MATERNAL911®

Sepsis

Welcome

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Course Description:
Sepsis is one of the top four causes of maternal mortality. This module describes maternal sepsis, how to recognize it and how to respond.

Approximate Time to Complete: 25 minutes

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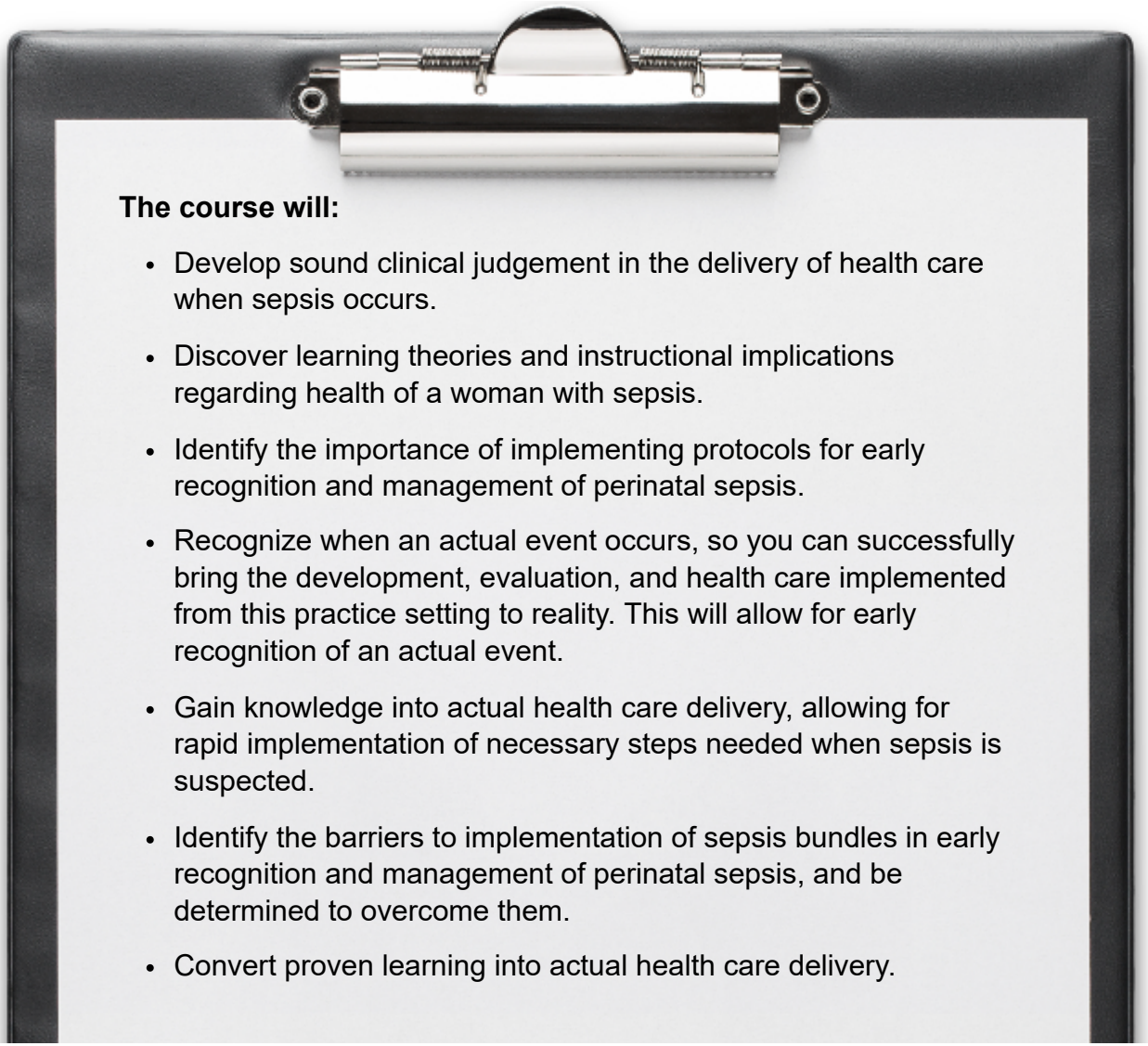
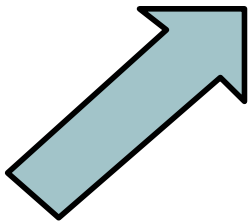
Introduction



The course will:

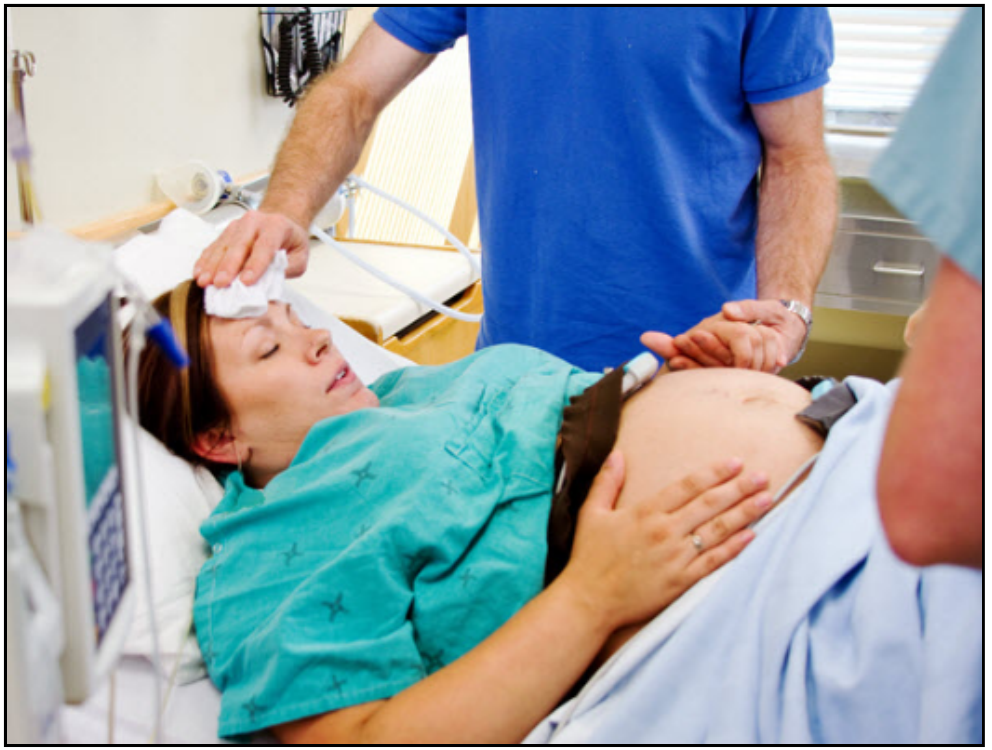
- Develop sound clinical judgement in the delivery of health care when sepsis occurs.
- Discover learning theories and instructional implications regarding health of a woman with sepsis.
- Identify the importance of implementing protocols for early recognition and management of perinatal sepsis.
- Recognize when an actual event occurs, so you can successfully bring the development, evaluation, and health care implemented from this practice setting to reality. This will allow for early recognition of an actual event.
- Gain knowledge into actual health care delivery, allowing for rapid implementation of necessary steps needed when sepsis is suspected.
- Identify the barriers to implementation of sepsis bundles in early recognition and management of perinatal sepsis, and be determined to overcome them.
- Convert proven learning into actual health care delivery.



- The **Home** button will take you to the beginning of this course.
- The **Help** button will show you the features of this module
- The **X** will close this course

Facts About Sepsis

- Maternal sepsis is the leading cause of maternal death, accounting for 15% of maternal deaths worldwide [2].
- Sepsis is life-threatening organ dysfunction caused by response to infection [3].
- The organisms responsible for sepsis along with the site of infection evolve throughout pregnancy, delivery, and postnatally [4].



Risk Factors for Sepsis [1,4]

Demographic Risk Factors
- Nulliparity
- Black race
- Advanced maternal age
- Public or no insurance

Obstetric Risk Factors
- Cesarean section
- Assisted Reproductive Technologies
- Multiple gestation
- Peripartum hysterectomy
- Need for transfusion
- Cerclage placement

Medical Risk Factors
- HIV infection

More than 50% of the women who die from sepsis have one or more chronic comorbid conditions.
These conditions may include:
- Chronic renal disease
- Chronic liver disease
- Congestive heart failure

Maternal Sepsis Incidence

Common sources of infection in sepsis [7]		
Variables	**Antepartum**	**Postpartum**
Obstetric	Septic abortion	Endometritis
	Chorioaminonitis	Wound infection
Nonobstetric	Urinary tract infection	Urinary tract infection
	Pneumonia	Pneumonia
	Appendicitis	Gastrointestinal

Rates of sepsis have doubled from the 6/10,000 in 2001 to 12/10,000 in 2010.

If abortions and fetal demises are included in the evaluation, rates have risen from 11/10,000 in 2001 to 26/10,000 in 2010 [5].

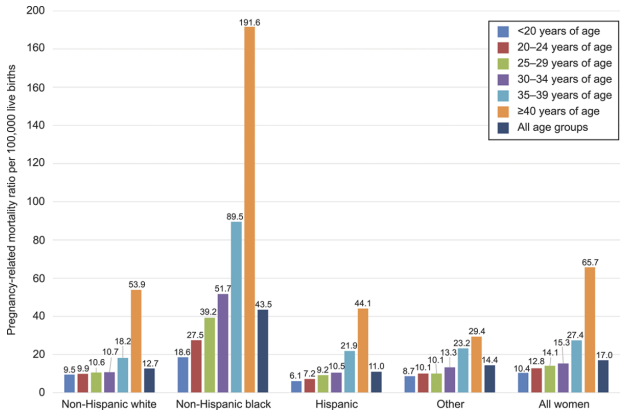
Causes of sepsis can be divided into obstetric (56%) and non-obstetric etiologies (44%)

Of non-obstetric infections:

- 32% Urinary tract infection
- 18% Pneumonia
- 15% Appendicitis

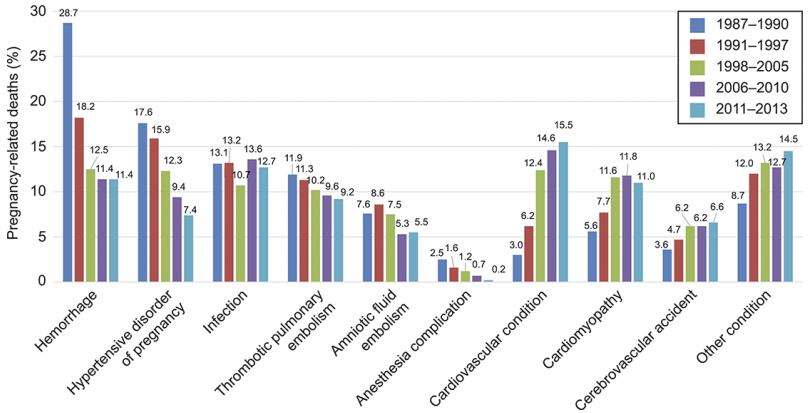
Recent US data shows that maternal sepsis complicates 4-10 per 10,000 live births [8, 15, 16].

Sepsis and the Perinatal Population, a View of History 1987 - 2013

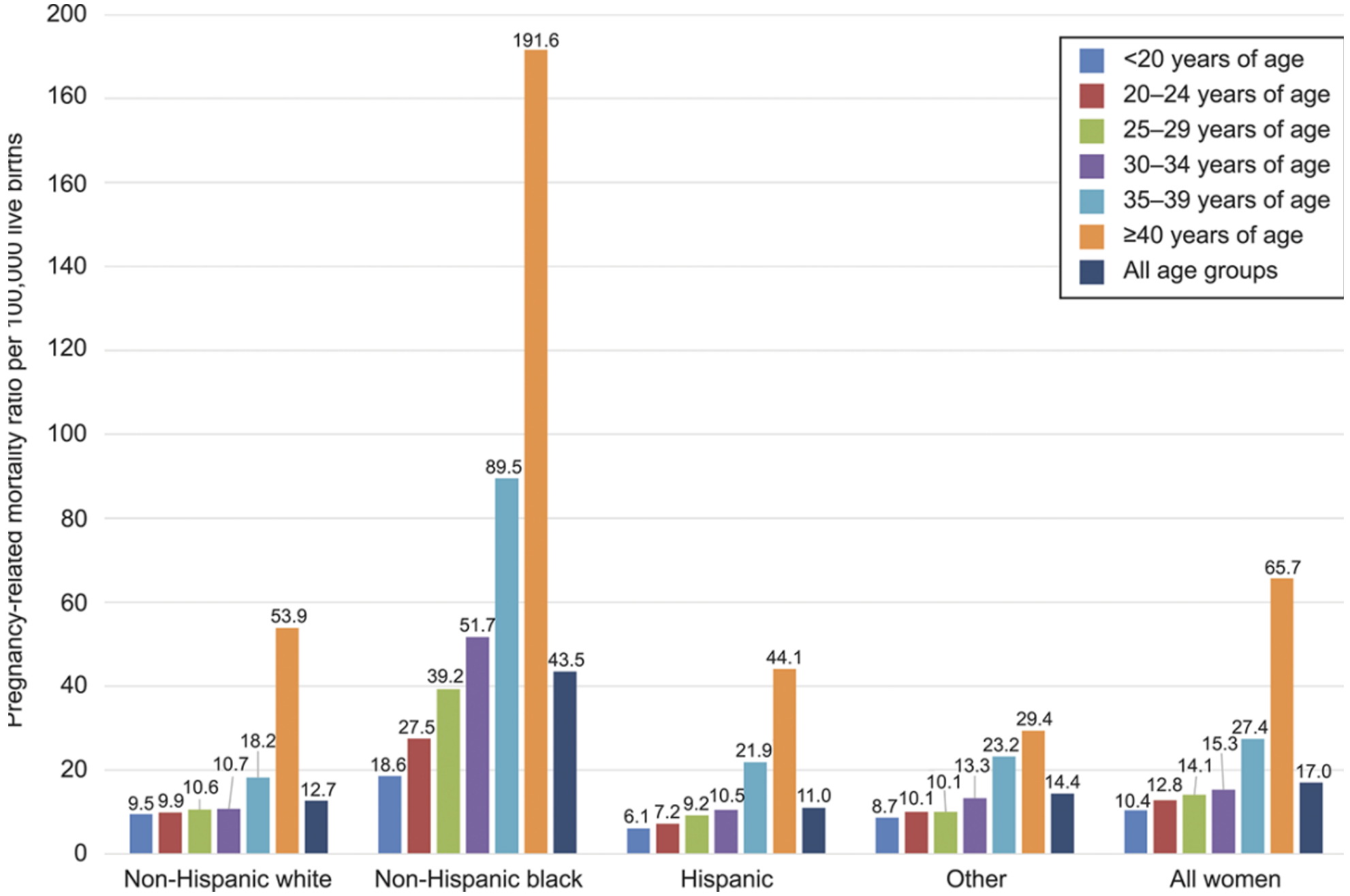


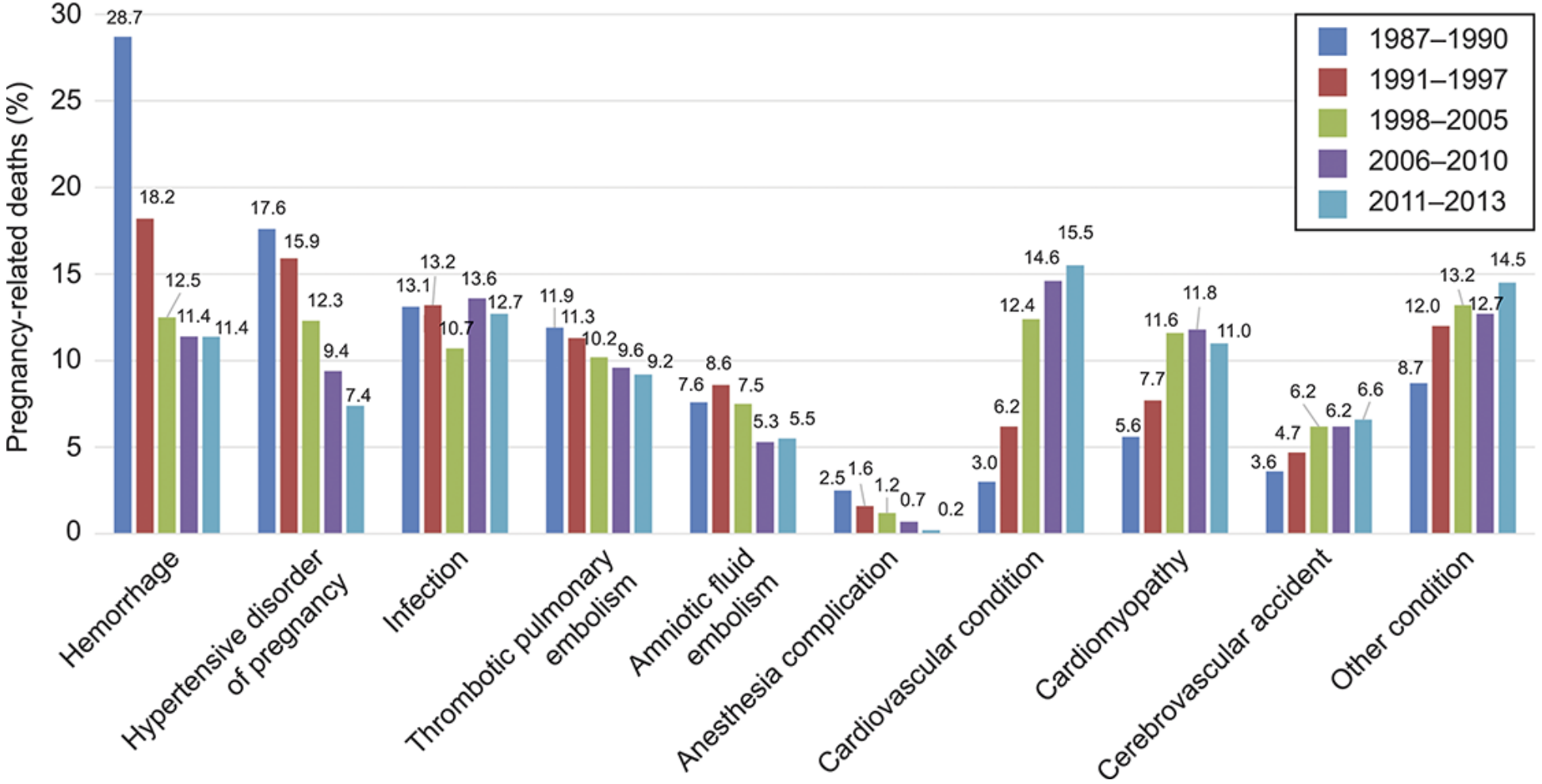
Population-level pregnancy-related mortality ratios by age, race-ethnicity, and overall for 2011-2013. Results are population-level and can be compared as absolute values.Creanga. Pregnancy-Related Mortality in the United States. Obstet Gynecol 2017. Reprinted with permission.

Click on each image for a larger view



Population-level, cause-specific proportionate pregnancy-related mortality for 1987-1990, 1991-1997, 1998-2005, 2006-2010, and 2011-2013. Results are population-level and can be compared as absolute values.Creanga. Pregnancy-Related Mortality in the United States. Obstet Gynecol 2017. Reprinted with permission.

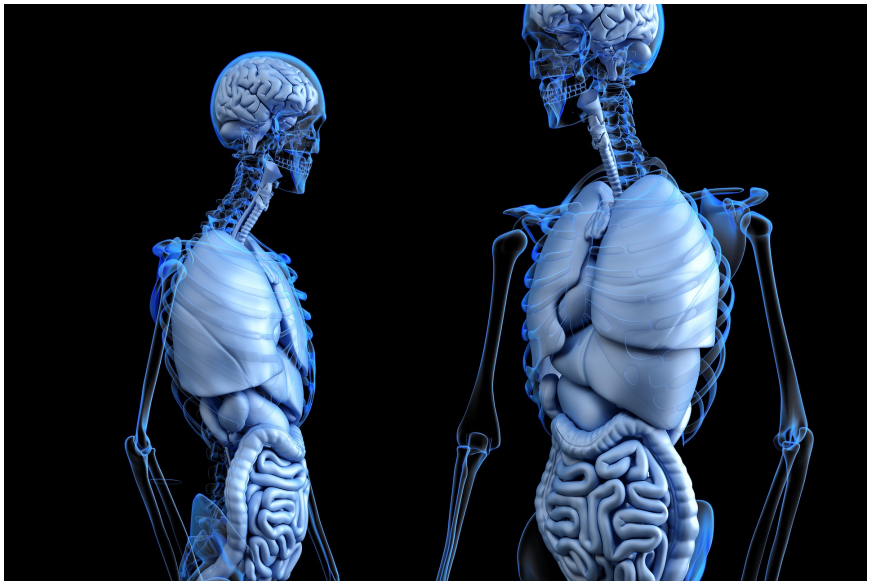

Pregnancy-related mortality ratio per 100,000 live births
200
160
160
140
120
100
80
60
40
20
0
<20 years of age
20–24 years of age
25–29 years of age
30–34 years of age
35–39 years of age
≥40 years of age
All age groups
9.5
9.9
10.6
10.7
18.2
53.9
12.7
18.6
27.5
39.2
51.7
89.5
191.6
43.5
6.1
7.2
9.2
10.5
21.9
44.1
11.0
8.7
10.1
10.1
13.3
23.2
29.4
14.4
10.4
12.8
14.1
15.3
27.4
65.7
17.0
Non-Hispanic white
Non-Hispanic black
Hispanic
Other
All women


Pregnancy-related deaths (%)
30
25
20
15
10
5
0
1987–1990
1991–1997
1998–2005
2006–2010
2011–2013
28.7
18.2
12.5
11.4
11.4
17.6
15.9
12.3
9.4
7.4
13.1
13.2
10.7
13.6
12.7
11.9
11.3
10.2
9.6
9.2
7.6
8.6
7.5
5.3
5.5
2.5
1.6
1.2
0.7
0.2
3.0
6.2
12.4
14.6
15.5
5.6
7.7
11.6
11.8
11.0
3.6
4.7
6.2
6.2
6.6
8.7
12.0
13.2
12.7
14.5
Hemorrhage
Hypertensive disorder of pregnancy
Infection
Thrombotic pulmonary embolism
Amniotic fluid embolism
Anesthesia complication
Cardiovascular condition
Cardiomyopathy
Cerebrovascular accident
Other condition

Pathophysiology[3]

Sepsis begins with an infection that is escalated due to an exaggerated physiological response that causes organ damage. The classic components of this dysregulation include the following:

- Intravascular hypovolemia. Caused by extravasation of plasma and albumin from the intravascular to extravascular space.
- Decreased systemic vascular resistance. Caused by cytokine mediated vascular dilation.
- Increased cardiac output. Caused by the intravascular hypovolemia and decreased vascular resistance.



Most Common Infectious Etiologies of Sepsis in Pregnancy [3]

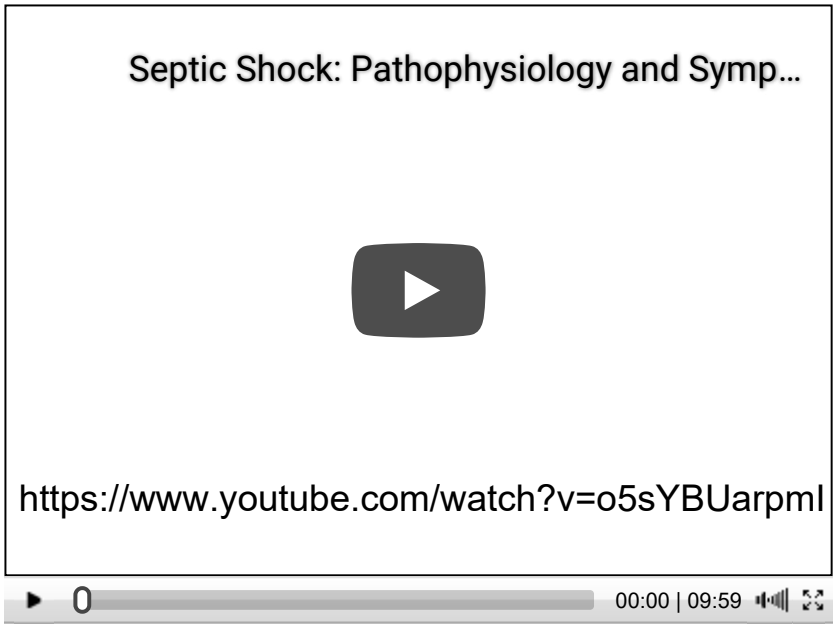
Pregnancy related etiologies:
- Septic abortion
- Chorioamnionitis
- Endometritis
- Wound infection

Non-pregnancy etiologies:
- Urinary tract
- Pneumonia
- Gastrointestinal, including appendicitis

Common sources of infection in sepsis [7]		
Variables	**Antepartum**	**Postpartum**
Obstetric	Septic abortion	Endometritis
	Chorioaminonitis	Wound infection
Nonobstetric	Urinary tract infection	Urinary tract infection
	Pneumonia	Pneumonia
	Appendicitis	Gastrointestinal

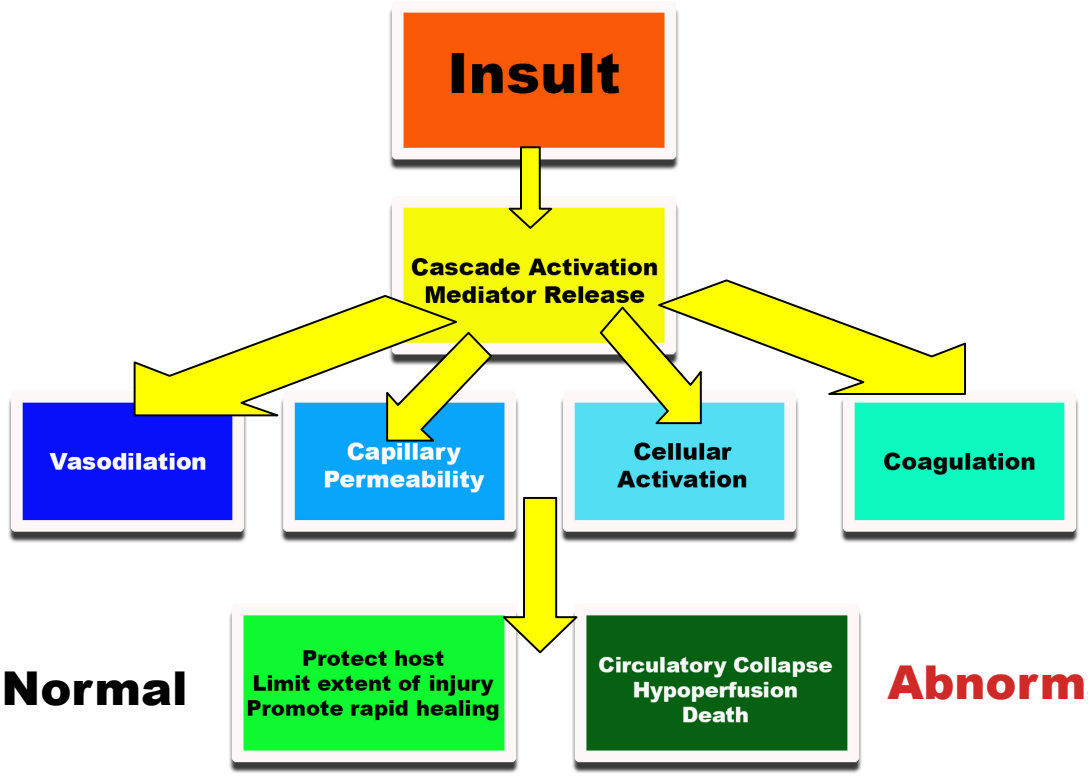
Original Definitions of Sepsis

- Initial definitions of sepsis were created in 1991 and included the following [11]:
  - Bacteremia - Presence of bacteria in the blood
  - SIRS - Systemic inflammatory response syndrome, which can develop from infectious or noninfectious causes (trauma, burns, pancreatitis, etc)
  - Sepsis - SIRS explicitly caused by infection
  - Severe sepsis - Sepsis plus organ dysfunction
  - Septic shock - Sepsis with hypotension and/or hypoperfusion despite adequate fluid resuscitation



Click above to view a video on septic shock.

Updated Definitions of Sepsis [12]

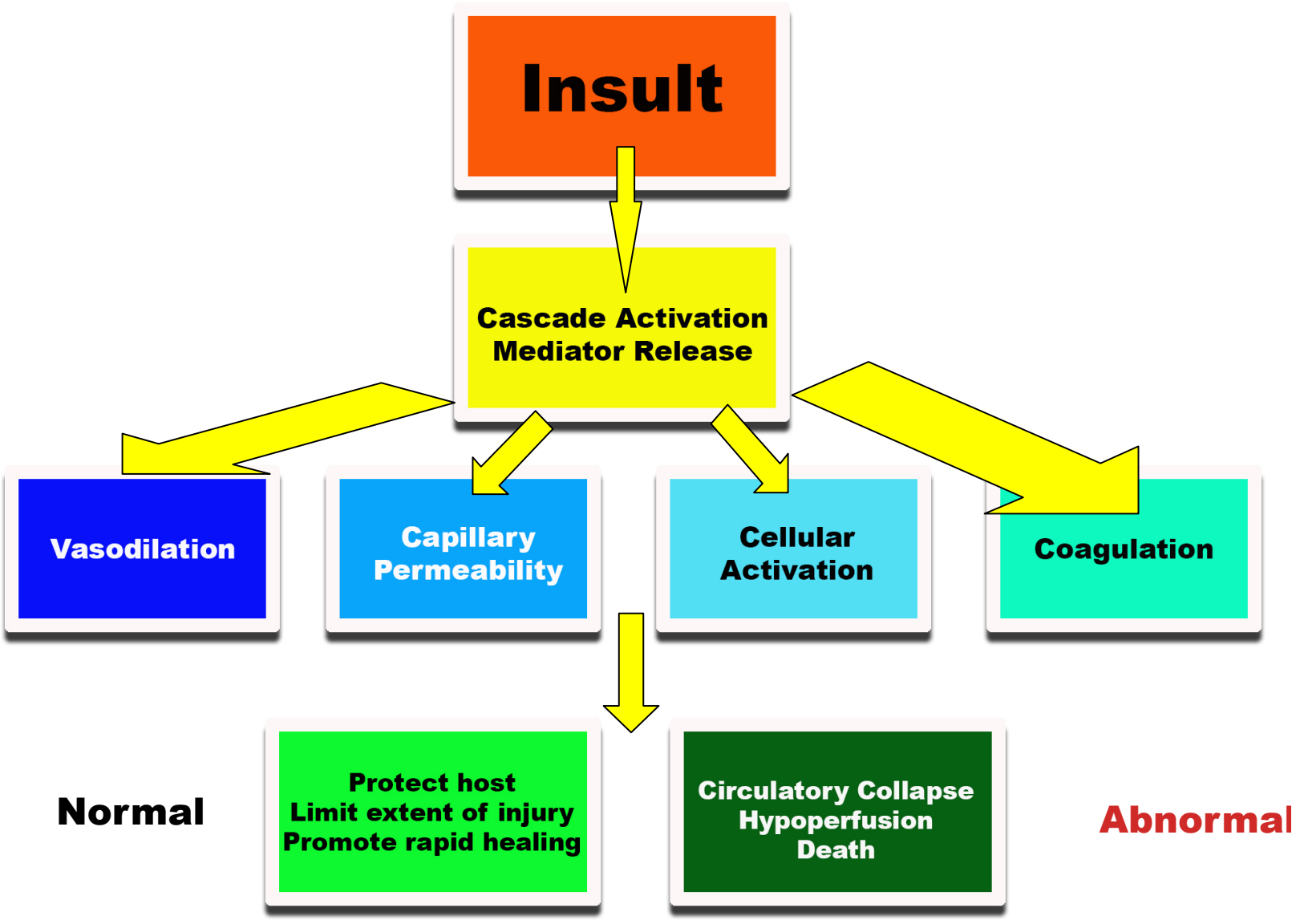


- In 2016, the definitions of sepsis were updated at the Third Internal Consensus Definitions for Sepsis and Septic Shock Task Force
- The only remaining categories are sepsis and septic shock

Sequential Organ Failure Assessment Score Table

Click the picture for a larger view

Updated Definition of Sepsis


Insult
Cascade Activation
Mediator Release
Vasodilation
Capillary
Permeability
Cellular
Activation
Coagulation
Normal
Protect host
Limit extent of injury
Promote rapid healing
Circulatory Collapse
Hypoperfusion
Death
Abnormal

Sequential Organ Failure Assessment Score [7]					
	Score				
Organ System	**0**	**1**	**2**	**3**	**4**
Respiratory					
PaO_2/F_IO_2	≥400 mm Hg (53.3 kPa)	<400 mmHg (53.3 kPa)	<300 mmHg (40 kPa)	<200 mmHg (26.7 kPa) with respiratory support	<100 mmHg (13.3kPa) with respiratory support
Coagulation					
Platelets	≥150 x $10^3/\mu L$	<150	<100	<50	<20
Hepatic					
Bilirubin	<1.2 mg/dL (20 μmol/L)	1.2-1.9 mg/dL (20-32 μmol/L)	2.0-5.9 mg/dL (33-101 μmol/L)	6.0-11.0 mg/dL (102-204 μmol/L)	>12 mg/dL (204 μmol/L)
Cardiovascular					
MAP	≥70 mm Hg	<70	Dopamine <5 μg/kg per minute or any dose of dobutamine	Dopamine 5.1-15 μg/kg per minute or epinephrine 0.1 μg/kg per minute or norepinephrine 0.1 μg/kg per minute	Dopamine >15 or epinephrine >0.1 or norepinephrine >0.1
Central nervous system: Glasgow Coma Scale score	15	13-14	10-12	6-9	<6
Renal	Serum creatinine <1.2 mg/dL (110 μmol/L)	Serum creatinine 1.2-1.9 mg/dL (110-170 μmol/L)	Serum creatinine 2.0-3.4 mg/dL (171-299 μmol/L)	Serum creatinine 3.5-4.9 mg/dL (300-440 μmol/L) or urine output	Serum creatinine >5.0 mg/dL (440 μmol/L) or urine output < 200 mL/d

Physiologic Changes in Pregnancy [3]

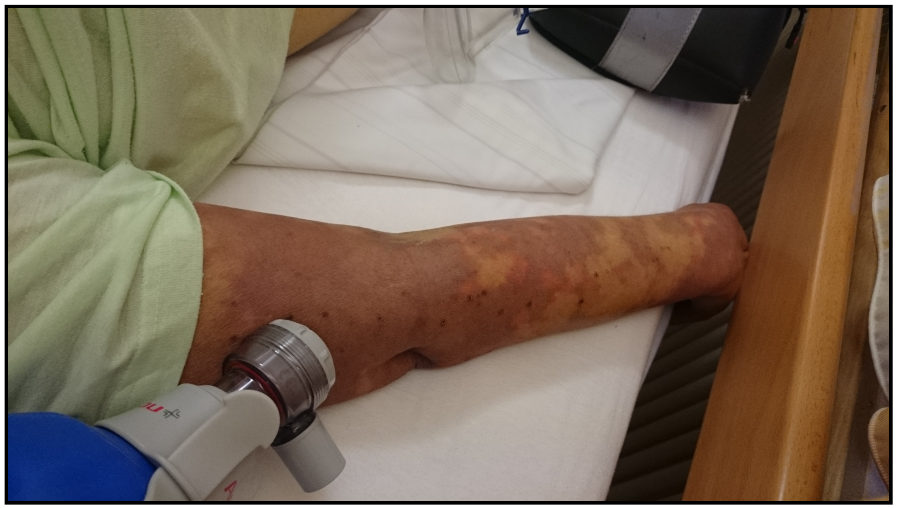
- Diagnosing sepsis in pregnancy can be difficult due to the physiologic changes of pregnancy
- Maternal heart rate increases 10-20 bpm due to increased plasma volume
- Respiratory rate is unchanged, but minute ventilation increases due to increased tidal volume
- Mild leukocytosis is present throughout pregnancy, labor and immediate postpartum
- Creatinine decreases due to increased renal perfusion

Sepsis [11]
Life threatening organ dysfunction caused by a dysregulated host response to infection
Clinical criteria include any 2 of the following: • Systolic BP <100 mm Hg • Respiratory rate >22/min • Altered mental status
The clinical criteria are collectively called the quick Sequential Organ Failure Assessment (qSOFA) score, which is typically reserved for patients outside of an ICU setting
The qSOFA score does not define sepsis, but is a method of identifying patients at high risk of developing severe complications who require more aggressive therapy
A qSOFA score of 2 predicts a heightened risk for prolonged ICU stay or mortality and should trigger the health care team to evaluate for organ dysfunction, start therapy, increase monitoring and potentially transfer to higher level of care
If a patient is already in the ICU, a full SOFA score should be used to assess organ dysfunction
The full SOFA score includes PaO2/FiO2 ratio, platelet count, bilirubin level, creatinine level, urine output, Glasgow coma scale and cardiovascular assessment via mean arterial pressure or vasopressor dose

Septic Shock [11]
A subset of sepsis in which underlying circulatory and cellular metabolism abnormalities are profound enough to substantially increase mortality
Clinically, this translates to hypotension (mean arterial pressure <65 mmHg) requiring vasopressors plus serum lactate levels >2 mmol/L despite adequate volume resuscitation
In patients who meet this criteria, risk of mortality is 35-54%

How does sepsis differ in pregnancy [9,12]

- Normal physiological changes in pregnancy include expanded plasma volume, increased cardiac output and peripheral vasodilation
- None of the sepsis definitions account for the pregnancy associated changes
- There is no pregnancy validated version of the SOFA or qSOFA scores; however, the SOFA and qSOFA scores have been demonstrated to perform poorly in pregnancy. Therefore, a high degree of suspicion is required
- The Society of Obstetric Medicine Australia and New Zealand (SOMANZ) has developed an obstetrically modified qSOFA score that accounts for the altered physiology of pregnancy



System Parameter	omSOFA Score		
	0	1	2
Respiration			
PaO_2/FIO_2	≥ 400	300 to < 400	< 300
Coagulation			
Platelets, $x10^6/L$	≥ 150	100-150	<100
Liver			
Bilirubin (micromol/L)	≤ 20	20-32	>32
Cardiovascular			
Mean arterial pressure (mmHg)	MAP ≥ 70	MAP <70	Vasopressors required
Central Nervous System	Alert	Voice response	Pain response
Renal			
Creatinine (micromol/L)	(≤ 90	90-120	>120
FIO_2 fraction of inspired oxygen (expressed as a decimal); MAP, mean arterial pressure; mmHg, millimeters of mercury; PaO_2, partial pressure oxygen (in mmHg); SOFA, Sequential (sepsis-related) Organ Failure score			

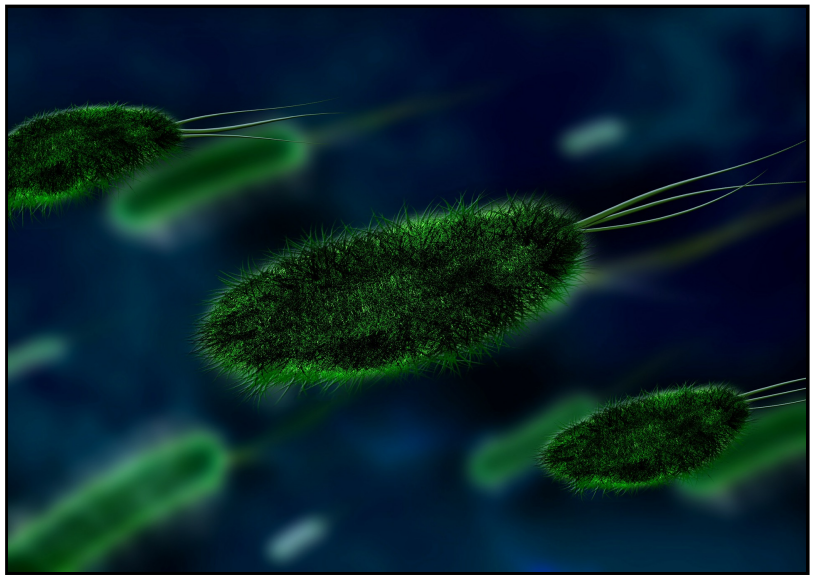
Obstetrically Modified Sepsis Scoring

Table 2.1: Obstetrically modified qSOFA Score		
Parameter	Score	
	0	1
Systolic Blood Pressure	>or= 90mmHg	<90mmHg
Respiratory Rate	Less than 25 breaths per minute	25 breath/minute or greater
Altered Mentation	Alert	Not alert
Min, minute; mmHg, millimeters of mercury; qSOFA, quick Sequential (sepsis-related) Organ Failure score		

- omqSOFA is designed to quickly screen women for sepsis based on clinical assessment and vital signs.
- Sepsis should be considered if the omqSOFA score is 2 or highe.r
- If omqSOFA is 2 or higher, a full omSOFA score should be performed.
- The omSOFA accounts for the following pregnancy changes:
  - Eliminates need for Glasgow coma scoring, which is not routinely used on L&D.
  - Accounts for healthy pregnant women who typically have a baseline MAP <70 mmHg.
  - The score is considered positive if 2 or greater for sake of simplicity.

Causes of Sepsis in Pregnancy

- Antepartum cases of sepsis are most commonly non-pelvic origin
- Intrapartum or postpartum cases most commonly originate from a pelvic source
- In 30% of cases, no source is identified
- The most commonly isolated organisms in maternal sepsis include E. coli, Group A and Group B streptococcus
- In 15% of cases, the infections are polymicrobial



Why is Sepsis a Topic of Concern?[9,12]

- All perinatal staff should be trained on early recognition and management of maternal sepsis
  - Recognition and treatment of maternal sepsis will improve survival, decrease length of stay and length of stay in ICU
  - A delay in diagnosing and treating sepsis is shown to increase mortality

Initial Management of Sepsis [13]

If a pregnant woman appears unwell or has a positive omqSOFA score

- Perform history and physical
  - Obtain vital signs
  - Obtain labs
    - CBC with differential
    - CMP
    - Lactate
- Obtain cultures
  - Blood, urine
  - Consider sputum culture if any respiratory symptoms are present
- Antibiotics should be initiated within one hour of diagnosis
  - The choice of antibiotic is driven by presumed source and local patterns of resistance
  - The antibiotic should be broad-spectrum and cover both aerobic and anaerobic Gram positive and Gram negative bacteria
- After antibiotics have been initiated, imaging should be pursued to identify a source
  - Consider CXR, ultrasound or CT

Intravenous Fluid (IVF) Resuscitation

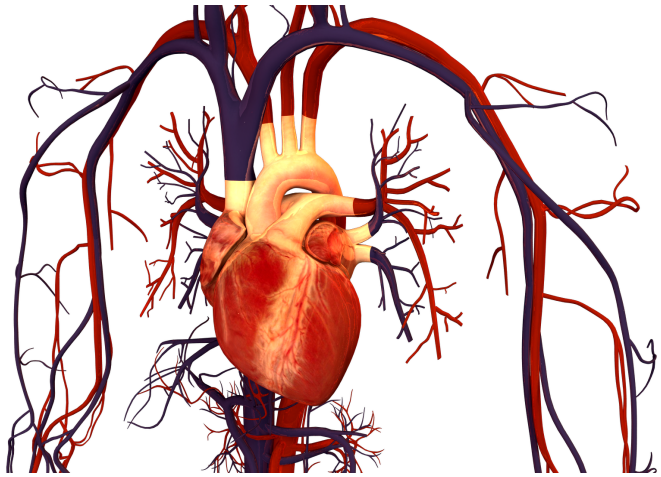
- IVF should be an initial intervention if hypotension or hypoperfusion is present
- The "Surviving Sepsis" Campaign recommends IVF bolus of 30 ml/kg. It is reasonable to start by administering 1-2 L to ensure response.
- Response to IVF can be assessed by evaluating pulse-pressure variation or passive leg raising
- Pulse pressure variation is assessed by analyzing the waveform obtained from an arterial line
  - This should not be affected by pregnancy
  - Only reliable in sedated patients on positive pressure ventilation and in sinus rhythm
  - If the pulse pressure varies by >13% with the respiratory cycle, the patient is volume responsive
- In patients who are not mechanically ventilated or not in sinus rhythm, passive leg raising can be performed
  - Raise the leg 30-45 degrees causes autotransfusion of ~300 ml of blood from the legs into the chest
  - If the patient responds to fluid, cardiac output should increase within 2-3 minutes; if the cardiac output does not improve, the patient will likely respond better to vasopressors

Photo Credit: أمين, CC BY-SA 4.0 <https://creativecommons.org/licenses/by-sa/4.0>, via Wikimedia Commons

Use of Vasopressors and Inotropes in Sepsis

If a patient doesn't respond to IVF, or is not a candidate for further IVF, vasopressors are indicated to increase blood pressures

- Vasopressors work by constricting the abnormally dilated systemic circulation and to maintain adequate perfusion
- The recommended vasopressor is norepinephrine
- If the patient continues to demonstrate hypoperfusion or myocardial dysfunction despite fluid resuscitation and vasopressor therapy, inotropes are indicated
- The inotrope of choice is dobutamine, which works by increasing cardiac output



Decoys - Dismissing Abnormal Vital Signs [14]

It can be difficult to diagnose sepsis in a pregnant patient due to normal physiologic changes in pregnancy

Fever - ALWAYS CONCERNING

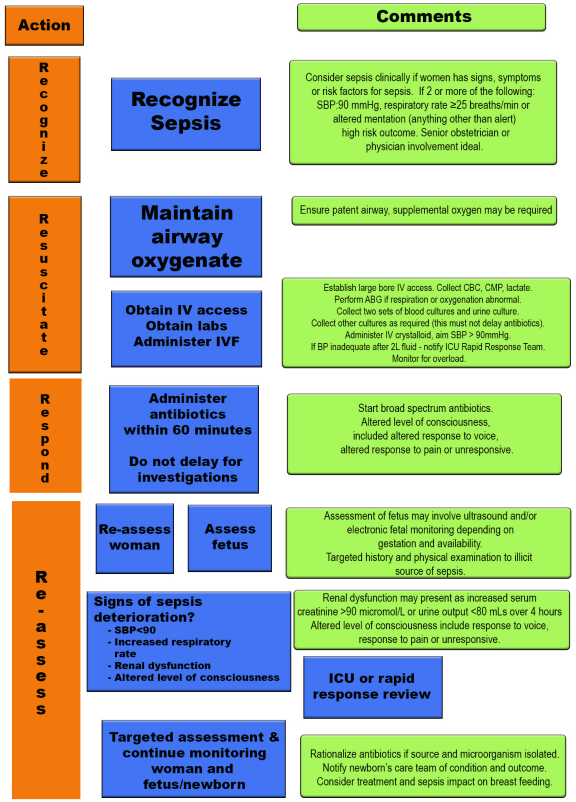
Tachycardia - Mild tachycardia up to 110 is normal in pregnancy

Leukocytosis - Mild leukocytosis is common in pregnancy with more significant elevations seen in the context of administration of betamethasone and delivery

Hypotension - Mild hypotension is commonly seen during pregnancy, most significantly in the second trimester

Early recognition of sepsis is critical to maternal survival [13]

- Units should establish sepsis screening for all triage patients and protocols to help guide quick management
- If screening is positive, immediate physician evaluation should be performed
- H&P, labs, cultures, antibiotics and IVF should be initiated within one hour of presentation in the setting of positive screening
- Depending on acuity of the patient, consider calling a rapid response and an intensivist

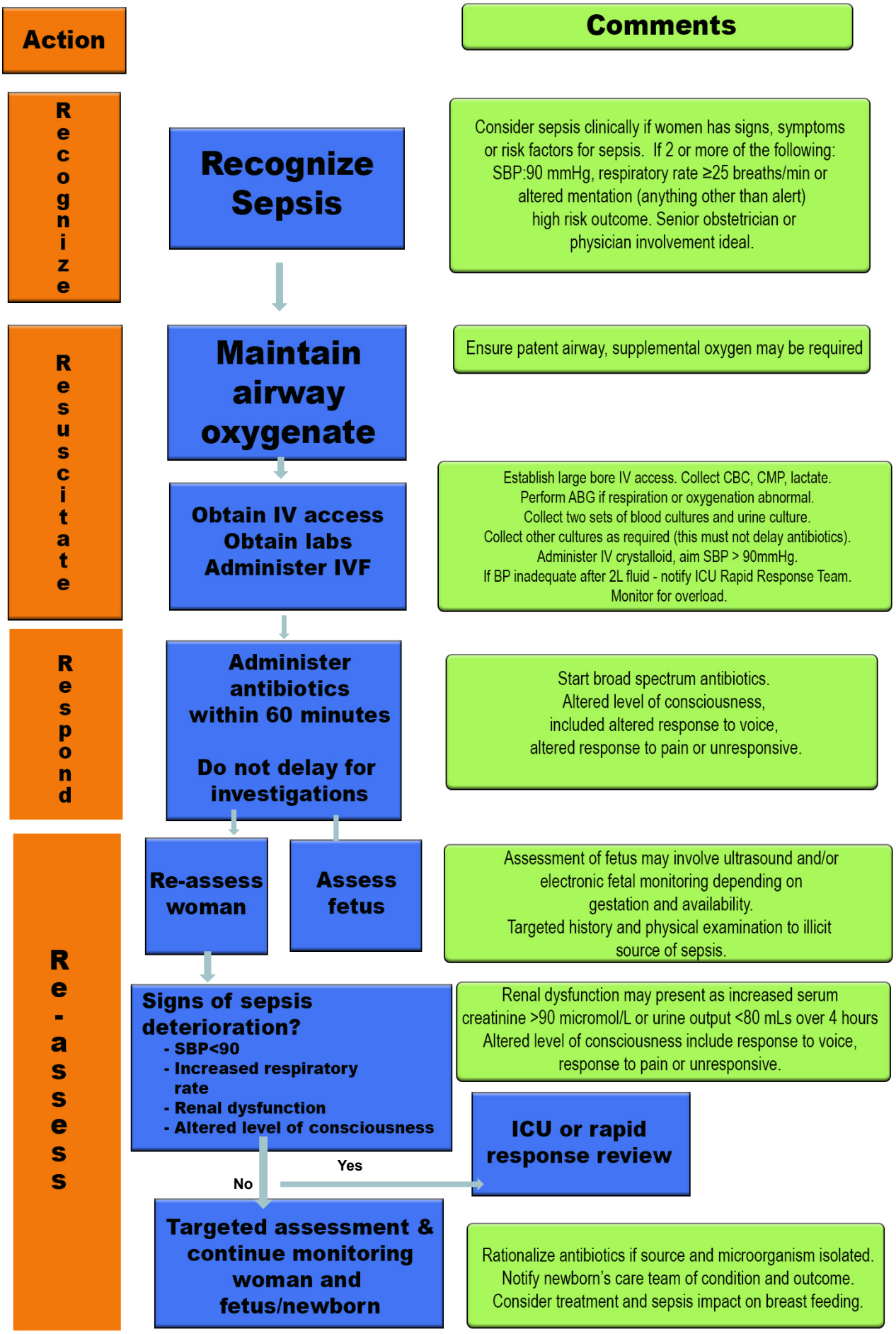


Flowchart for the assessment and management of sepsis in pregnancy.

Click the image for a larger view.

From “SOMANZ guidelines for the investigation and management sepsis in pregnancy,” by L. Bowyer, et al. 2017, *Aust NZ J Obstet Gynaecol, 57,* p.542. Copyright 2017 by the Royal Australian and New Zealand College of Obstetrics and Gynaecologists. Reprinted with permission. Terms and conditions of use.

Flow Chart for assessment of sepsis


Action
Comments
Recognize
Recognize Sepsis
Consider sepsis clinically if women has signs, symptoms or risk factors for sepsis. If 2 or more of the following: SBP:90 mmHg, respiratory rate ≥25 breaths/min or altered mentation (anything other than alert) high risk outcome. Senior obstetrician or physician involvement ideal.
Resuscitate
Maintain airway oxygenate
Ensure patent airway, supplemental oxygen may be required
Obtain IV access
Obtain labs
Administer IVF
Establish large bore IV access. Collect CBC, CMP, lactate.
Perform ABG if respiration or oxygenation abnormal.
Collect two sets of blood cultures and urine culture.
Collect other cultures as required (this must not delay antibiotics).
Administer IV crystalloid, aim SBP > 90mmHg.
If BP inadequate after 2L fluid - notify ICU Rapid Response Team.
Monitor for overload.
Respond
Administer antibiotics within 60 minutes
Do not delay for investigations
Start broad spectrum antibiotics.
Altered level of consciousness,
included altered response to voice,
altered response to pain or unresponsive.
Re-assess
Re-assess woman
Assess fetus
Assessment of fetus may involve ultrasound and/or electronic fetal monitoring depending on gestation and availability.
Targeted history and physical examination to illicit source of sepsis.
Signs of sepsis deterioration?
- SBP<90
- Increased respiratory rate
- Renal dysfunction
- Altered level of consciousness
Renal dysfunction may present as increased serum creatinine >90 micromol/L or urine output <80 mLs over 4 hours
Altered level of consciousness include response to voice, response to pain or unresponsive.
Yes
ICU or rapid response review
No
Targeted assessment & continue monitoring woman and fetus/newborn
Rationalize antibiotics if source and microorganism isolated.
Notify newborn's care team of condition and outcome.
Consider treatment and sepsis impact on breast feeding.

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1. This figure and the associated guidelines should be considered together
2. Is not meant to represent specific medical advice-appropriate advice should be sought from a medical professional in this instance .
3. They are guidelines for the management of Sepsis specific to women who are, or have recently been pregnant aimed for clinicians in Australia and NZ.
4. We accept no responsibility for the application of this guideline outside of Australia and NZ or of notifying you or your organisation of any changes to the guideline if and when they occur in the future.
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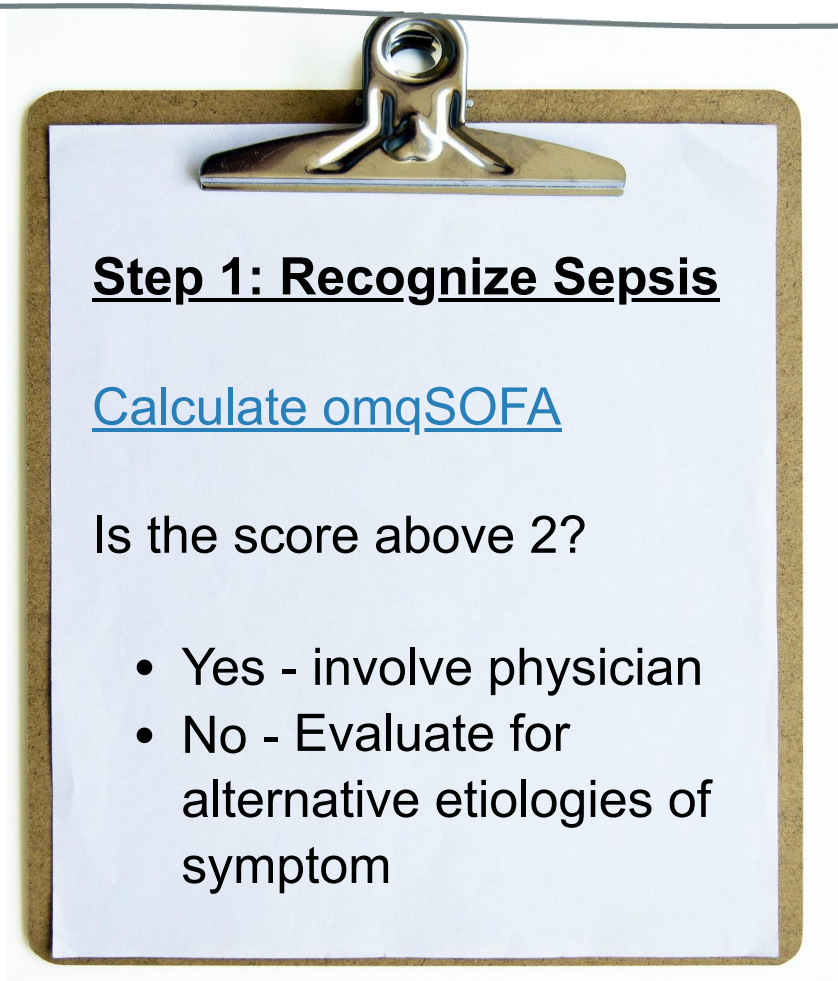

Step 1: Recognize Sepsis

Calculate omqSOFA

Is the score above 2?

- Yes - involve physician
- No - Evaluate for alternative etiologies of symptom

Table 2.1: Obstetrically modified qSOFA Score		
Parameter	Score	
	0	1
Systolic Blood Pressure	>or= 90mmHg	<90mmHg
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Min, minute; mmHg, millimeters of mercury; qSOFA, quick Sequential (sepsis-related) Organ Failure score		

Intravenous Fluid (IVF) Resuscitation

- IVF should be an initial intervention if hypotension or hypoperfusion is present
- The "Surviving Sepsis" Campaign recommends IVF bolus of 30 ml/kg. It is reasonable to start by administering 1-2 L to ensure response.
- Response to IVF can be assessed by evaluating pulse-pressure variation or passive leg raising
- Pulse pressure variation is assessed by analyzing the waveform obtained from an arterial line
  - This should not be affected by pregnancy
  - Only reliable in sedated patients on positive pressure ventilation and in sinus rhythm
  - If the pulse pressure varies by >13% with the respiratory cycle, the patient is volume responsive
- In patients who are not mechanically ventilated or not in sinus rhythm, passive leg raising can be performed
  - Raise the leg 30-45 degrees causes autotransfusion of ~300 ml of blood from the legs into the chest
  - If the patient responds to fluid, cardiac output should increase within 2-3 minutes; if the cardiac output does not improve, the patient will likely respond better to vasopressors

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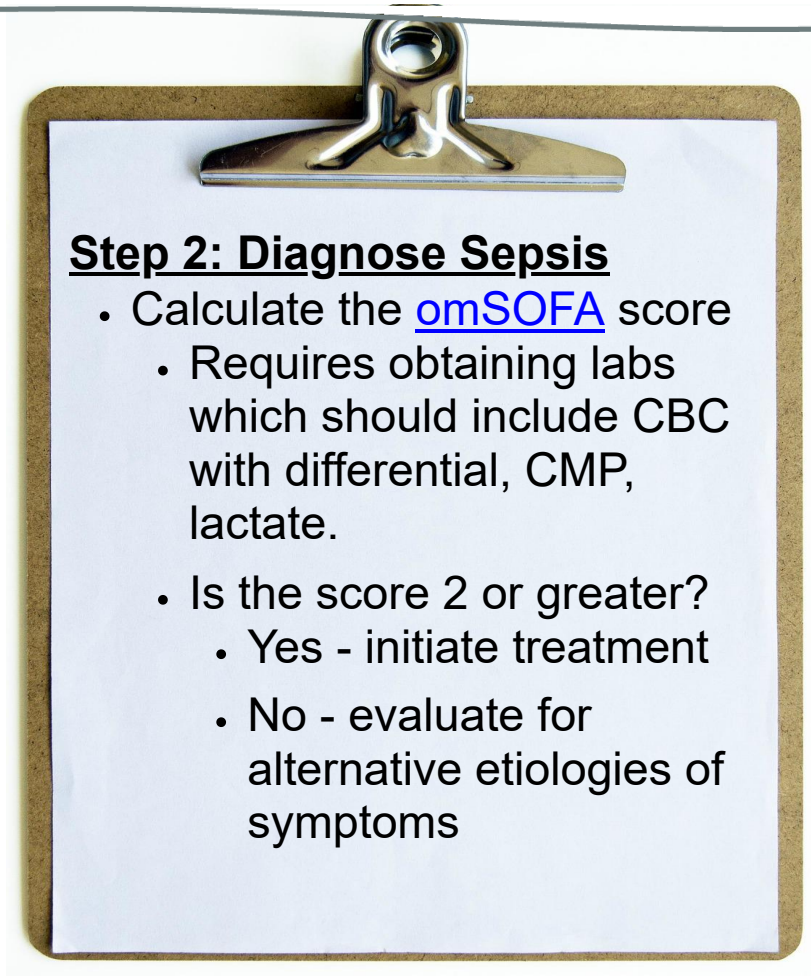
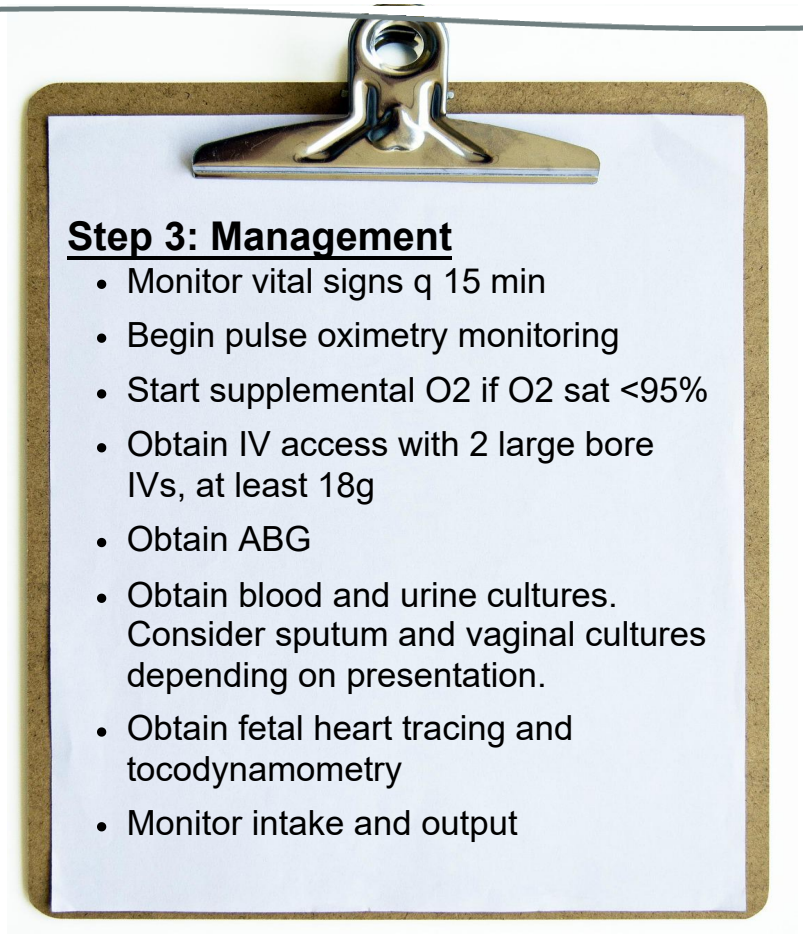


Step 2: Diagnose Sepsis

- Calculate the omSOFA score
  - Requires obtaining labs which should include CBC with differential, CMP, lactate.
  - Is the score 2 or greater?
    - Yes - initiate treatment
    - No - evaluate for alternative etiologies of symptoms

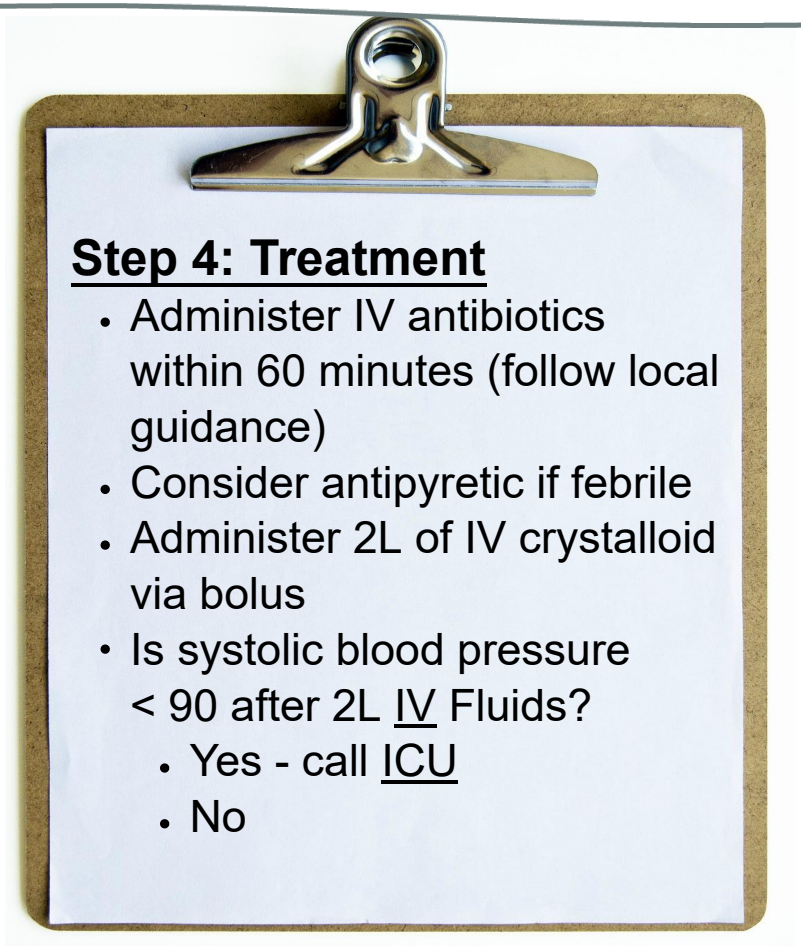
System Parameter	omSOFA Score		
	0	1	2
Respiration			
PaO_2/FIO_2	≥ 400	300 to < 400	< 300
Coagulation			
Platelets, $x10^6/L$	≥ 150	100-150	<100
Liver			
Bilirubin (micromol/L)	≤ 20	20-32	>32
Cardiovascular			
Mean arterial pressure (mmHg)	MAP ≥ 70	MAP <70	Vasopressors required
Central Nervous System	Alert	Voice response	Pain response
Renal			
Creatinine (micromol/L)	(≤ 90	90-120	>120

FIO_2 fraction of inspired oxygen (expressed as a decimal); MAP, mean arterial pressure; mmHg, millimeters of mercury; PaO_2, partial pressure oxygen (in mmHg); SOFA, Sequential (sepsis-related) Organ Failure score



Step 3: Management

- Monitor vital signs q 15 min
- Begin pulse oximetry monitoring
- Start supplemental O2 if O2 sat <95%
- Obtain IV access with 2 large bore IVs, at least 18g
- Obtain ABG
- Obtain blood and urine cultures. Consider sputum and vaginal cultures depending on presentation.
- Obtain fetal heart tracing and tocodynamometry
- Monitor intake and output



Step 4: Treatment

- Administer IV antibiotics within 60 minutes (follow local guidance)
- Consider antipyretic if febrile
- Administer 2L of IV crystalloid via bolus
- Is systolic blood pressure < 90 after 2L IV Fluids?
  - Yes - call ICU
  - No

Proposed broad-spectrum empiric antibiotic coverage in sepsis complicating pregnancy [7]	
Source Infection	**Recommended antibiotics**
Community-acquired pneumonia	Cefotaxime, ceftriaxone, ertapenem, or ampicillin plus azithromycin, clarithromycin, or erythromycin[a]
Hospital-acquired pneumonia	Low-risk patients may be treated with piperacillin-tazobactam, meropenem, imipenem, or cefepime.
Chorioamnionitis	Patients at high risk of mortality may need double coverage for Pseudomonas (beta lactam plus an aminoglycoside or a quinolone) and MRSA coverage with vancomycin or linezolid.[b]
	Ampicillin plus gentamicin.[c] Add anaerobic coverage with clindamycin or metronidazole if cesarean delivery required.
Endomyometritis	Ampicillin, gentamicin, and metronidazole (or clindamycin)
Urinary tract infections	Alternatively may use cefotaxime or ceftriaxone plus metronidazole[d]
	Gentamicin with ampicillin
	Alternatively, may use monotherapy with a carbapenem or piperacillin-tazobactam[e]
Skin and soft tissues (necrotizing)	Vancomycin plus piperacillin-tazobactam[g]
	If Streptococcus Group A or Clostridium perfringens are present, use penicillin G plus clindamycin.

MRSA, methicillin-resistant Staphylococcus aureus.
Sources: a Mandell LA, Wunderink RG, Anzueto A, Bartlet JG, et al. Infectious Diseases Society of America/American Thoracic Society Consensus Guidelines on the management of community-acquired pneumonia in adults. Clinical Infect Dis 2007; 44: S27-72; b American Thoracic Society and Infectious Diseases Society of America. Guidelines for the management of adults with hospital-acquired, ventilator-associated, and healthcare-associated pneumonia. Am J Respir Crit Care Med 2005; 171: 388-416; c Higgins RD, Saade G, Polin RA, Grobman WA, et al, for the Chorioamnionitis Workshop Participants. Evaluation and management of women and newborns with a maternal diagnosis of chorioamnionitis: summary of a workshop. Obstet Gynecol 2016; 127: 426-36; d Chebbo A, Tan S, Kassis C, Tamura L, Carlson RW. Maternal sepsis and septic shock. Crit Care Clin 2016; 32: 119- 35; e International clinical practice guidelines for treatment of acute uncomplicated cystitis and pyelonephritis in women: a 2010 update by the Infectious Diseases Society of American and the European Society for Microbiology and Infectious Diseases. Clin Infect Dis 2011; 52(5):e103-e120; f Solomkin JS, Mazuski JE, Bradley JS, Rodvold KA, et al. Diagnosis and management of complicated intra-abdominal infection in adults and children: Guidelines by the Surgical Infection Society and the Infectious Diseases Society of American. Clin Infect Dis 2010; 50: 133-64; g Stevens DL, Bisno AL, Chambers HF, Dellinger EP, et al. Practice guidelines for the diagnosis and management of skin and soft tissue infections: 2014 update by the Infectious Disease Society of American. Clin Infect Dis 2014; 1-43.

Table 4

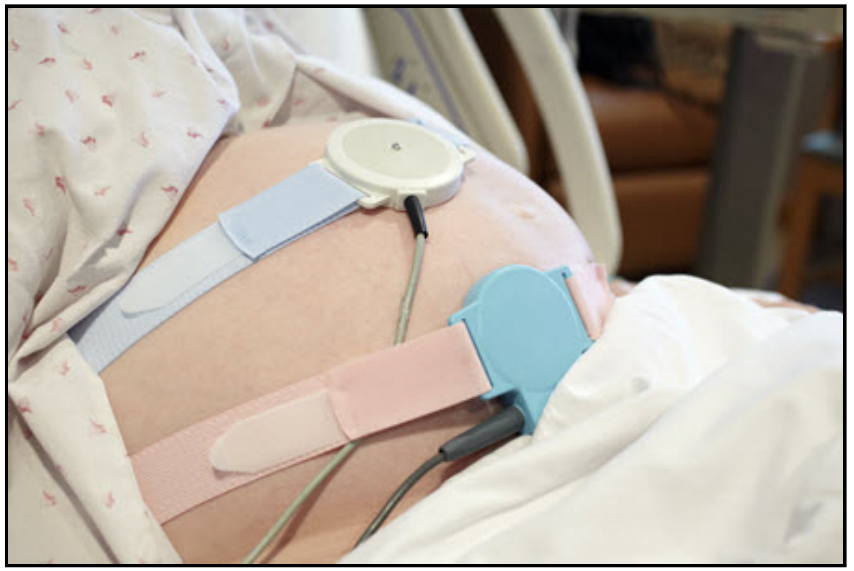
Be Mindful of the Sepsis Six [14]

These six items are intended to be performed during the first hour after sepsis is diagnosed and consist of the following steps:

1. Administer high flow oxygen
2. Take blood cultures before antibiotics are given
3. Give broad spectrum antibiotics
4. Give intravenous fluid challenges
5. Measure serum lactate and hemoglobin
6. Accurately measure urine output

Is delivery indicated?

- The presence of sepsis alone is not an immediate indication for delivery, except in cases of chorioamnionitis
- If fetal rate changes are noted, particularly tachycardia, they will typically normalize with maternal treatment. It is not recommended to urgently deliver a pregnant septic patient without attempt at maternal resuscitation
- Maternal resuscitation improves hemodynamics, which improves uteroplacental perfusion; and, therefore, fetal condition
- In the setting of sepsis, there is no evidence that delivery improves maternal outcomes. Delivery should be reserved for standard obstetric indications.
- Betamethasone can be given in any sepsis scenario for fetal benefit. It should not be withheld regardless of maternal condition.



Maternal and Perinatal Outcomes Related to Sepsis

The pregnancy mortality rate is estimated at 1%-4.6% [3], which is significantly improved compared to prior decades

- Preterm delivery is common after maternal sepsis, even if the source of infection is not uterine [3].
- Various studies have reported rates of preterm delivery of 16-33% [3], which is likely related to the systemic inflammation in the setting of sepsis
- Sepsis is associated with increased rate of miscarriage and IUFD with reported rates of 10-30%, particularly if the illness occurs in first or second trimester [3]

Can maternal deaths from sepsis be prevented?

- The majority of women who die from sepsis have a delay in care or delay in escalation of care.
- Many women who die present without a fever, which likely contributes to lack of diagnosis and timely intervention.
- In 73% of cases, maternal mortality is related to lack of appropriate antibiotic coverage [3]. Starting broad spectrum antibiotics and narrowing coverage after a pathogen is identified can be life saving.
- Involving consultants such as maternal fetal medicine, critical care and infectious disease early in the clinical course can provide guidance on management
- Implementation of screening protocols in the ER and OB triage can help to increase awareness and diagnosis of sepsis, which is key to improving outcomes

Prevention of Sepsis [4]

- Educate women on infectious exposures in pregnancy
- If local infections develop, such as pharyngitis or skin infection, treat promptly
- Prior to any surgical procedure, antibiotic prophylaxis should be administered
- Avoid tobacco use in pregnancy, but particularly within 30 days of surgery
- If diabetic, control blood sugar levels throughout pregnancy and particularly post-operatively.
- If PPROM occurs, administer latency antibiotics
- If there is a manual extraction of the placenta, or a severe obstetric laceration, antibiotic administration is recommended

Pregnancy Nuances

- Sepsis in pregnancy can be difficult to diagnose due to the compensatory mechanisms present in women who are otherwise young and healthy
- Additionally, pregnancy associated symptoms and vital signs can mask the early signs and symptoms of sepsis
- In pregnancy, women can initially appear deceptively well before rapidly deteriorating
- Health care providers need to maintain a high index of suspicion when caring for pregnant women given that the outcome and survivability are improved with early recognition and treatment of sepsis

Recognition of Sepsis

- Think sepsis. Know the signs and symptoms of sepsis to identify and treat patients early.
- Act fast when sepsis is suspected.
- Reassess the management and antibiotic therapy.

Click the picture for a larger view

Prevent sepsis and improve early recognition.

Improve health conditions.

George is a 72-year-old man with diabetes. During his check-up, George's healthcare provider takes the opportunity to strengthen his chronic disease care (glucose control and skin care), provide recommended vaccines, and share information about symptoms that indicate an infection is worsening or sepsis is developing.

Educate patients and their families.

One month later, George has a cut on his foot that might be infected. He calls his healthcare provider, who tells him how to take care of the cut and signs of infection. Two days later, his foot is worse and he becomes short of breath, has clammy skin, and is more tired than usual. He recognizes symptoms are worsening and it could be sepsis. He seeks medical attention immediately.

Think sepsis. Act fast.

At the hospital, a healthcare provider recognizes the signs and symptoms of sepsis. She immediately orders tests to determine the source of infection and starts appropriate treatment, including antibiotics. She documents the dose, duration, and purpose of antibiotics.

Reassess patient management.

Healthcare providers closely monitor George's progress and adjust therapy as needed. When George improves, his providers transfer him to a rehabilitation facility to continue his recovery. The hospital care team discusses his treatment plan with the team at the new facility.

SOURCE: CDC Vital Signs, August 2016.

In Conclusion [3]

- Sepsis and septic shock are considered medical emergencies requiring immediate treatment and resuscitation.
- Sepsis should be consider when pregnant women, with otherwise unexplained end organ damage, have an infectious process regardless of whether a fever is present or not.
- Empiric broad spectrum antibiotics need to be administered as soon as possible in any pregnant woman suspected to have sepsis, within the hour of diagnosing or suspecting sepsis.
- Cultures should be obtained: Blood, urine respiratory, wound, or any other culture as indicated
- 2L of crystalloid IV fluids should be administered within one hour of diagnosing or suspecting sepsis
- Earlier than later, consider transferring the patient to ICU. Then, the providers in ICU should consider norepinephrine as first line vasopressor with peri-partum sepsis when persistent hypo-perfusion or hypotension is present.
- If there is evidence of septic shock, norepinephrine should be used as the first line vasopressor for a pregnant patient.

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If you do not attain a passing score after two attempts at the post-test the entire program must be repurchased.

Thank you!!

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