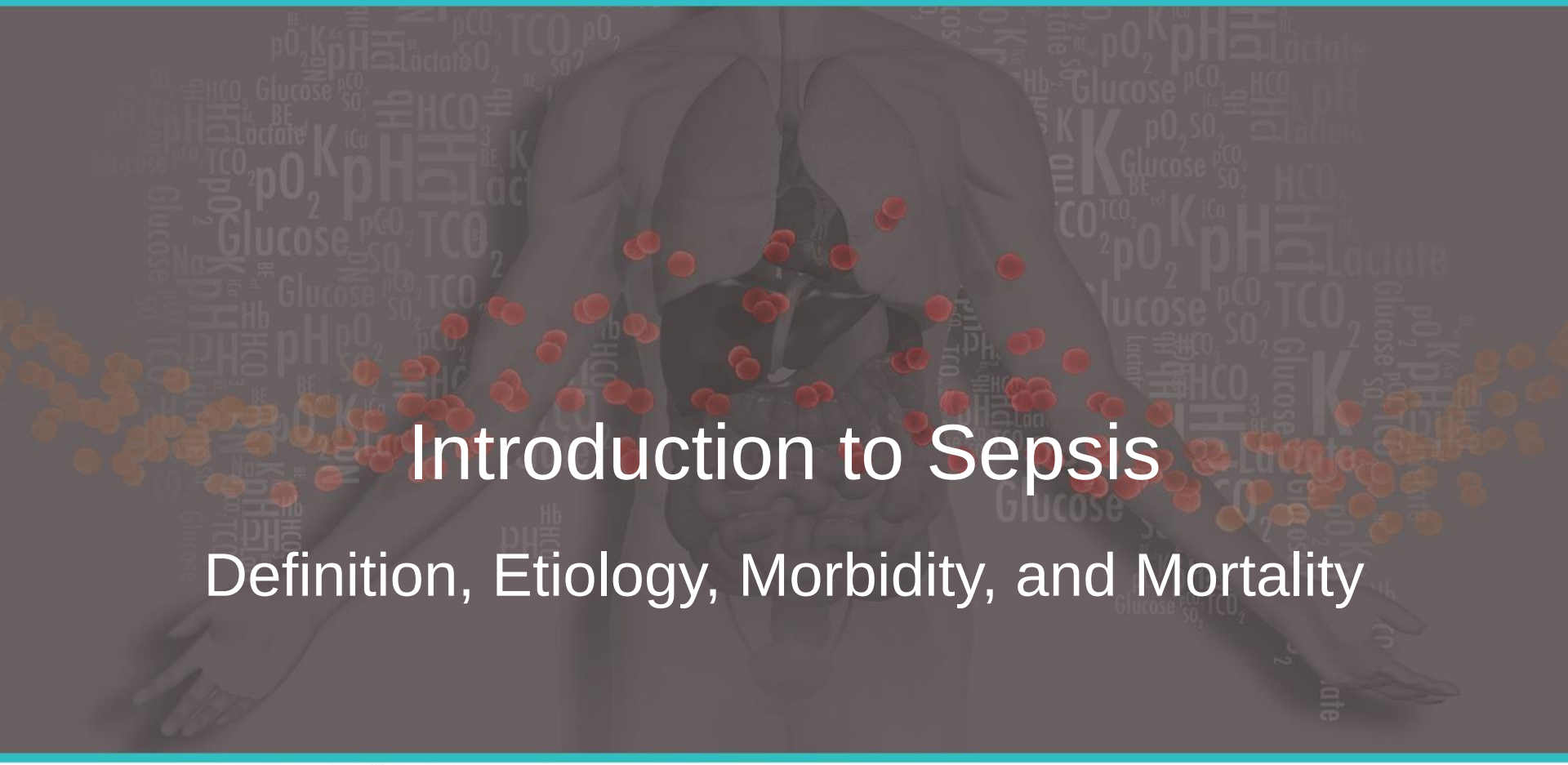
Jill A. Sellers
BSPharm, PharmD

Emanuel P. Rivers
MD, MPH

Disclosures

There are no disclosures for this learning activity.

Table of Contents



Introduction to Sepsis

Definition, Etiology, Morbidity, and Mortality

Sepsis

"Hectic fever, at its inception, is difficult to recognize but easy to treat; left unattended it becomes easy to recognize and difficult to treat."

— Niccolo Machiavelli

The Prince, 1513

Centers for Medicaid & Medicare Services (CMS) Definition: Severe Sepsis

1. Documentation of a suspected source of clinical infection.
2. Two or more manifestations of systemic infection (SIRS criteria).
3. The presence of organ dysfunction.

In order to establish the presence of severe sepsis, all **three** criteria **must be met** within 6 hours of each other.

SIRS Criteria	Organ Dysfunction Variables
Temperature > 38.3ºC or < 36.0ºC	Systolic blood pressure (SBP) < 90 mmHg or mean arterial pressure < 65 mmHg or a SBP decrease > 40 mmHg from the last SBP considered normal for that patient
Heart rate > 90 beats per minute	Creatinine > 2.0 mg/dL (176.8 mmol/L) or Urine output < 0.5 mL/kg/hour for > 2 hours
Respiration > 20 breaths/min	Bilirubin > 2 mg/dL (34.2 mmol/L)
White blood cell count > 12,000 or < 4000/mm^3 or > 10% bandemia	Platelet count < 100,000
	Coagulopathy (INR > 1.5 or aPTT > 60 secs)
	Lactate > 2 mmol/L (18.0 mg/dl)

SIRS = Systemic Inflammatory Response Syndrome aPPT = activated partial thromboplastin time

Kuye I, et al. *Crit Care Expl*. 2021;3(3):e0373.

CMS Definitions: Septic Shock

1. There must be documentation of severe sepsis present.

AND

2. Tissue hypoperfusion persists in the hour after crystalloid fluid administration, evidenced by either
   - Systolic blood pressure (SBP) < 90, or
   - Mean arterial pressure < 65, or
   - A decrease in systolic blood pressure by > 40 mmHg from the last previously recorded SBP considered normal for that specific patient.

OR

3. Lactate level is ≥ 4 mmol/L.

Kuye I, et al. *Crit Care Expl*. 2021;3(3):e0373.

Sepsis-3 Definition

- Sepsis: Infection + 2 qSOFA criteria
- Severe sepsis: Definition eliminated
- Septic shock: SBP < 90 mmHg AND lactate > 2 after adequate fluid resuscitation

Quick Sequential Organ Failure Assessment (SOFA) Score

qSOFA (Quick SOFA) Criteria	Points
Respiratory rate ≥ 22/min	**1**
Change in mental status	**1**
Systolic blood pressure ≤ 100 mmHg	**1**

Kalantari A, et al. *West J Emerg Med*. 2017;18(5)951-956.

Surviving Sepsis Campaign Guideline: 2016

- Sepsis: Infection + end organ dysfunction
- Severe sepsis: Definition eliminated
- Septic shock: Subset of sepsis with circulatory and cellular/ metabolic dysfunction associated with a higher risk of mortality

Kalantari A, et al. *West J Emerg Med*. 2017;18(5)951-956.

Evolving Sepsis Definitions

	2012 SCCG	NQF	CMS	Sepsis-3	2016 SSCG
SIRS	No change	No change	No change	Eliminated and qSOFA introduced for purpose of risk stratification	No SIRS. No qSOFA.
Sepsis	No change	No change	No change	Infection + 2 qSOFA	Infection + end-organ dysfunction. No clinical criteria offered.
Severe sepsis	Sepsis + end-organ dysfunction. Lactate > 4	No change	Sepsis + end-organ dysfunction. Lactate > 2	Eliminated	Eliminated
Septic shock	MAP threshold increased to < 70 mmHg and fluid bolus defined as 30 mL/kg	No change	Initial lactate > 4 or SBP < 90 mmHg after 30 mL/kg fluid bolus	SBP < 90 mmHg AND lactate > 2 after adequate fluid resuscitation	Subset of sepsis with circulatory and cellular/metabolic dysfunction associated with a higher risk of mortality. No clinical criteria offered.

Symptoms of Sepsis

CONFUSION OR DISORIENTATION

SHORTNESS OF BREATH

HIGH HEART RATE

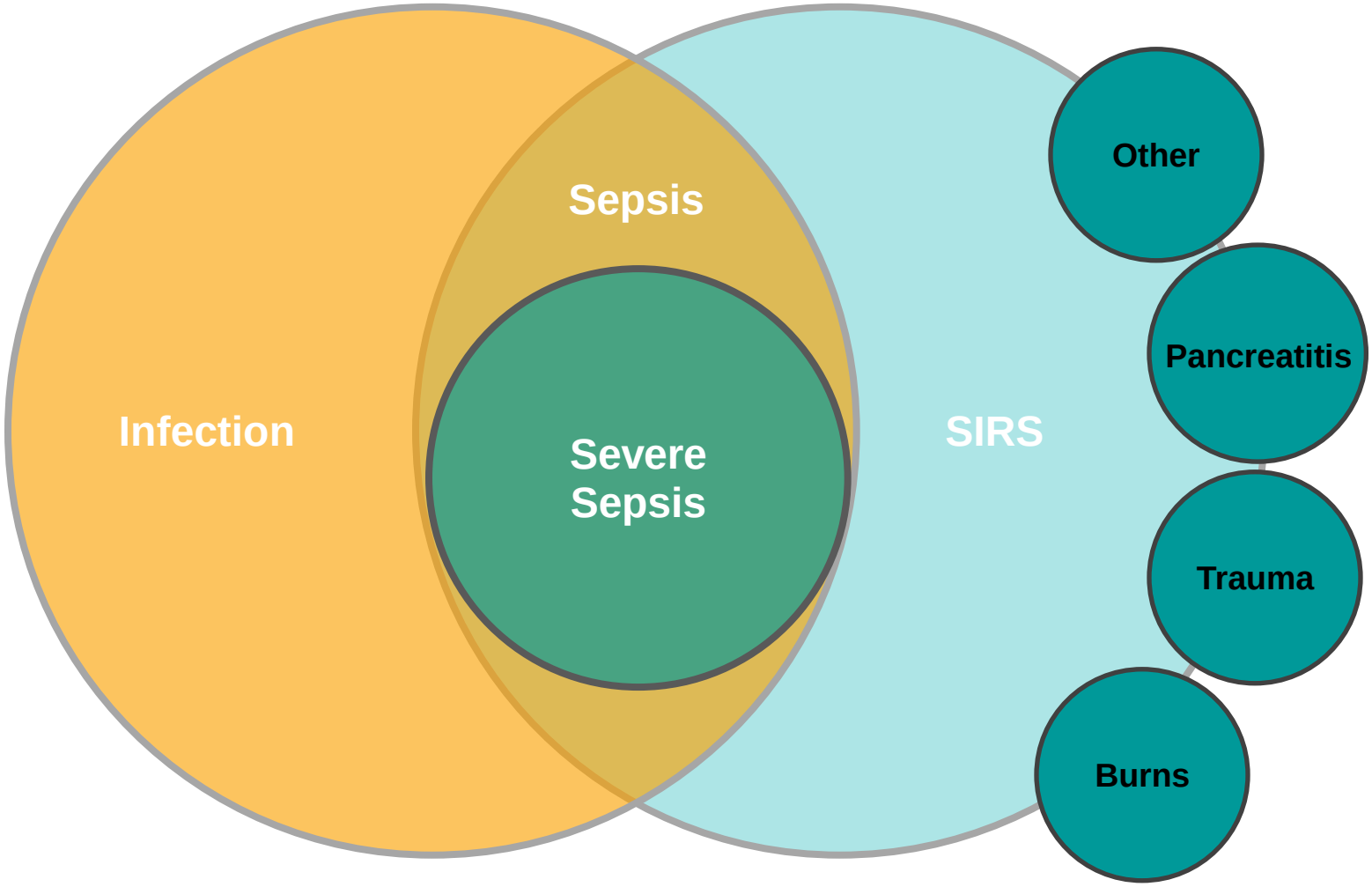
FEVER, OR SHIVERING, OR FEELING VERY COLD

EXTREME PAIN OR DISCOMFORT

CLAMMY OR SWEATY SKIN

Adapted from CDC Sepsis Infographic. https://www.cdc.gov/sepsis/pdfs/HCP_infographic_protect-your-patients-from-sepsis_508.pdf. Accessed June 11, 2021.

The Relationship Between SIRS, Sepsis, and Severe Sepsis

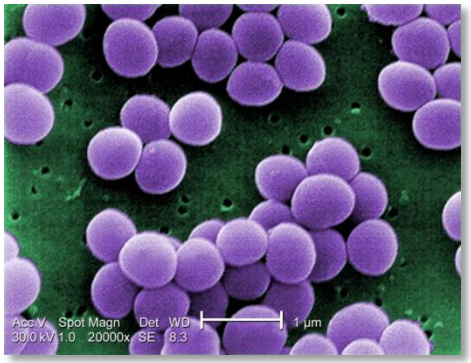


Bone RC, et al. *Chest.* 1992;101:1644-55.

Microbes

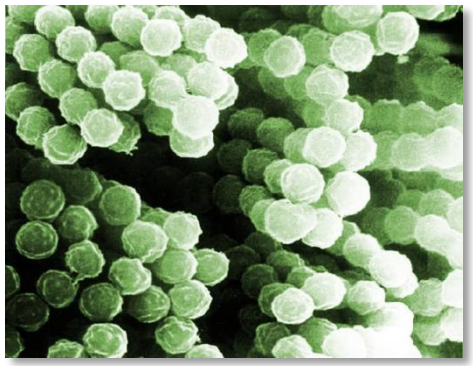
- Many different types of microbes can cause sepsis:
  - Bacteria (most common)
  - Fungi
  - Viruses
- Severe cases often result from a localized infection but sepsis can also spread throughout the body

Staphylococcus sp. (Bacteria)



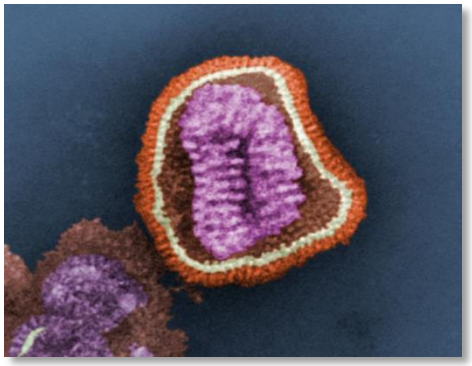
CDC/ Matthew J. Arduino

Aspergillus sp. (Fungi)



CDC/ Robert Simmons

Influenza (Virus)



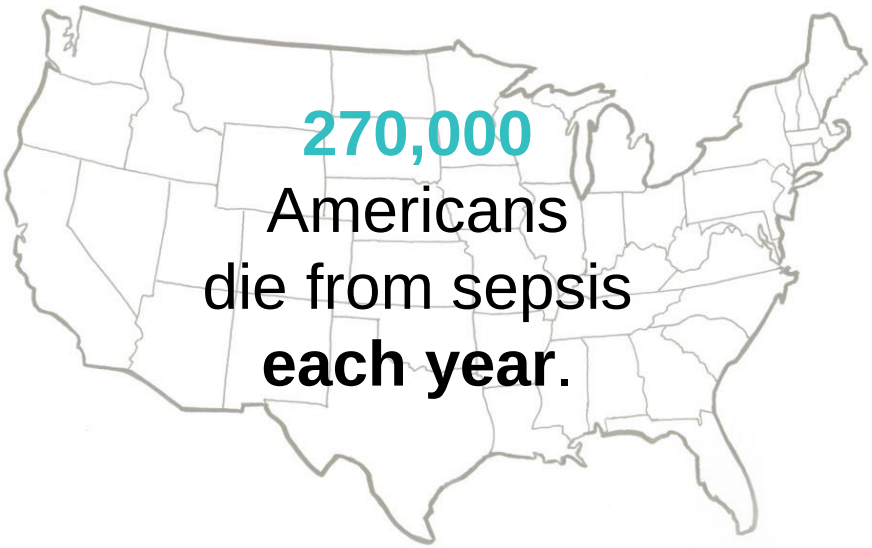
CDC/ Erskine. L. Palmer, PhD; M. L. Martin

https://www.nigms.nih.gov/education/fact-sheets/Pages/sepsis.aspx. Accessed June 9, 2021.

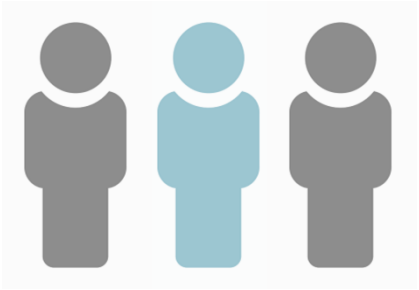
Sepsis Incidence and Mortality

1.7 Million

People get **sepsis** each year in the U.S.



270,000
Americans
die from sepsis
each year.



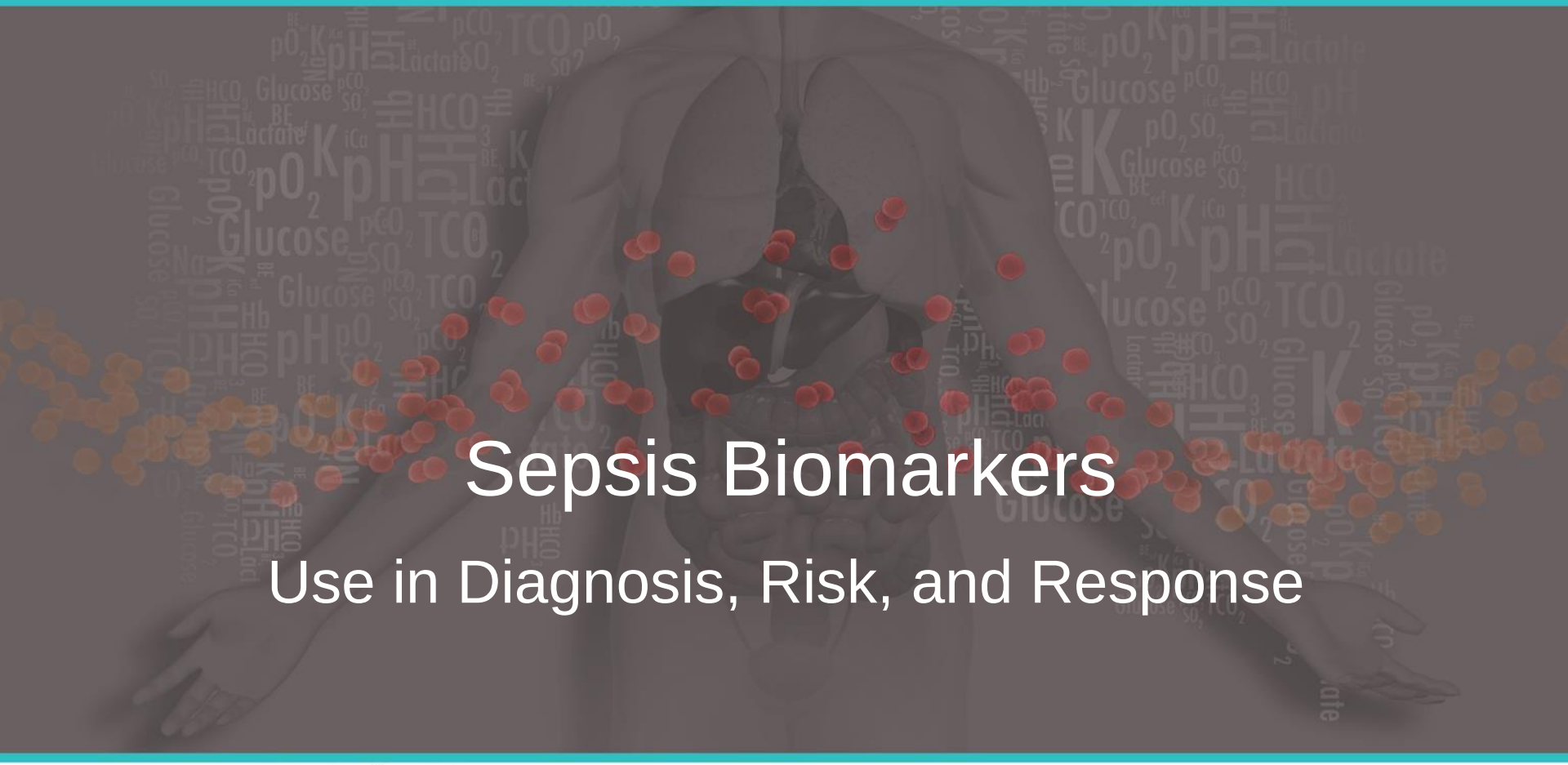
1 in 3 patients
who **die in a hospital**
have **sepsis**.

https://www.cdc.gov/sepsis/clinicaltools/index.html. Accessed June 9, 2021.

Length of Stay and Cost for Unplanned Readmissions After Index Admission for Sepsis, AMI, Heart Failure, Pneumonia, COPD

	National Readmission Data			Weighted Proportion of Cases in the United States	
	No. of All Index Admissions Readmitted Within 30 Days	Estimated Mean Length of Stay (95% CI), d	Estimated Mean Cost per Readmission (95% CI), $	Percentage of Index Admissions Readmitted Within 30 Days (95% CI)	Percentage of Total Estimated Cost of All Readmissions (95% CI)
Admissions associated with 30 d readmission	1,187,697	6.4 (6.4-6.5)	8,242 (8,225-8,258)	NA	100.0
Sensitivity analyses					
Sepsis	**89,800**	**7.6 (7.6-7.7)**	**10,828 (10,760-10,897)**	**7.3 (7.1-7.5)**	**9.1 (8.8-9.4)**
Acute Myocardial Infarction (AMI)	21,281	6.0 (5.9-6.1)	9,530 (9,408-9,654)	1.8 (1.7-1.8)	2.0 (1.9-2.1)
Heart Failure (HF)	236,636	6.5 (6.5-6.5)	9,248 (9,211-9,285)	20.0 (19.6-20.4)	22.1 (21.6-22.6)
Pneumonia	130,904	6.9 (6.9-7.0)	9,749 (9,700-9,797)	11.1 (10.9-11.4)	12.5 (12.2-12.8)
Chronic Obstructive Pulmonary Disease (COPD)	201,867	6.3 (6.3-6.4)	8,677 (8,641-8,713)	17.4 (17-17.7)	17.2 (16.7-17.7)

Mayer FB, et al. *J Am Med Assoc*. 2017;317(5):530-31.



Sepsis Biomarkers

Use in Diagnosis, Risk, and Response

Sepsis Biomarkers: Screening

1. Diagnosis of sepsis and evaluation of its severity is complicated by the highly variable and non-specific nature of signs and symptoms.

2. Many patients meet SIRS criteria but have weak signs of infection.

3. SIRS is not specific to sepsis and can result from other conditions such as acute pancreatitis and immunodeficiencies.

4. Biomarkers of sepsis may improve diagnosis and therapeutic decision-making.

Hung S, et al. *Biomedicines.* 2020;8(11):494.

Issues Encountered in Sepsis Biomarker Research

Problem
Lack of a gold standard
Effect of comorbidities and treatments
Disease heterogeneity
Small study sample size
Failure to consider pre-test probability
Inappropriate control groups

Heffernan AJ, et al. *Curr Infect Dis Report.* 2021;23:4.

Early Sepsis Biomarker Outcomes

Blood Biomarkers	Survivor Group, Median (IQR)	Nor-survivor Group, Median (IQR)	Total	*P* value
Inflammation				
hs-CRP (mg/L)	188.3 (102.9–295.7)	175.7 (136.5–300.2)	187.9 (129.8–296.8)	0.849
PCT (ng/ml)	28.0 (6.1–95.3)	29.0 (10.8–102.4)	28.5 (6.3–97.1)	0.961
IL-6 (pg/ml)	217.6 (103.3–962.4)	4809.0 (247.2–5000.0)	313.7 (121.3–2565.3)	0.001*
Circulation				
Lactate (mmol/l)	2.4 (1.8–3.2)	6.3 (2.5–14.3)	2.5 (1.9–4.1)	0.014*
NT-proBNP (ng/ml)	1596.5 (1708.6–10,635.4)	32,905.3 (17,942.5–35,000.0)	3720.1 (880.9–23,665.7)	< 0.001*
Tn-I (ng/ml)	0.0 (0.01–0.12)	0.2 (0.01–0.98)	0.01 (0.01–0.31)	0.953
Renal function				
Cr (μmol/l)	125.0 (92.0–247.0)	252.0 (239.0–463.0)	170.0 (103.0–281.0)	0.215
Liver function				
Total bilirubin (μmol/l)	13.8 (5.0–70.9)	14.8 (8.3–110.9)	14.0 (6.0–88.9)	0.505
Coagulation function				
PLT ($\times 10^9$/l), mean (SD)	170.6 (109.5)	167.4 (110.5)	169.7 (108.0)	0.919
PT (s)	15.6 (13.2–17.4)	20.1 (16.9–25.2)	16.2 (14.0–19.5)	0.030*
APTT (s)	45.1 (38.5–55.3)	59.0 (46.8–90.5)	49.0 (42.2–58.0)	0.026*
Fib (g/l)	5.1 (4.2–7.7)	5.7 (2.2–6.2)	5.1 (4.1–7.3)	0.882
INR	1.3 (1.1–1.5)	1.8 (1.5–3.8)	1.4 (1.2–1.8)	< 0.001*
d-Dimer (μg/l)	3948.5 (2093.5–7848.0)	8889.4 (4278.9–10,000.0)	4765.9 (2792.7–8716.9)	0.717

Liu J, et al. *Sci Rep.* 2021;11:1275.

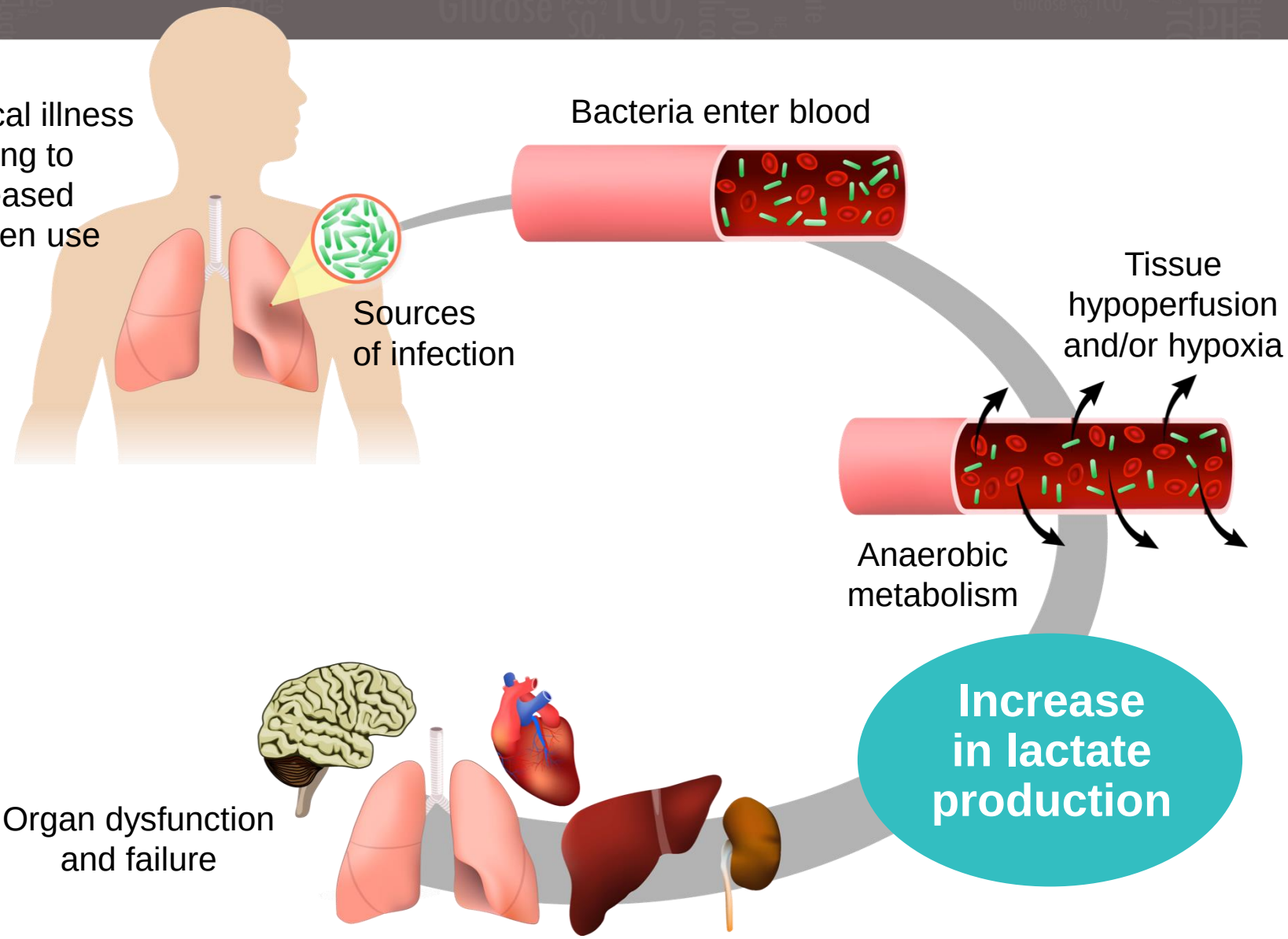
Mortality Associated With Markers of Sepsis

Marker	Univariate		Multivariate	
	OR (95 % CI)	*P*	OR (95 % CI)	*P*
Age	1.017 (1.001, 1.033)	0.038	1.022 (1.003, 1.041)	0.024
Gender	0.670 (0.389, 1.156)	0.150	0.805 (0.437, 1.485)	0.488
PCT (ng/mL)	0.999 (0.996, 1.003)	0.671	0.997 (0.982, 1.013)	0.720
CRP (mg/L)	1.001 (0.997, 1.005)	0.606	0.999(0.994, 1.004)	0.718
SOFA	1.261 (1.160, 1.371)	< 0.001	1.263 (1.148, 1.389)	< 0.001
IL-6	1.010 (1.001, 1.017)	0.045	1.000 (1.000, 1.001)	0.128
WBC	1.007 (0.997, 1.018)	0.179	1.005 (0.994, 1.004)	0.392
Body temperature	1.214 (1.002, 1.471)	0.048	1.100 (0.876, 1.381)	0.413

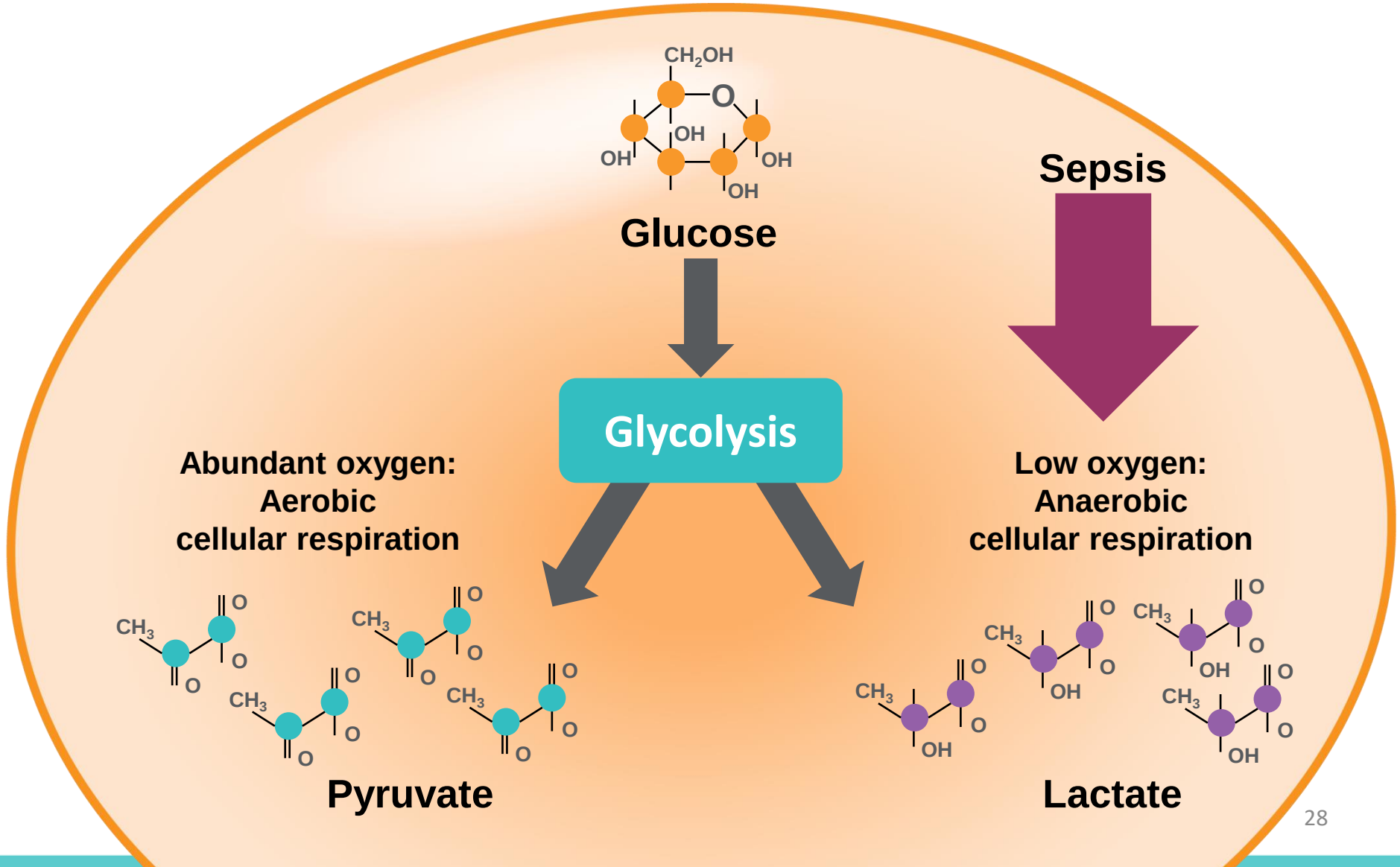
WBC = white blood cell count

Yang Y, et al. *Ann Inten Care.* 2016;6:51.

Lactate Production

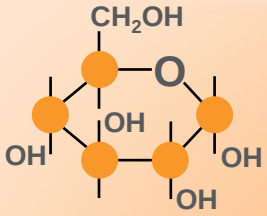


Glycolysis: Pyruvate vs. Lactate Generation

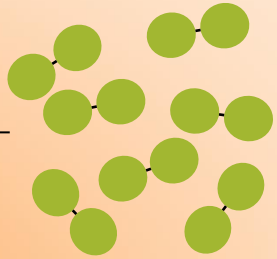


Standard Aerobic Metabolism

Glucose and oxygen within normal range

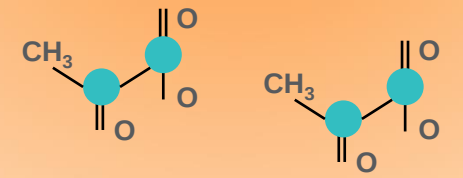


Glucose



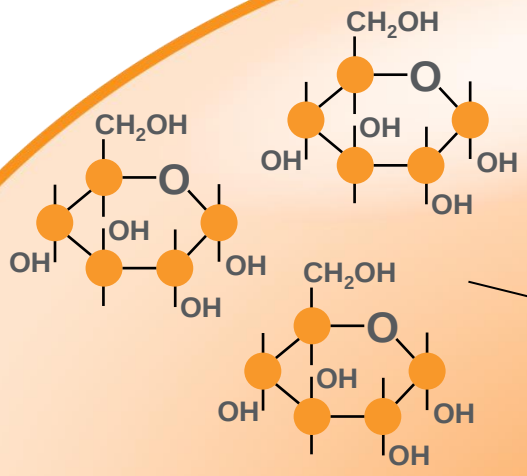
Oxygen

Glycolysis

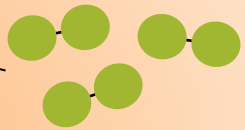


Pyruvate

Anaerobic Metabolism in Sepsis



Excessive glucose and decreased oxygen perfusion



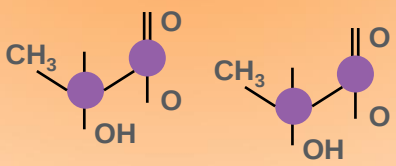
Glucose

Uncontrollable inflammatory response may cause metabolic derangements including hyperglycemia

Glycolysis

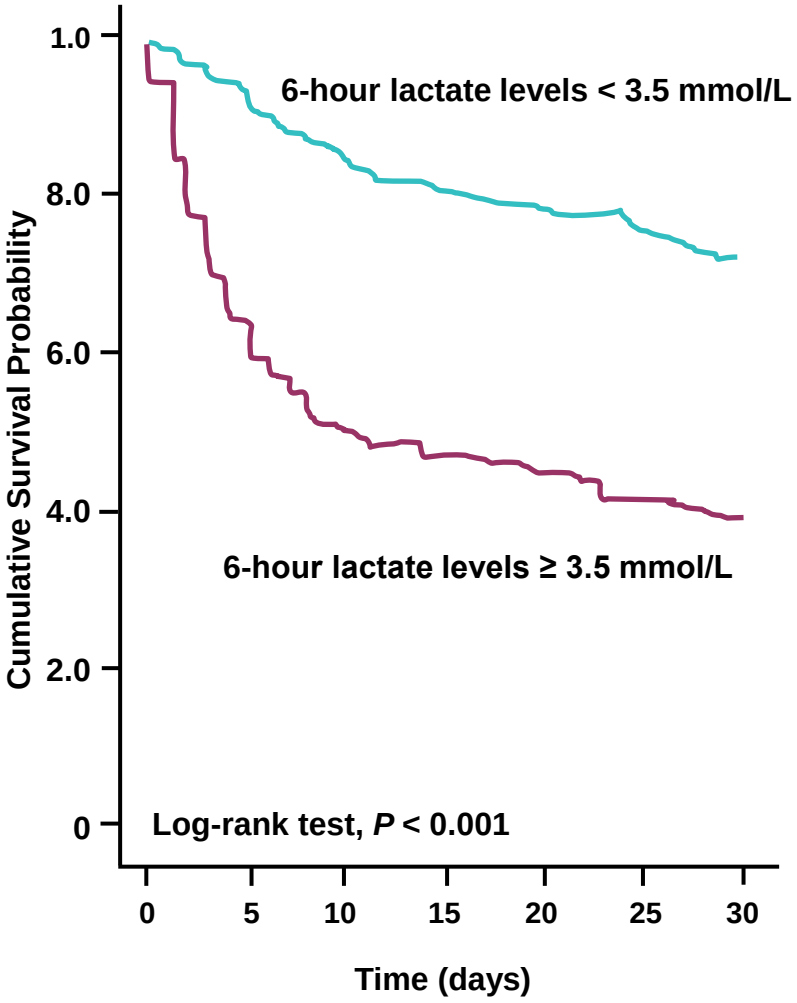
Oxygen

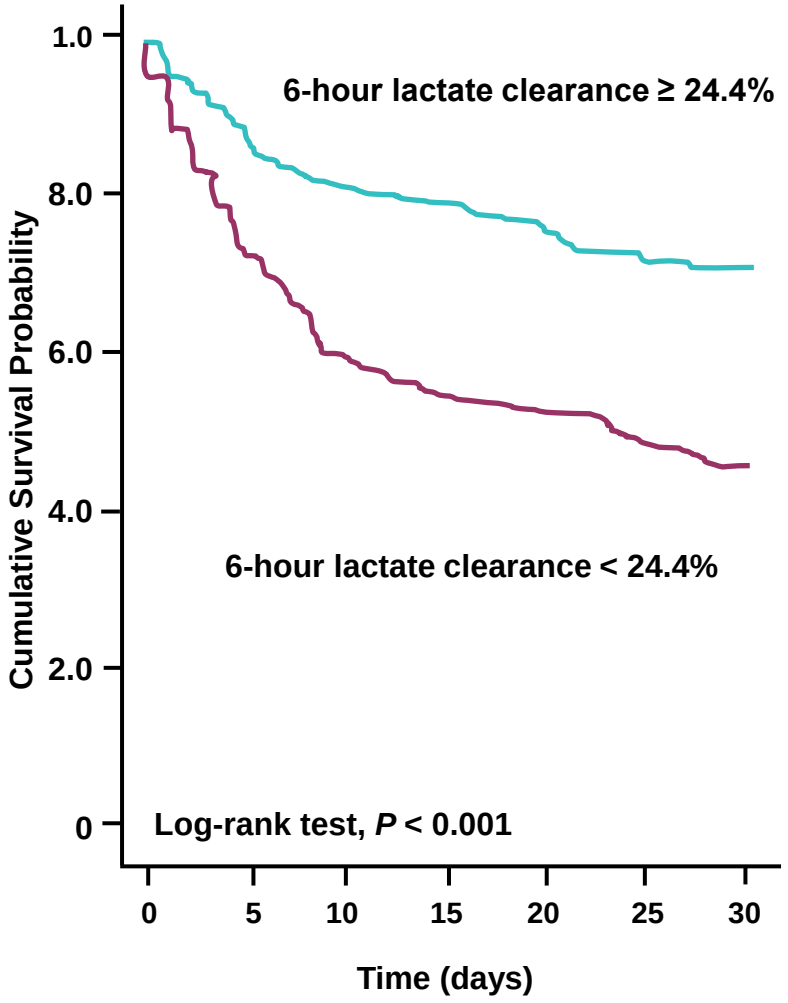
Decrease tissue perfusion leads to hypoxia



Lactate

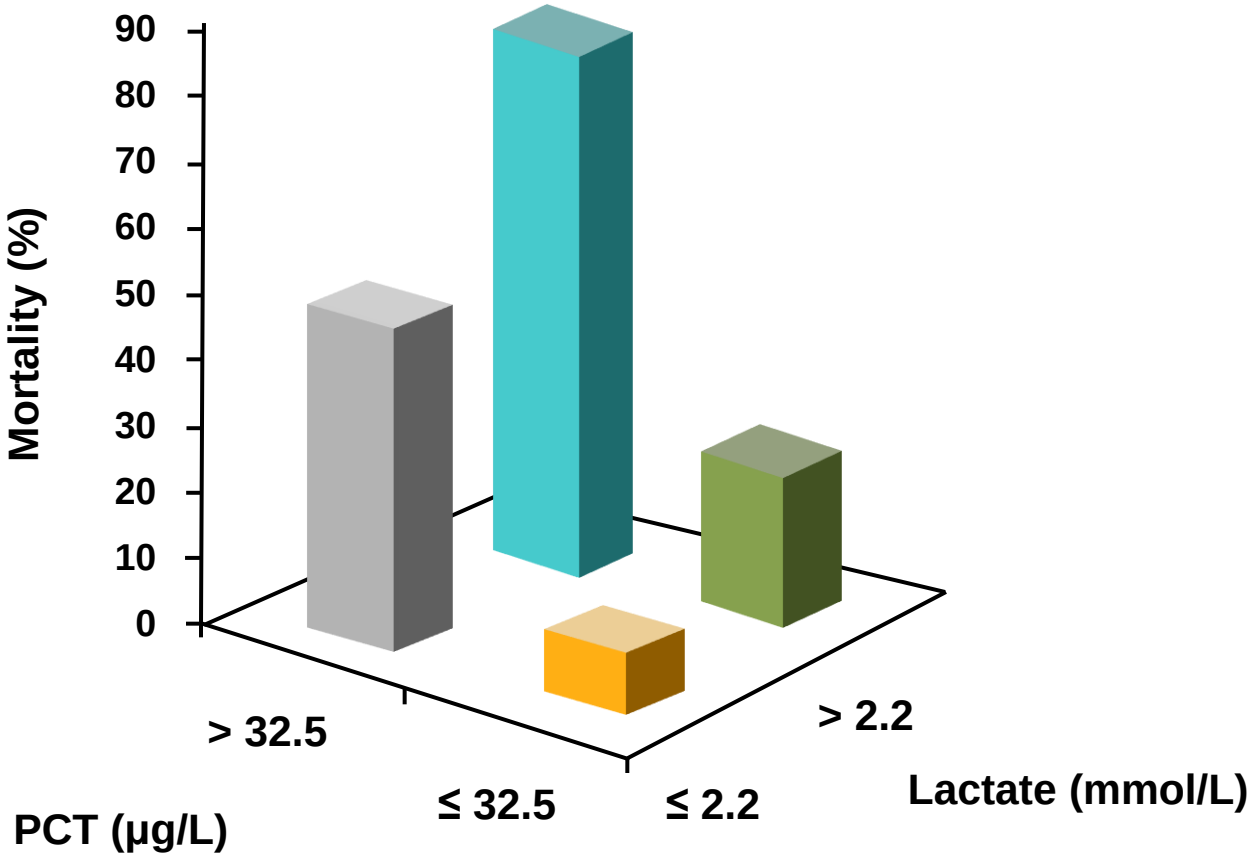
6-Hour Lactate and 30-Day Mortality





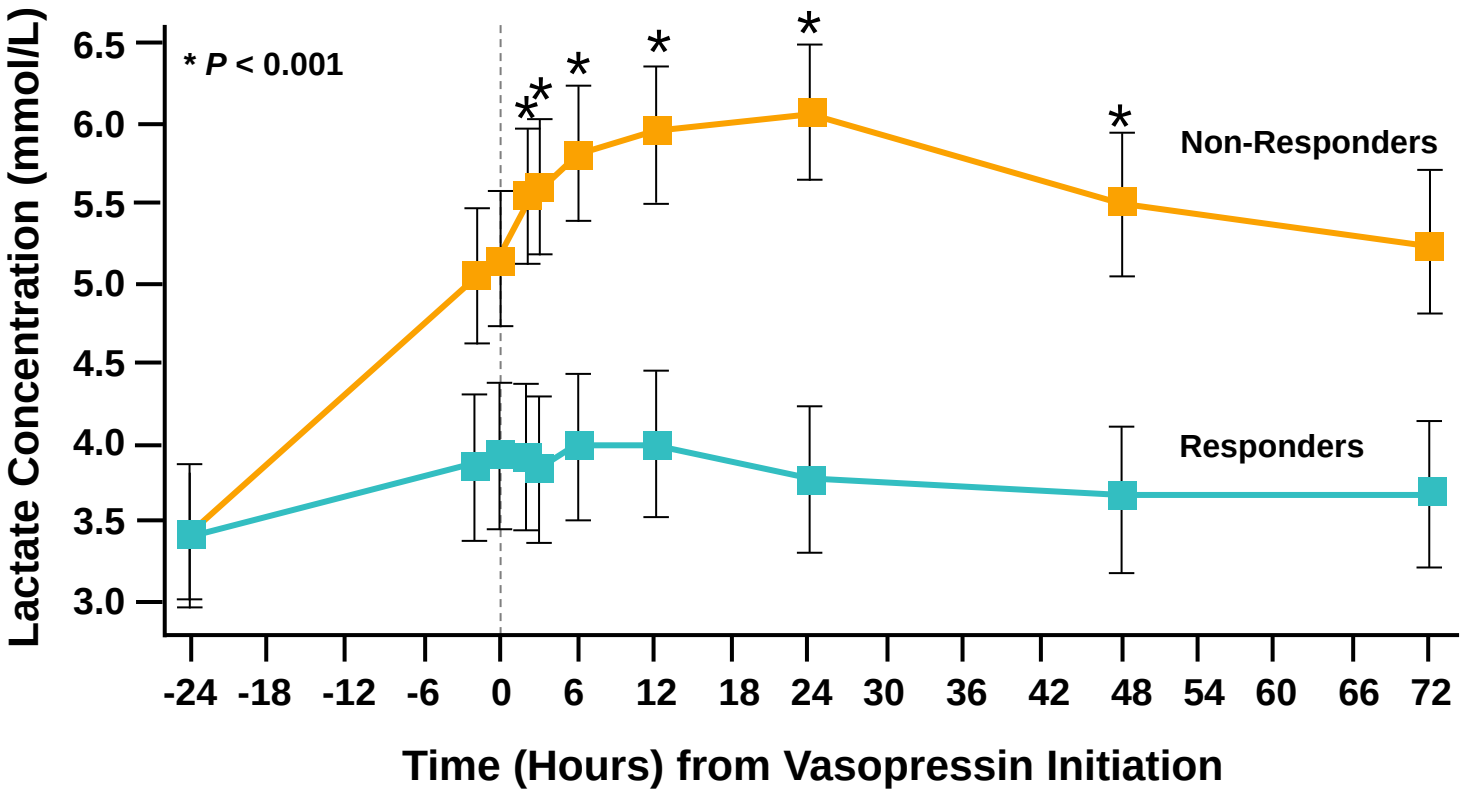
Lee SG, et al. *Med (Baltimore)*. 2021;100(7):e24835.

Lactate and PCT: 30-Day Mortality



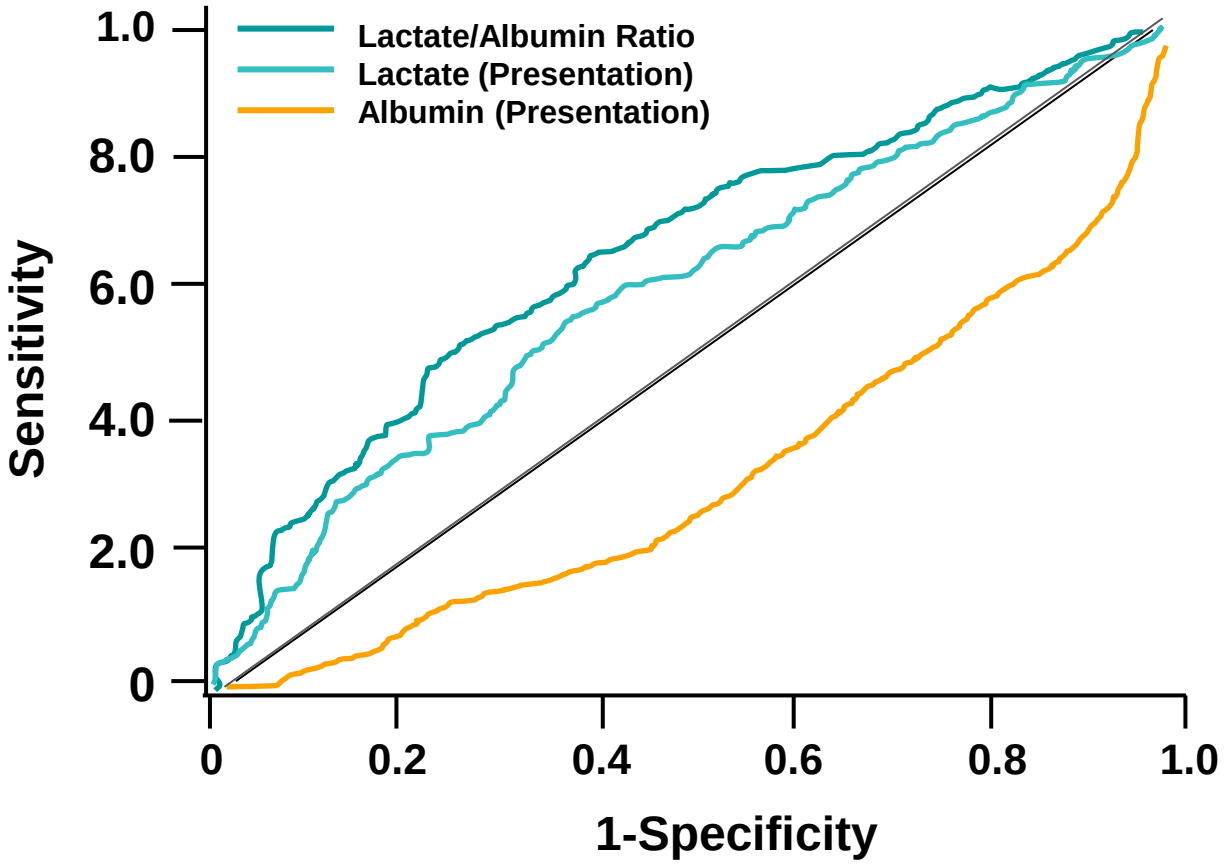
Peschanski N, et al. *Ann Inten Care.* 2016;6:47.

Lactate and Vasopressin Response in Septic Shock



Adapted from Sacha GL, et al. *Ann Intensive Care.* 2018;8:35.

Lactate/Albumin Ration Predicts In-Hospital Mortality



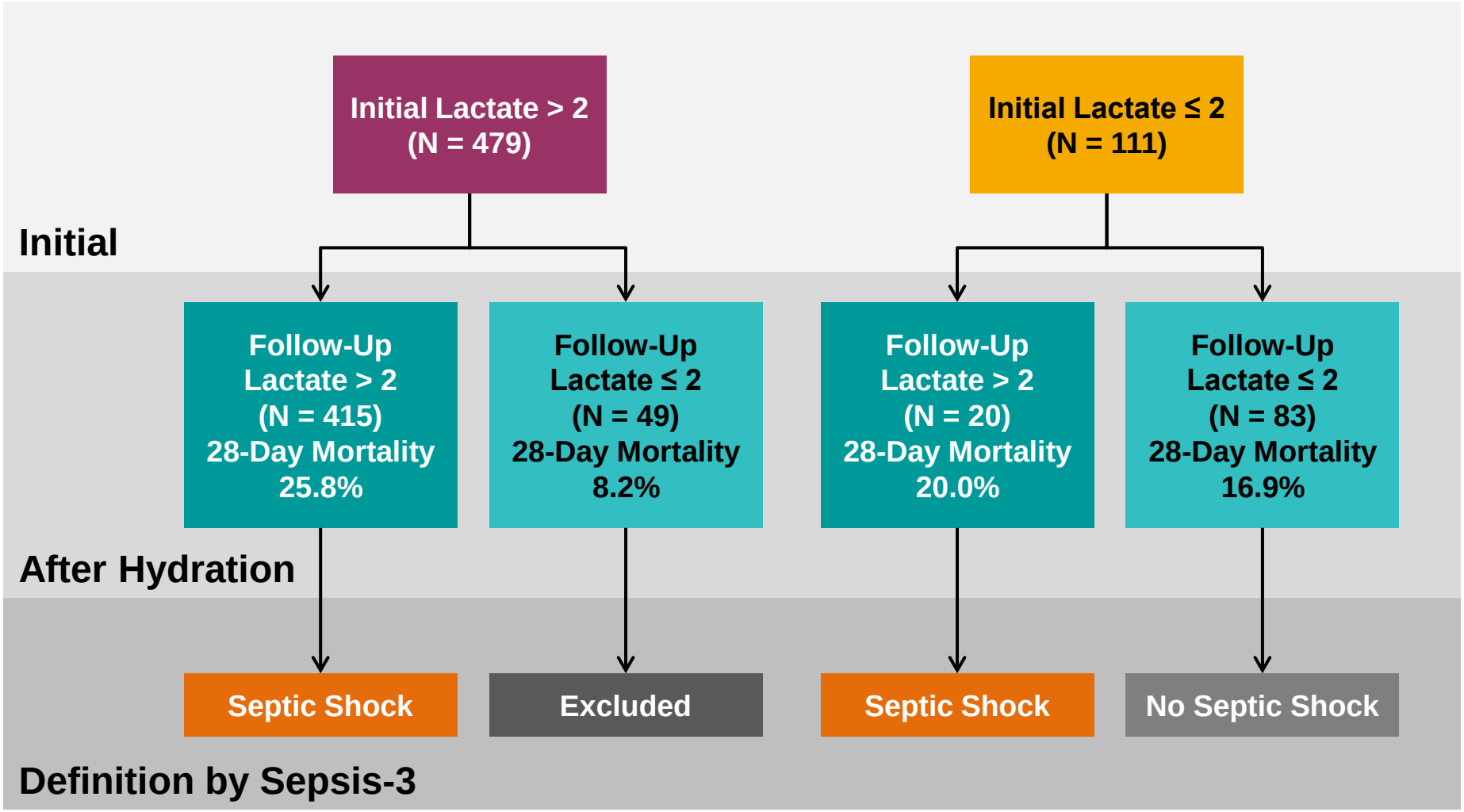
Chebl RB, et al. *Front Med.* 2020;7:550182.

Septic Shock

Outcome	OR (95% CI)	*P* value
Multivariable analysis and association with response to vasopressin[a]		
Non-medical ICU	1.70 (1.18–2.46)	0.005
Lactate at AVP initiation, mmol/L	0.93 (0.89–0.97)	< 0.001
Multivariable analysis and association with ICU mortality		
Hemodynamic response to AVP	0.51 (0.35–0.76)	0.001
Catecholamine dose, mcg/kg/min	3.14 (1.36–7.28)	0.008
Lactate at AVP initiation, mmol/L	1.10 (1.04–1.18)	0.002

Adapted from Sacha GL, et al. *Ann Intensive Care.* 2018;8:35.

Mortality in Septic Shock



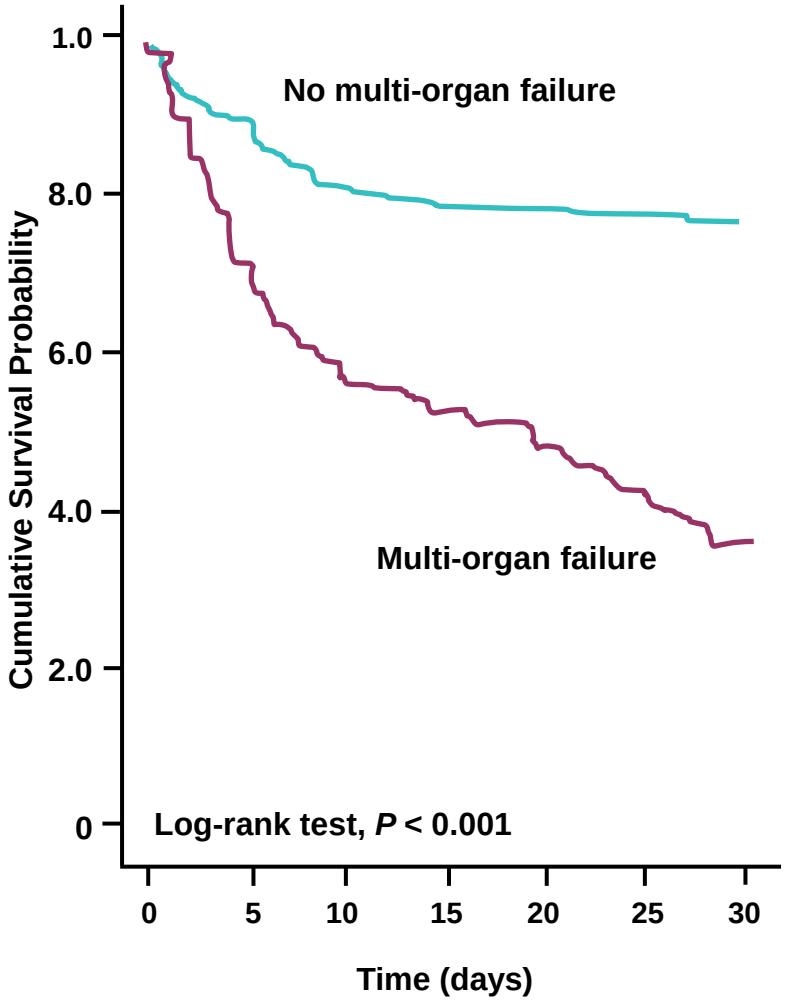
Ko BS, et al. *Critical Care*. 2018;22:47.

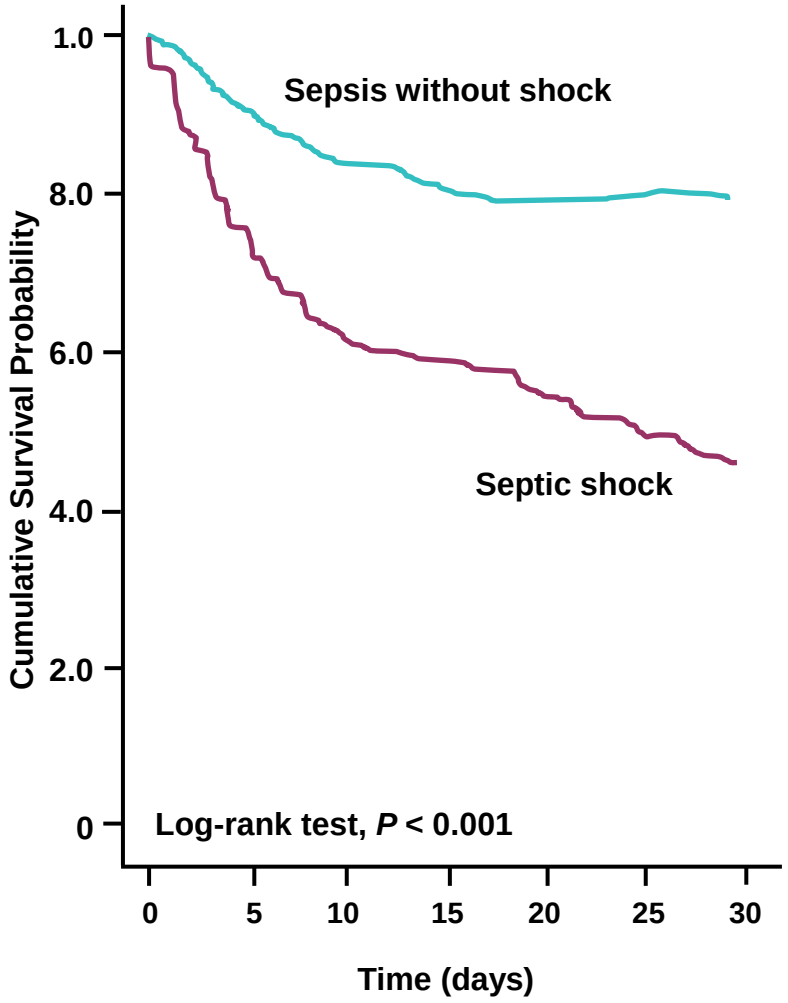
Mortality in Septic Shock

	Mortality at 28 days, number/total number of patients per group (%)
Hypotensive after fluids and vasopressor therapy and serum lactate levels > 2 mmol/L)	111/435 (25.5%)
Hypotensive after fluids and vasopressor therapy and serum lactate levels ≤ 2 mmol/L)	18/132 (13.6%)
Hypotensive after fluids and no vasopressors and serum lactate levels > 2 mmol/L)	18/77 (23.4%)
Serum lactate levels > 2 mmol/L and no hypotension after fluids and no vasopressors)	20/82 (24.4%)
Serum lactate levels between 2-4 mmol/L and no hypotension before fluids and no vasopressors)	Not applicable
Hypotensive after fluids and no vasopressors and serum lactate ≤ 2 mmol/L)	8/86 (9.3%)

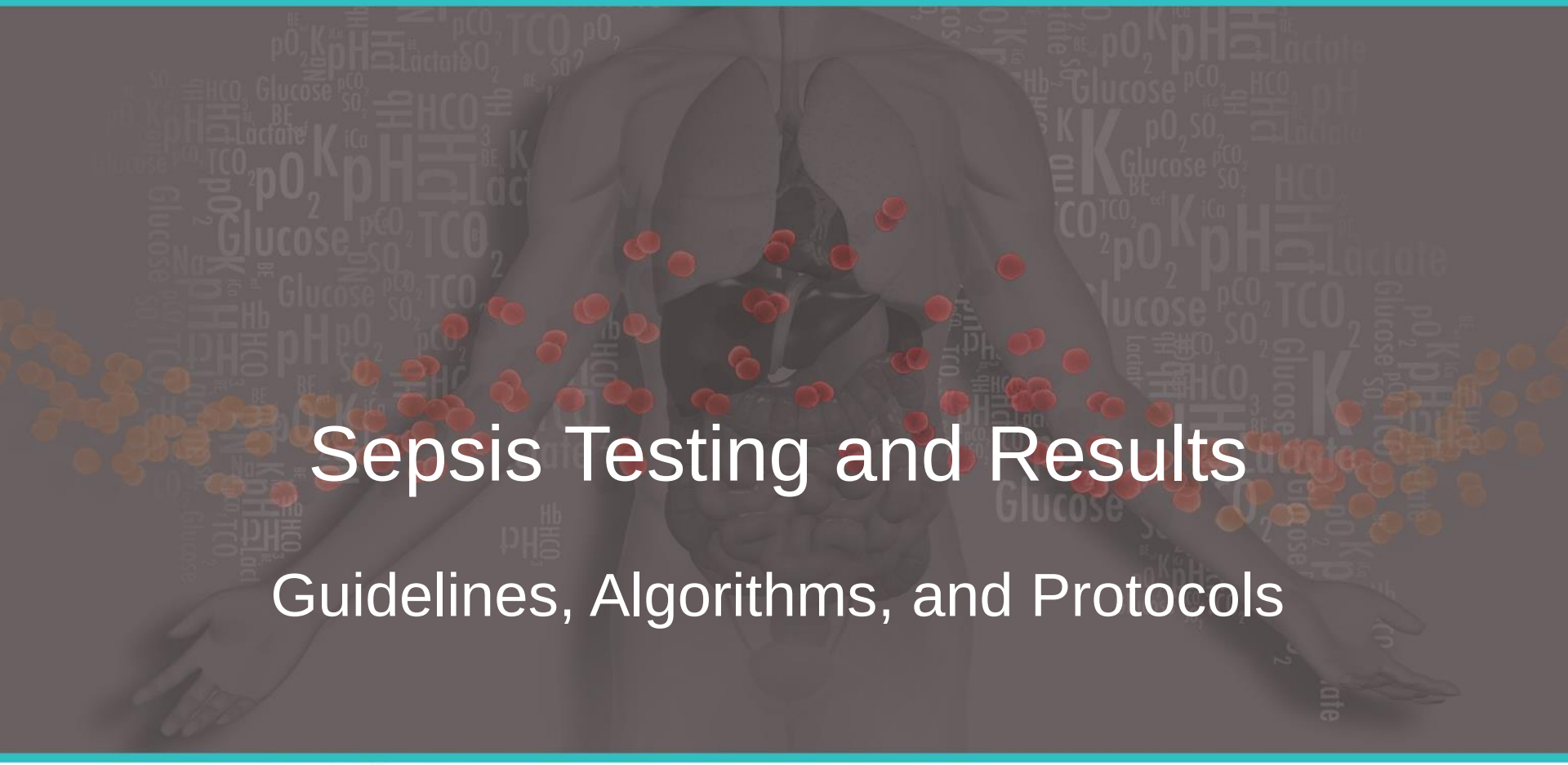
Ko BS, et al. *Critical Care*. 2018;22:47.

Multi-Organ Failure and Septic Shock Predict 30-Day Mortality





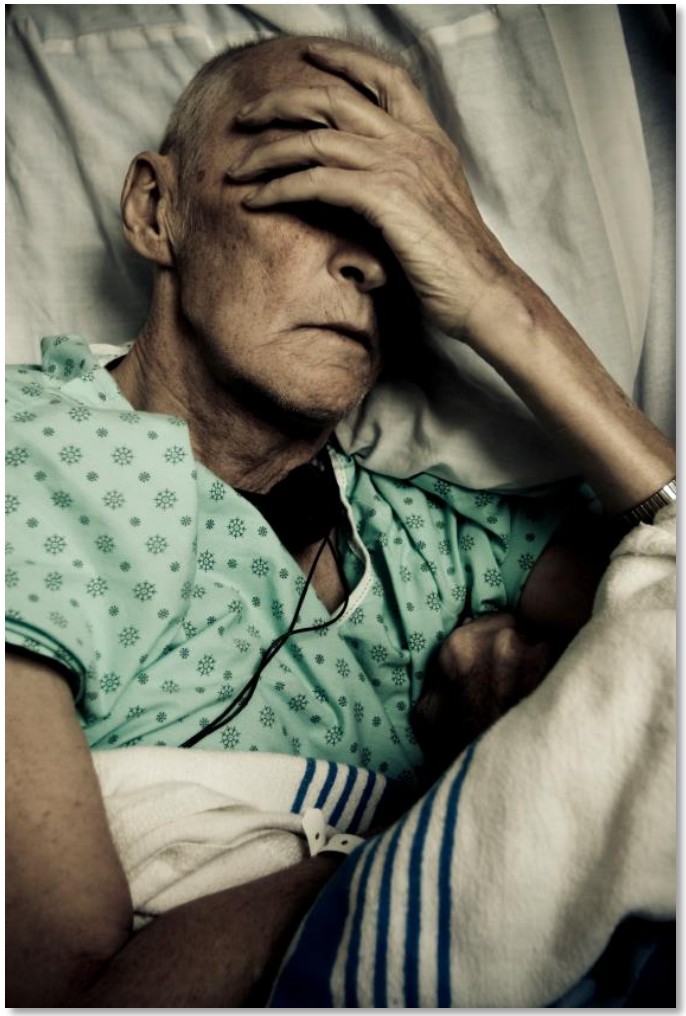
Lee SG, et al. *Med (Baltimore)*. 2021; 100(7):e24835.



Sepsis Testing and Results

Guidelines, Algorithms, and Protocols

Factors to Consider When Evaluating Sepsis



- Blood gases
- Electrolytes
- Glucose
- Hematocrit
- Lactate

Sepsis Resuscitation Bundle and CMS Core Measures

1. The Sepsis Resuscitation Bundle is published by the Surviving Sepsis Campaign and is used by multiple hospitals across the country.

2. The goal is to perform all indicated tasks 100% of the time within the first 6 hours of identification of severe sepsis.

3. CMS has used the Sepsis Resuscitation Bundle as a foundation for SEP-1, the new early management core measures bundle for sepsis.
   - SEP-1 includes 3 and 6 hour time limits

Surviving Sepsis Campaign. http://sccm.org
Early Management Bundle, Severe Sepsis/Septic Shock. Specifications Manual for National Hospital Inpatient Quality Measures Discharges 07-01-19 (3Q19) through 12-31-19 (4Q19) Version 5.6. 2019.

2016 Surviving Sepsis Campaign Guideline

2016 Resuscitation Guideline
Treatment and resuscitation should begin immediately.
> 30 mL/kg of IV crystalloid should fluid be given within the first 3 hours.
Following initial fluid resuscitation, additional fluids should be guided by frequent reassessment of hemodynamic status.
Hemodynamic assessment should determine the type of shock if the clinical examination does not lead to a clear diagnosis.
Dynamic over static variables should be used to predict fluid responsiveness.
Initial target mean arterial pressure should be 65 mmHg in septic shock requiring vasopressors.
Guided resuscitation should normalize lactate in patients with elevated lactate levels.

Rhodes A, et al. *Intensive Care Med*. 2017;43:304–77.

Hour-One Surviving Sepsis Bundle Update

1. Measure lactate level (repeat lactate if initial lactate elevated [> 2mmol/L]).
2. Obtain blood cultures before administering antibiotics.
3. Administer broad-spectrum antibiotics.
4. Begin rapid administration of 30mL/kg crystalloid for hypotension or lactate ≥ 4mmol/L.
5. Apply vasopressors if hypotensive during or after fluid resuscitation to maintain mean arterial pressure ≥ 65 mmHg.

Levy MM, et al. *Intensive Care Med*. 2018;44:925–28.

SEP-1: Early Management Bundle, Severe Sepsis/Septic Shock Specifications Manual for National Inpatient Quality Measures

1. CMS has provided an algorithm for treatment of severe sepsis in the Severe Sepsis and Septic Shock Management Bundle.

2. On October 1, 2015 CMS began collecting data from hospitals participating in the inpatient quality reporting program for this management bundle.

3. SEP measures were updated in July of 2019.

Early Management Bundle, Severe Sepsis/Septic Shock. Specifications Manual for National Hospital Inpatient Quality Measures Discharges 07-01-19 (3Q19) through 12-31-19 (4Q19) Version 5.6. 2019.

Severe Sepsis and Septic Shock Management

Severe Sepsis

Within 3 Hours of Meeting All Severe Sepsis Criteria

1. Initial **lactate** level measurement.
2. Obtain blood cultures prior to antibiotics.
3. Administer a broad-spectrum or other antibiotic.

Within 6 Hours

4. Repeat **lactate** level measurement only if initial level is elevated.

Septic Shock

Within 3 Hours of Meeting All Septic Shock Criteria

1. Resuscitation with 30 mL/kg crystalloid fluids.

Within 6 Hours (If hypotension still present)

2. Vasopressors.
3. Repeat volume status and tissue perfusion assessment.

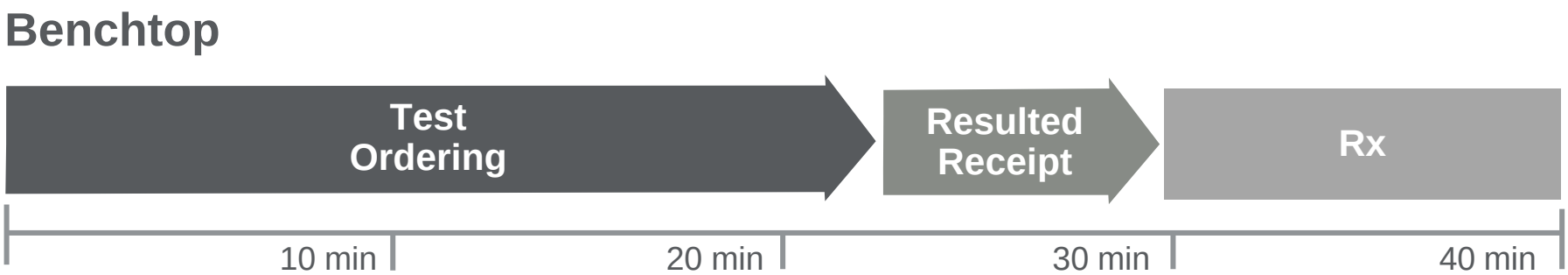
Early Management Bundle, Severe Sepsis/Septic Shock. Specifications Manual for National Hospital Inpatient Quality Measures Discharges 07-01-19 (3Q19) through 12-31-19 (4Q19) Version 5.6. 2019.

CMS Data Collection:
All Sepsis Codes AND Numbers of Compliant Cases

Total ICD-10-CM Codes of Sepsis, Severe Sepsis, or Septic Shock

Early Management Bundle, Severe Sepsis/Septic Shock. Specifications Manual for National Hospital Inpatient Quality Measures Discharges 07-01-19 (3Q19) through 12-31-19 (4Q19) Version 5.6. 2019.

Principles and Practice of Point-of-Care Testing



Nichols JH, et al. J Appl Lab Med. 2020. doi:10.1093/jalm/jfaa059.

Turnaround Time

- Serum lactate must be available with rapid turnaround time (within minutes) to effectively treat severely septic patients
- An arterial blood gas analyzer located in the clinical laboratory usually accomplishes this
- Hospitals should invest in adequate equipment in to meet present standards of care for septic patients
- If a central analyzer is not efficient in a particular hospital setting, point-of-care analyzers should be evaluated for faster turnaround time

https://www.sccm.org/SurvivingSepsisCampaign/Guidelines. Accessed July 9, 2021.
www.emcrit.org/wp-content/uploads/lactate-faq.pdf. Accessed July 9, 2021.

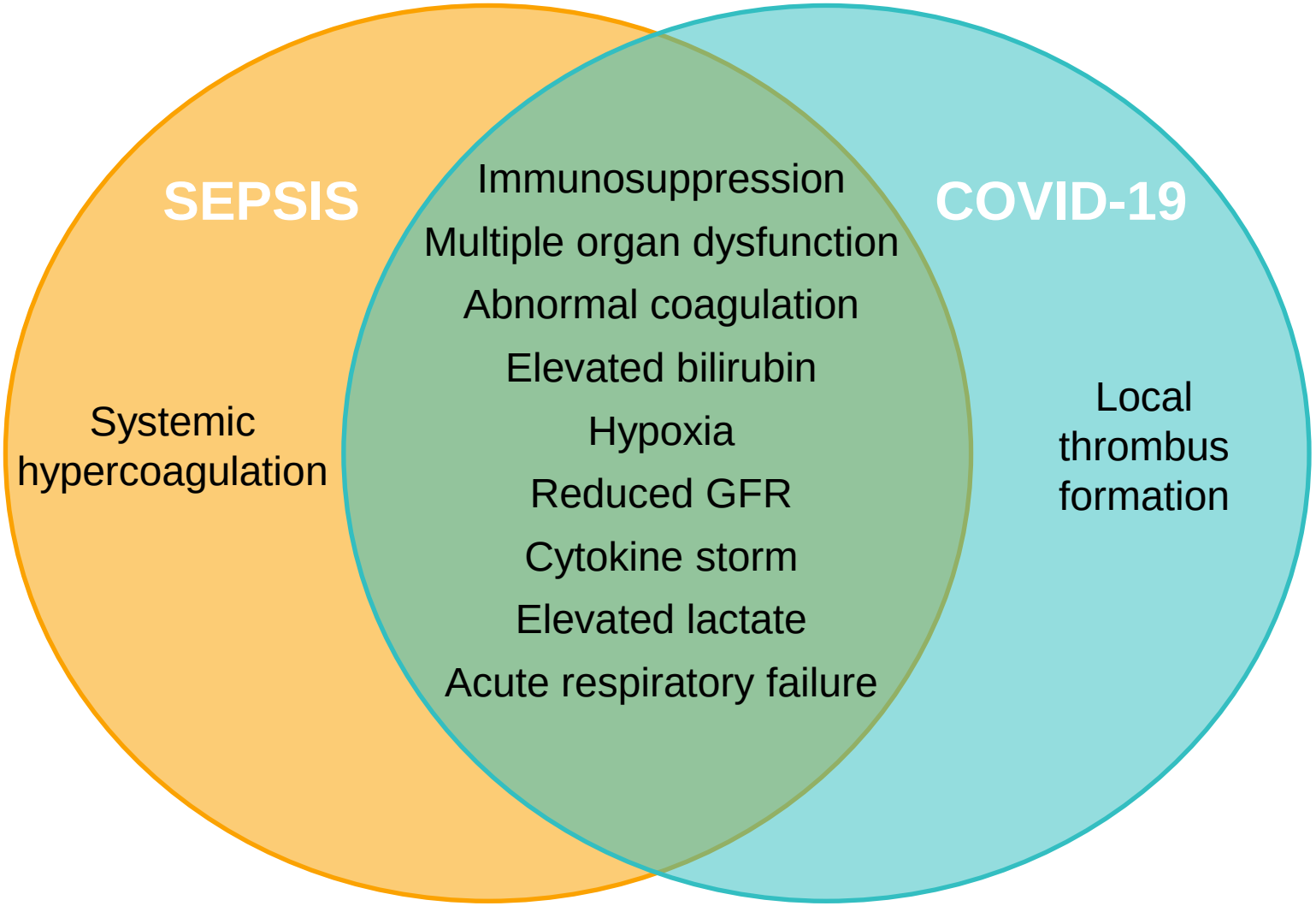
Outcomes of Point-of-Care Lactate

Outcome	*P* Value
Mortality	< 0.05
Length of stay	< 0.05
Time to available result	< 0.001
Time to IV fluids	< 0.05
Time to antibiotics	< 0.001

Morris E, et al. *Br J Gen Pract.* 2017;67(665):e859–70.

Sepsis and Covid-19

Is Covid-19 Viral Sepsis?



Olwal CO, et al. *Front Immunol*. 2021;12:602848.

SSC Covid-19 Definition

Category	Definition
Severe	Clinical signs of pneumonia (fever, cough, dyspnea, fast breathing) and one of the following:
	• Respiratory rate > 30 breaths/min;
	• Severe respiratory distress; or
	• Oxygen saturation < 90% on room air
Critical	Presence of acute respiratory distress syndrome or respiratory failure requiring ventilation, **sepsis, or septic shock**

Alhazzani W, et al. *Crit Care Med*. 2021;49(3):e219-34.

SSC COVID-19 Guidelines

Previous SSC COVID-19 Guideline	New SSC COVID-19 Guideline	Justification
Recommendation/Statement	**Recommendation/Statement**	
Ventilation		
Not applicable	1. There is insufficient evidence to issue a recommendation on the use of awake prone positioning in nonintubated adults with severe COVID-19.	• Uncertainty about the balance between benefit and harm • Awaiting the results of ongoing RCTs
Therapy		
No recommendation	2. For adults with severe or critical COVID-19, we recommend against using hydroxychloroquine (strong recommendation).	• Moderate-quality evidence showed no effect on mortality or need for mechanical ventilation
In mechanically ventilated adults with COVID-19 and respiratory failure (without ARDS), we suggest against the routine use of systemic corticosteroids. In mechanically ventilated adults with COVID-19 and ARDS, we suggest using systemic corticosteroids over not using corticosteroids.	3. For adults with severe or critical COVID-19, we recommend using a short course of systemic corticosteroids over not using corticosteroids (strong recommendation).	• High-quality evidence showing reduction in death • Minimal adverse effects with short course of corticosteroids • Corticosteroids are affordable and widely available

Alhazzani W, et al. *Crit Care Med*. 2021;49(3):e219-34.

SSC COVID-19 Guidelines

Previous SSC COVID-19 Guideline	New SSC COVID-19 Guideline	Justification
Recommendation/Statement	**Recommendation/Statement**	
Therapy		
Not applicable	4. For adults with severe or critical COVID-19 who are considered for systemic corticosteroids, we suggest using dexamethasone over other corticosteroids (weak recommendation).	• There are no trials comparing different corticosteroids with each other
	Remark: If dexamethasone is not available, clinicians may use other corticosteroids in doses equivalent to 6 mg daily of dexamethasone for up to 10 days.	• Dexamethasone was associated with the largest treatment effect compared to no corticosteroids
		• Dexamethasone is widely available
		• It remains unclear whether this is a class effect or drug-specific effect
In critically ill adults with COVID-19, we suggest against the routine use of convalescent plasma.	5. For adults with severe or critical COVID-19, we suggest against the use convalescent plasma outside clinical trials (weak recommendation).	• Low-quality evidence from RCTs showed no improvement in outcomes
		• Awaiting the results of large ongoing RCT

Alhazzani W, et al. *Crit Care Med*. 2021;49(3):e219-34.

SSC COVID-19 Guidelines

Previous SSC COVID-19 Guideline	New SSC COVID-19 Guideline	Justification
Recommendation/Statement	**Recommendation/Statement**	
Therapy		
No recommendation	6. For adults with severe COVID-19 who do not require mechanical ventilation, suggest using IV remdesivir over not using it (weak recommendation).	• The result of a placebo-controlled trial showed large reduction in time to recovery and hospital stay
	Remark: Remdesivir should ideally be started within 72 hours of positive severe acute respiratory syndrome coronavirus 2 polymerase chain reaction or antigen testing.	• Subgroup analysis from the three trials showed a discordant effect on mortality, suggesting a possible reduction in death in patients who are not invasively ventilated
		• Despite cost and limited availability, we believe that many patients, if presented with data, would prefer to receive remdesivir
No recommendation	7. For adults undergoing mechanical ventilation for critical COVID-19, we suggest against starting IV remdesivir (weak recommendation).	• Limited data on the effect of remdesivir on outcomes of mechanically ventilated patients
		• Until more data is available, current costs and limited drug availability favor a weak recommendation against its use in this population

Alhazzani W, et al. *Crit Care Med*. 2021;49(3):e219-34.

SSC COVID-19 Guidelines

Previous SSC COVID-19 Guideline	New SSC COVID-19 Guideline	Justification
Recommendation/Statement	**Recommendation/Statement**	
Therapy		
Not applicable	8. For adults with severe or critical COVID-19, we recommend using pharmacologic VTE prophylaxis over not using prophylaxis (strong recommendation).	• High-quality indirect evidence from non-COVID-19 population shows that VTE prophylaxis is superior to no prophylaxis • VTE rates are higher in COVID-19 population
Not applicable	9. For adults with severe or critical COVID-19 and no evidence of VTE, we suggest against the routine use of therapeutic anticoagulation outside of clinical trials (weak recommendation, very low quality evidence).	• Awaiting the publication of ongoing RCTs

Alhazzani W, et al. *Crit Care Med*. 2021;49(3):e219-34.

Case Study

Case Study: Mr. Z

Mr. Z was a 47-year-old male who was admitted to the emergency department complaining of a toothache that had been present for 7 days.

His tooth pain was severe and he came to the emergency department since he could not see his dentist until the morning. He had drainage from tooth #20, for which a culture was obtained and sent to the lab.

He said, “My tooth is killing me! You can pull it if you need to. I feel like it is going to explode.”

Case Study: Mr. Z

Mr. Z was alert and oriented.

He had a history of hypertension and had a hemorrhagic stroke 10 years ago but had no major health issues since.

His heart and lung sounds were normal and his skin was cool and moist. He had good capillary refill, abdomen soft and non-tender.

He was currently on cefoxitin 2 g i.v. q6h.

Case Study: Mr. Z

Admission	
Heart Rate	111
Temperature	38.7
SPO_2	0.96
NIBP	128/88 (101)
Respiratory Rate	22

SPO2 = Pulse oximetry oxygen saturation
NIBP - Non-invasive blood pressure

Questions

1. Does Mr. Z have signs of sepsis?
   Yes

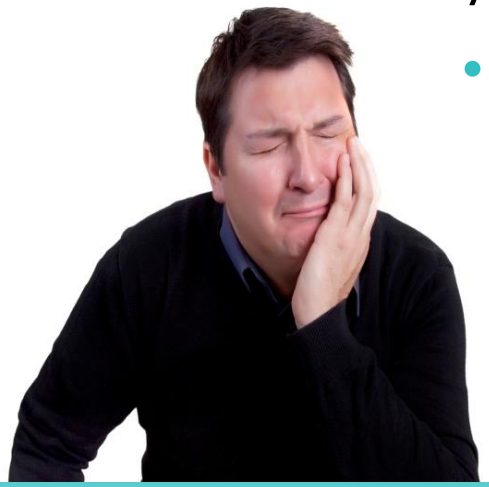
2. What is a blood test that would be useful?
   Lactate

Case Study: Mr. Z

	Admission	After 20 mL/kg normal saline (10 minutes)
Heart Rate	111	104
Temperature	38.7	38.6
SPO_2	0.96	0.96
NIBP	128/88 (101)	130/88 (102)
Respiratory Rate	22	22
Serum Lactate	3.5	-

Case Study: Mr. Z

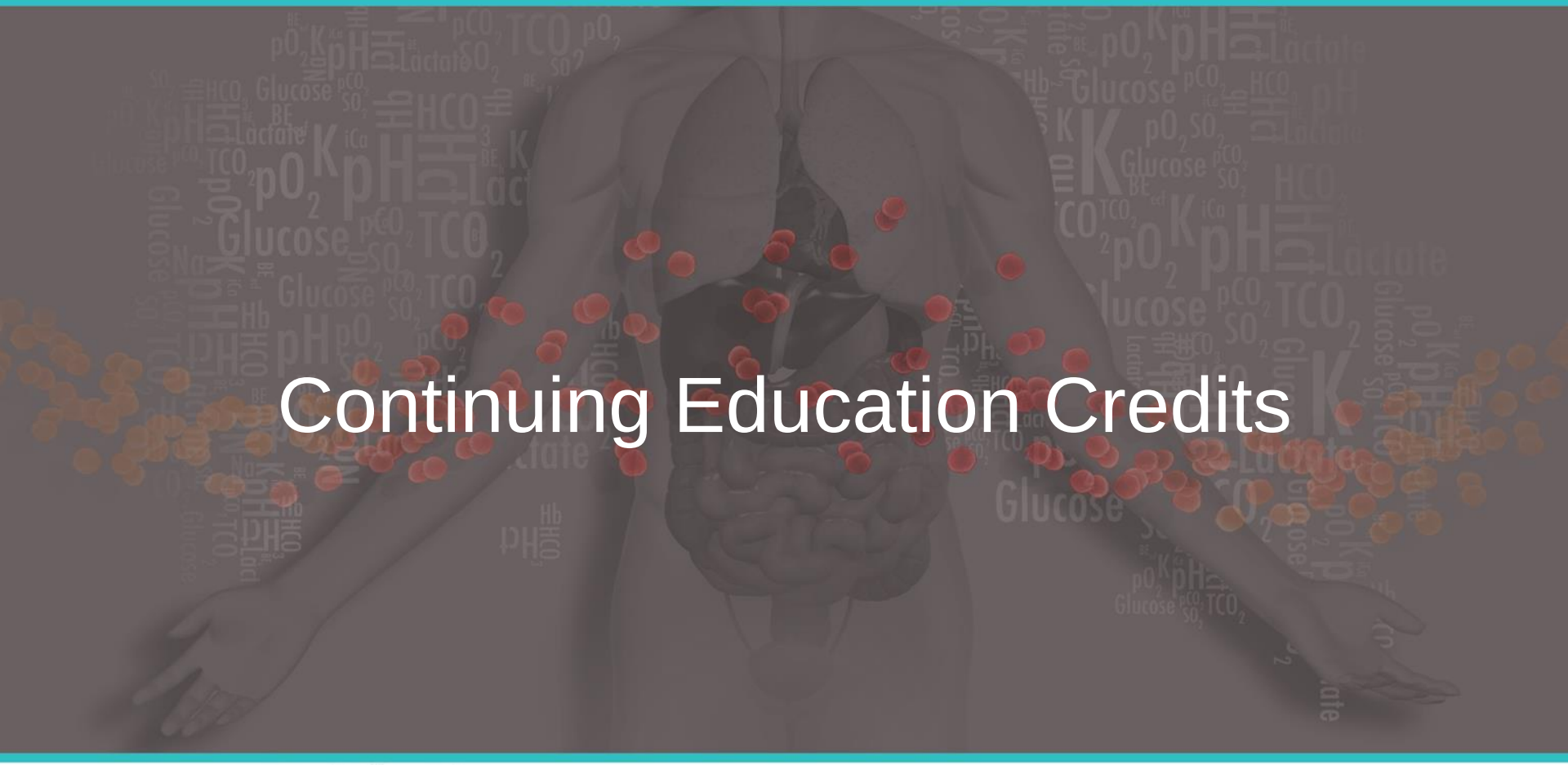
After 4 Hours	
Heart Rate	88
Temperature	38.1
SPO_2	0.98
NIBP	133/78 (94)
Respiratory Rate	17
Serum Lactate	1.8



- A decrease in lactate shows improved perfusion
  - If the lactate had remained elevated, more fluids could have been given
    - The use of the lactate allowed the clinician to better evaluate the seriousness of the situation
      - Often, vital signs are normal when lactate levels are elevated

Conclusions

1. Sepsis exists on a continuum of conditions ranging from mild to severe.
2. The incidence and prevalence of sepsis continues to increase along with length of stay and associated hospital costs.
3. High levels of sepsis markers such as SOFA scores and lactate are associated with increased risk of death independent of other aspects of sepsis bundle guidelines.
   - Clearance of biomarkers, such as lactate, are associated with improved outcome
4. Point-of-care measurements are faster than central laboratories.
   - May be beneficial for serial measurements



Continuing Education Credits

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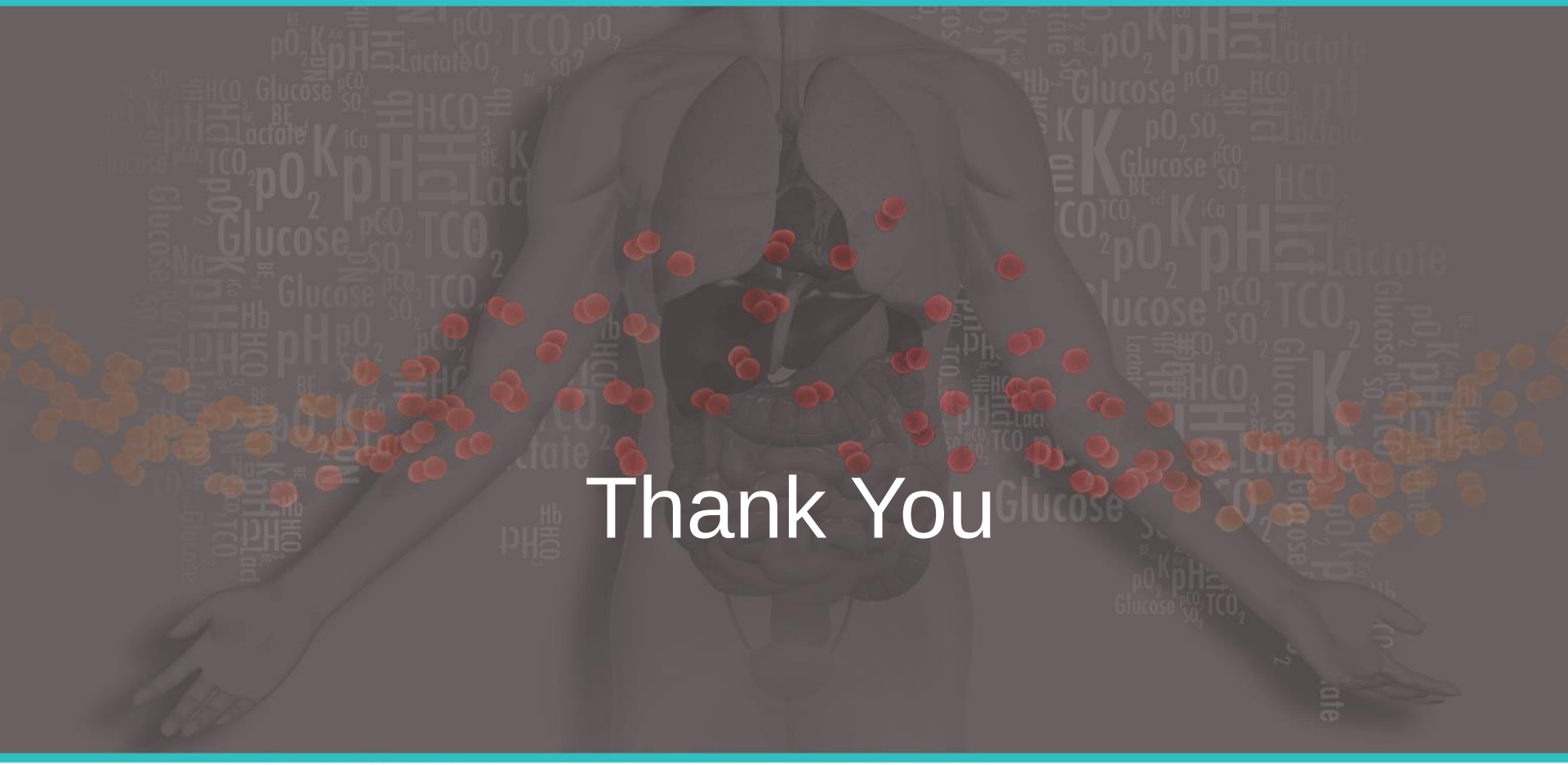
Thank You