



Sepsis



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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



Click here to download a print version of this course.



- Sepsis
- Pop-ups
- References
- Help





Hi! My name is Meghan. My colleagues and I will be guiding you through this module on sepsis. Our job is to point out helpful information you need to know.



I'm Tamara and I will walk you through how to identify maternal sepsis and what to do for maternal safety when we suspect sepsis.



I'm David and I'll talk about how to respond to maternal sepsis and some of the necessary calculations for medication.



- 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



Course Objectives

- 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.





Here are some facts about maternal sepsis.

- In the United States and the United Kingdom, maternal sepsis is considered to be the leading cause of death in the peripartum period [1].
- Maternal sepsis is the leading cause of maternal death, accounting for 15% of maternal deaths worldwide [2].
- Sepsis is not a specific illness; rather it is a syndrome that encompasses an uncertain pathobiology [3].
- The organisms responsible for sepsis along with the site of infection evolve throughout pregnancy, delivery, and postnatally [4].

Maternal Population associations for sepsis [6]

Demographics

- Advanced maternal age
- African-American
- Medicaid insurance

History

- Preterm delivery
- Postpartum hemorrhage
- Stillbirth
- Cesarean section
- Endometritis
- Cerclage
- Retained products
- Multiple gestation

[5]



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



Recent US data shows that maternal sepsis complicates 4-10 per 10,000 live births.

[8, 19, 20]

- Incidence of Maternal Sepsis in the United States Stratified National Inpatient Sample (NIS) 1998-2009 [7]
- 50 million obstetric visits were reviewed:
 - No significant change pre-delivery
 - Rate of post-delivery sepsis increased 148% between 1998-99 and 2008-09



Incidence of Pregnancy and Sepsis ^[9]

- Septic shock is rare in pregnancy and has an incidence of 0.002-0.01%
- Of all septic patients, 0.3-0.6% are pregnant

The incidence of severe sepsis and septic shock have increased overall due to changes in the demographics of pregnant women, such as:

- Advance maternal age
- Obesity
- Diabetes
- Assisted reproductive technology
- Placenta abnormalities
- Emerging infectious diseases
- Placental abruption





Etiology^[3]

Infection occurs with a disregulated host response resulting in organ damage and virtually any organ system can be affected, thus resulting in sepsis.

- The excessive inflammation responding to these conditions causes extravasation of albumin and fluid resulting in intravascular hypovolemia.
- Cytokines are released, leading to decreased systemic vascular resistance and increased cardiovascular output.
 - Up to 60% of patients with sepsis have an ejection fraction below 54%.



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



No source is identifiable in 30% of peri-partum septic women



Actions

Healthcare providers play a key role in preventing infections and illnesses that may lead to sepsis:

- Educate patients and their family about the early signs and symptoms of severe infection and sepsis, and when to seek care for an infection. Especially those at higher risk.
- Remind patients to take care of chronic illnesses and how to help prevent infections.
- Encourage infection prevention measures such as hand hygiene and vaccination against infections.



**Pregnant patients
need to be included in
our sepsis Protocols!**

“Pregnancies complicated by severe sepsis and septic shock are associated with increased rates of preterm labor, fetal infection, and preterm delivery. Sepsis onset in pregnancy can be insidious and patients may appear deceptively well before rapidly deteriorating with the development of severe shock, multiple organ dysfunction syndrome, or death. The outcome and survivability in severe sepsis and septic shock in pregnancy are improved with early detection, prompt recognition of the source of infection and targeted therapy” [9]



Recognition and Treatment 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.

Prevent sepsis and improve early recognition.



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Think sepsis. Act fast.

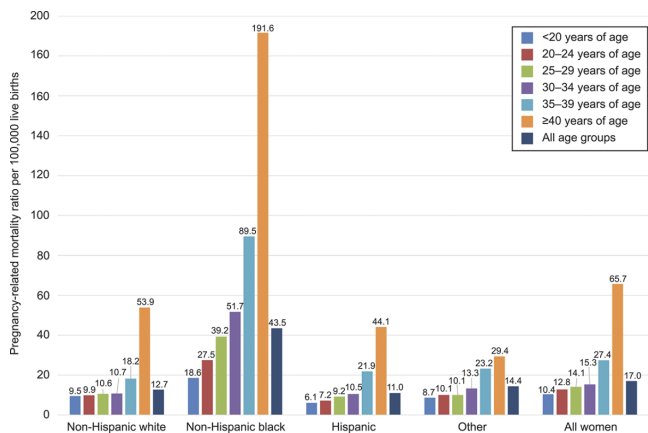
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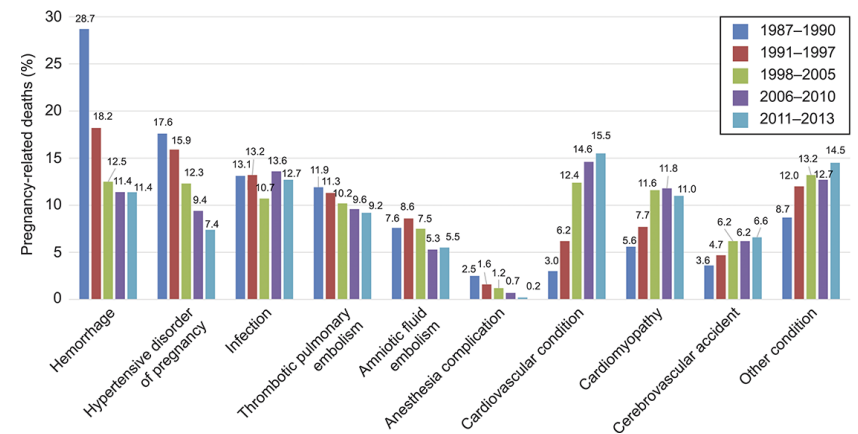
Reassess patient management.

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

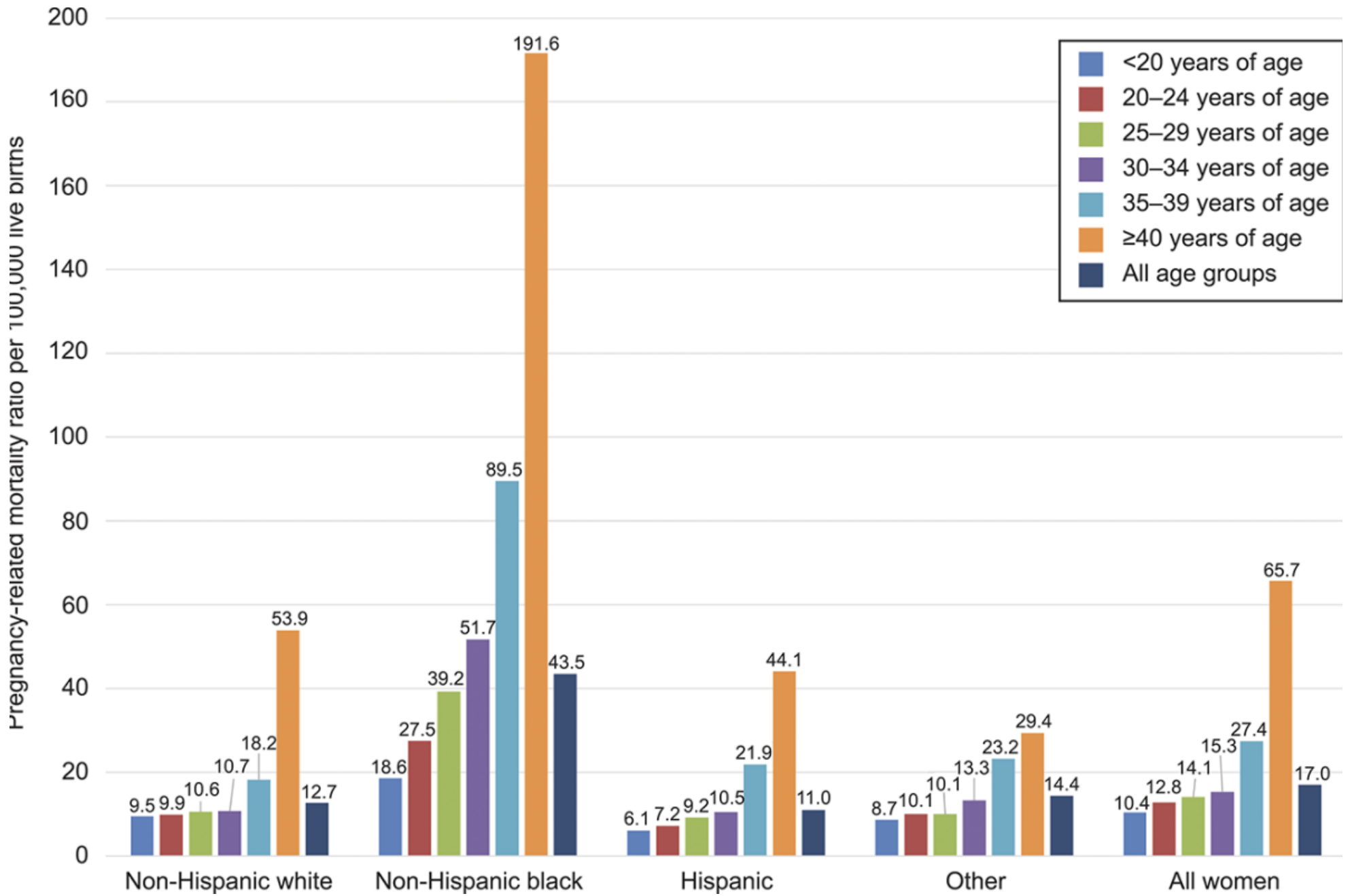


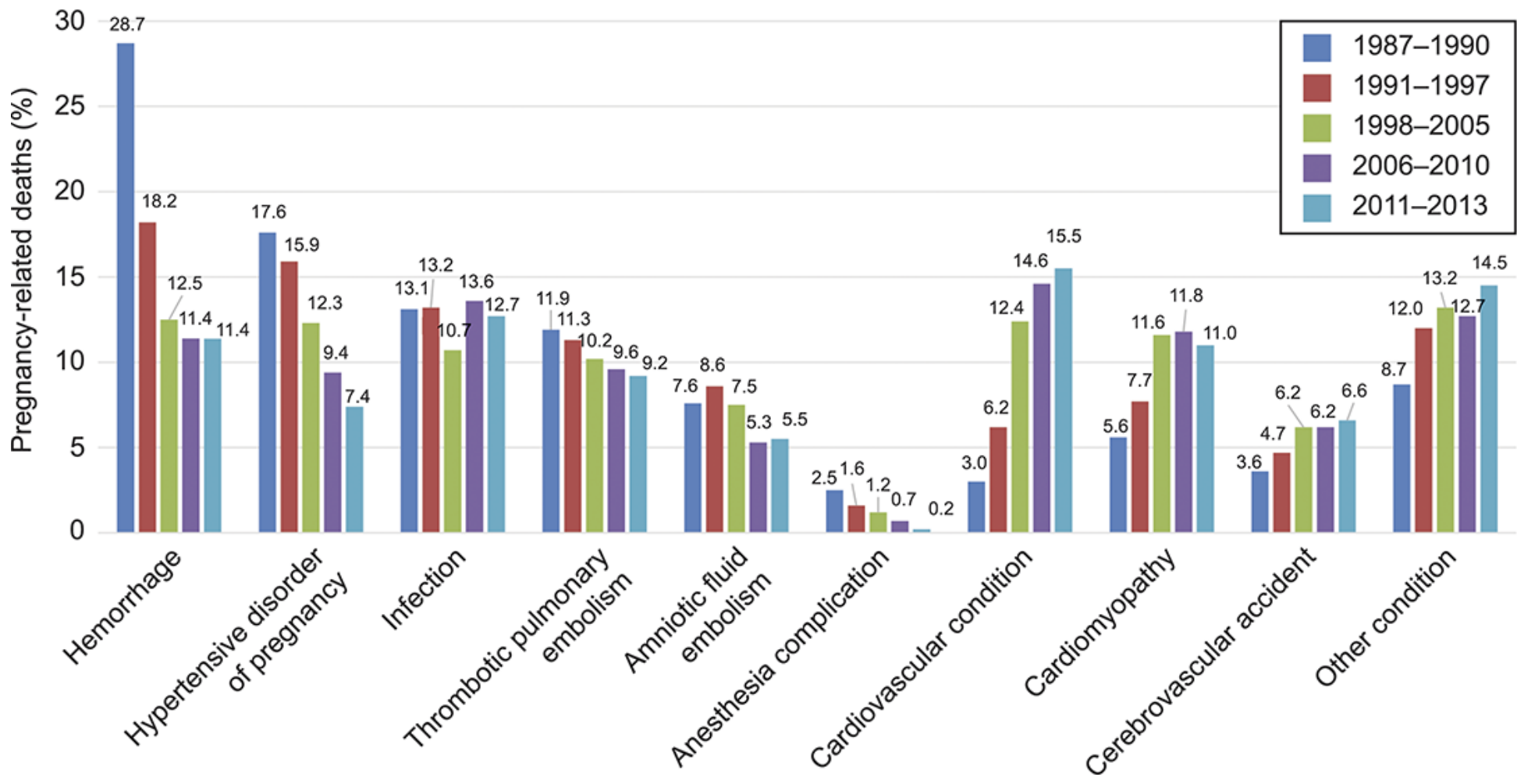
Click on each image for a larger view



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.

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.





- A systemic inflammatory response (SIR) occurs in sepsis and is defined as a clinical manifestation resulting from an insult, infection, or trauma, that includes body-wide activation of immune inflammatory cascades.
- SIRS criteria may overlap with normal hemodynamic and other parameters during pregnancy and the peri-partum period [11].



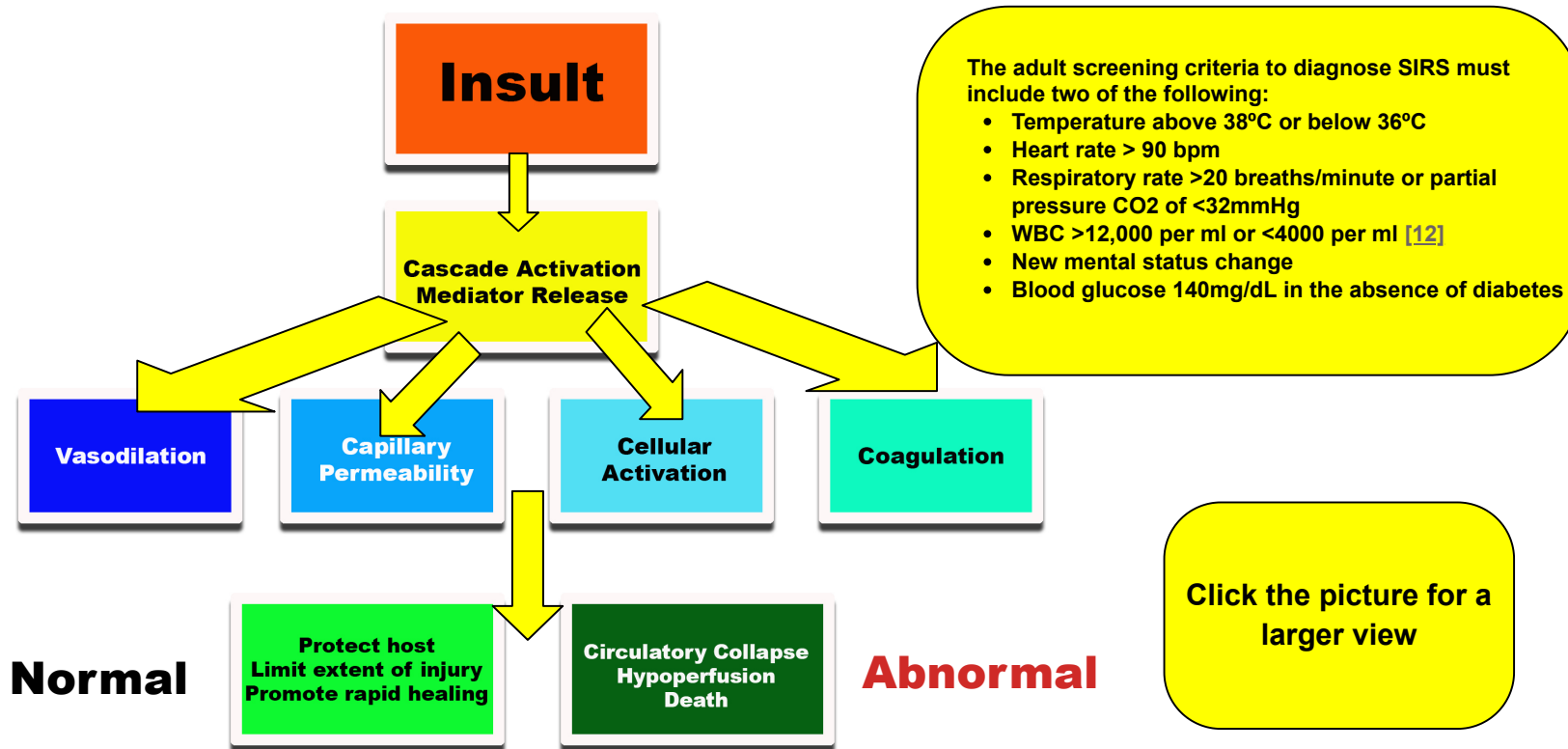
Pathophysiology of Sepsis & Definition

Video Player

<http://www.youtube.com/watch?v=o5sYBUarpml>



Understanding How Systemic Inflammatory Response Syndrome (SIRS) Can Kill in Sepsis

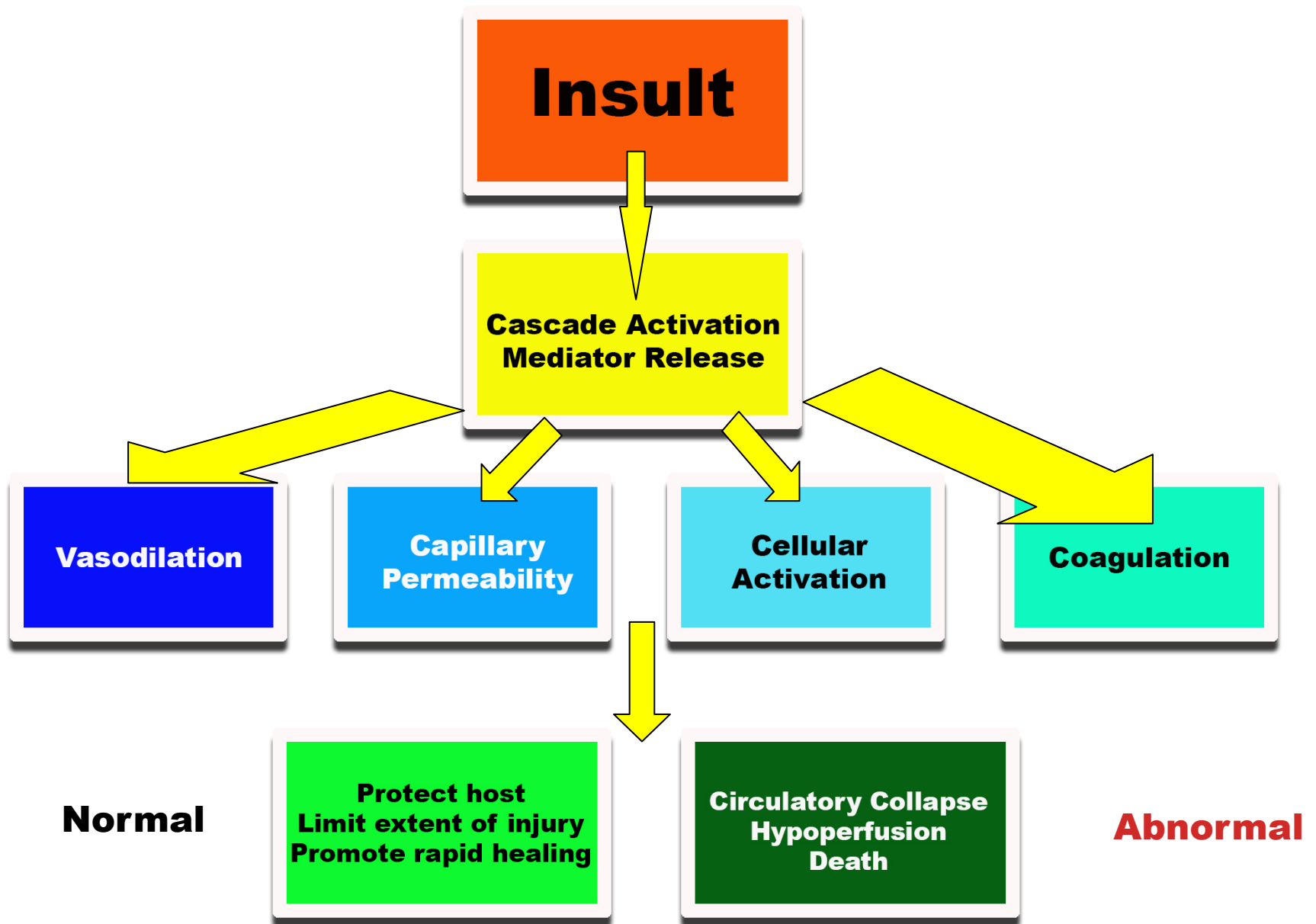


The adult screening criteria to diagnose SIRS must include two of the following:

- Temperature above 38°C or below 36°C
- Heart rate > 90 bpm
- Respiratory rate >20 breaths/minute or partial pressure CO2 of <32mmHg
- WBC >12,000 per ml or <4000 per ml [12]
- New mental status change
- Blood glucose 140mg/dL in the absence of diabetes

Click the picture for a larger view







Why is Sepsis a Topic of Concern? [9,13]

- Pregnant women are more vulnerable to infection and susceptible to serious complications
- Screening protocols are needed for early recognition and management of maternal sepsis

Sepsis is one of the top four causes of maternal mortality.



Why is Sepsis a Topic of Concern? [\[9,13\]](#)

- All perinatal staff are 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

Having trained staff who can identify maternal sepsis is important!





What are some best practices?

- Best practices are based on hospitals with the lowest sepsis mortality rate.
- Best practices are protocol driven, focusing on early recognition, and ICU level care.
- They also include communication strategies such as Code Sepsis OB. [\[14\]](#)





Parameters Differ in the Perinatal Period ^[3]

The screening criteria was adjusted for perinatal population due to the physiology of pregnancy:

- Maternal heart rate is increased by 10-20 bpm due to increased volume
- An increase in respiratory rate and tidal volume increases minute volume (Respiratory Rate x Tidal Volume) by 50%
- Decreases in lung volume and increases in the respiratory rate occur due to the position of the diaphragm
- Increase in WBC (leukocytosis) in labor and immediate postpartum
- Decrease in creatinine levels occur due to increases in perfusion to the kidneys





So we reviewed the parameters and differences. Now let's review the next table that compares these differences.

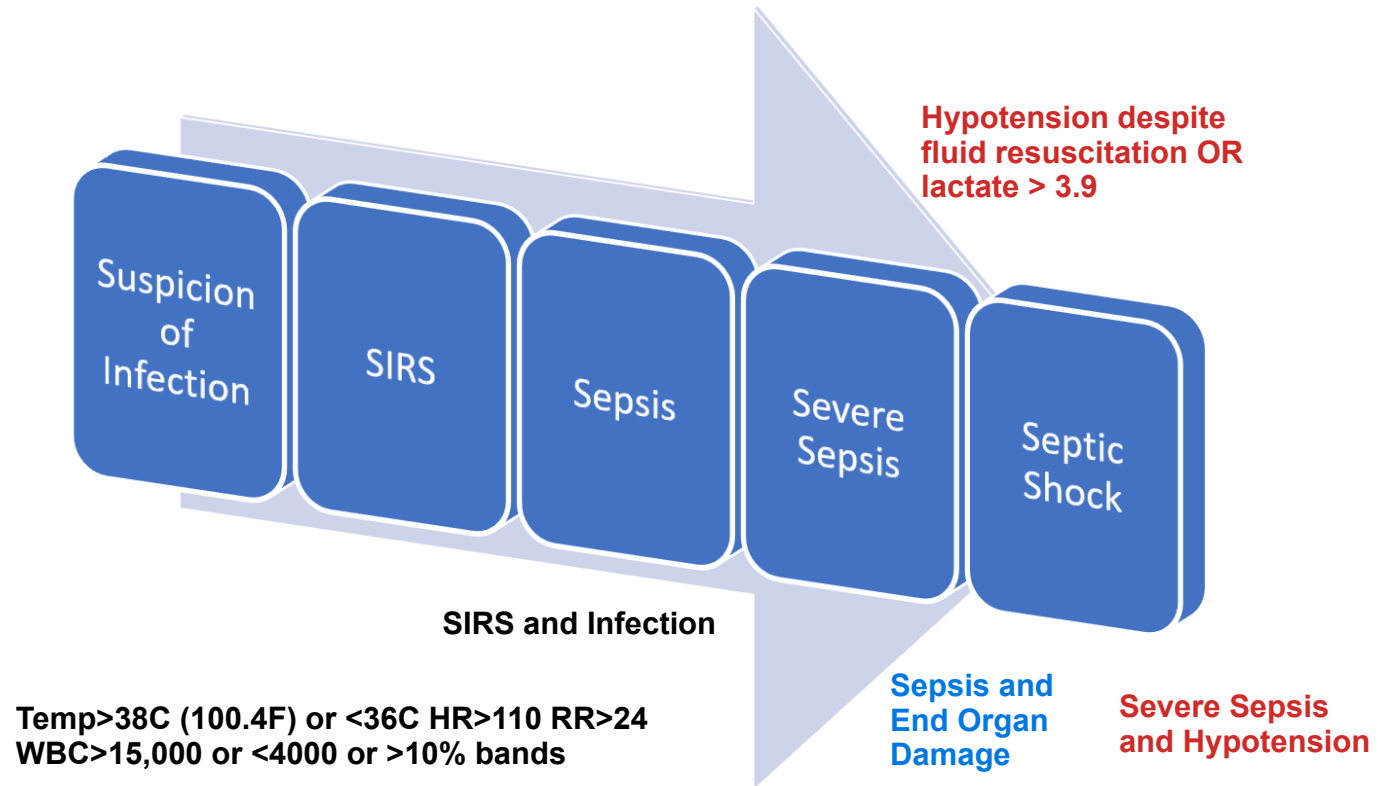
Comparison - SIRS Criteria

Adult Screening Criteria [14,15]	Perinatal Screening Criteria [14,16]
Temp > 38°C (100.4°F) or < 36°C (96.8°F)	Temp > 38°C (100.4°F) or < 36°C (96.8°F)
HR > 90 bpm	HR > 110 bpm
Resp Rate > 20 breaths/minute	Resp Rate > 24 breaths/minute
WBC >12,000, < 4,000 or >10% immature neutrophils	WBC > 15,000 or < 4,000 or > 10 % immature neutrophils
Blood glucose > 140 mg/dl in the absence of diabetes	Blood glucose > 140 mg/dl in absence of diabetes
New mental status change	Mental status change



Next, I want you to review the syndrome of sepsis, notice the progression on the next slide.

Syndrome with sepsis [14]





The next table I am going to show you reviews organ dysfunction. Several organs may be affected when sepsis is present.

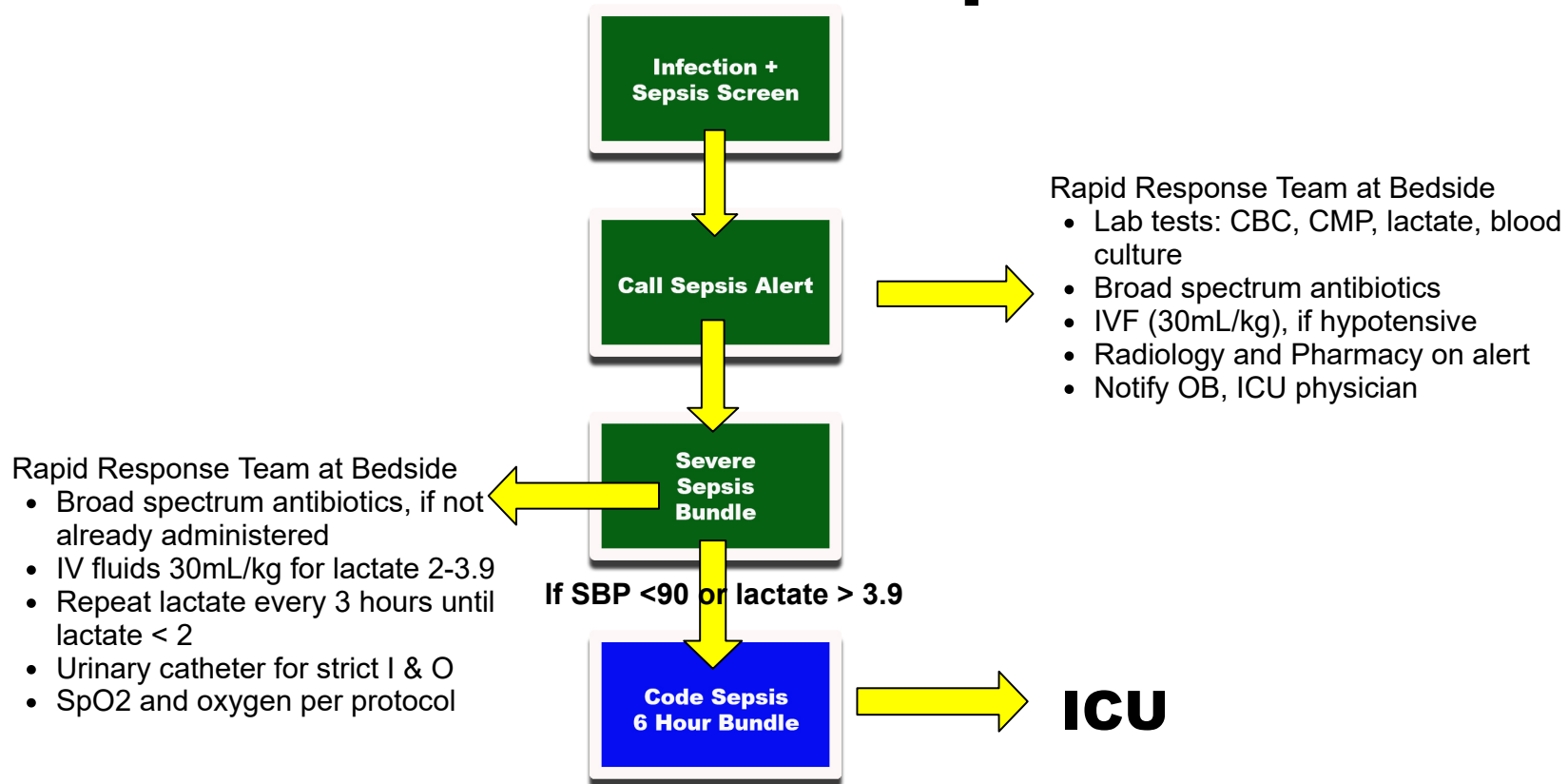
Organ Dysfunction [\[16\]](#)

Respiratory: SpO2 < 92%	Platelets: >100,000
Urine Output: Less than or equal to 30ml/hour for two hours	Lactate: Lactate > 2
Creatinine > 1.5mg/dL	Bilirubin > 2mg/dL
Altered mental status	Coagulopathy: INR > 15 or PPT > 60 seconds
Blood Pressure MAP: SBP < 90mmHg or 40mmHg below the base line or MAP < 65 mmHg	



On the next slide is a table alerting you of sepsis, and when to call for a rapid response team. Do this sooner than later!

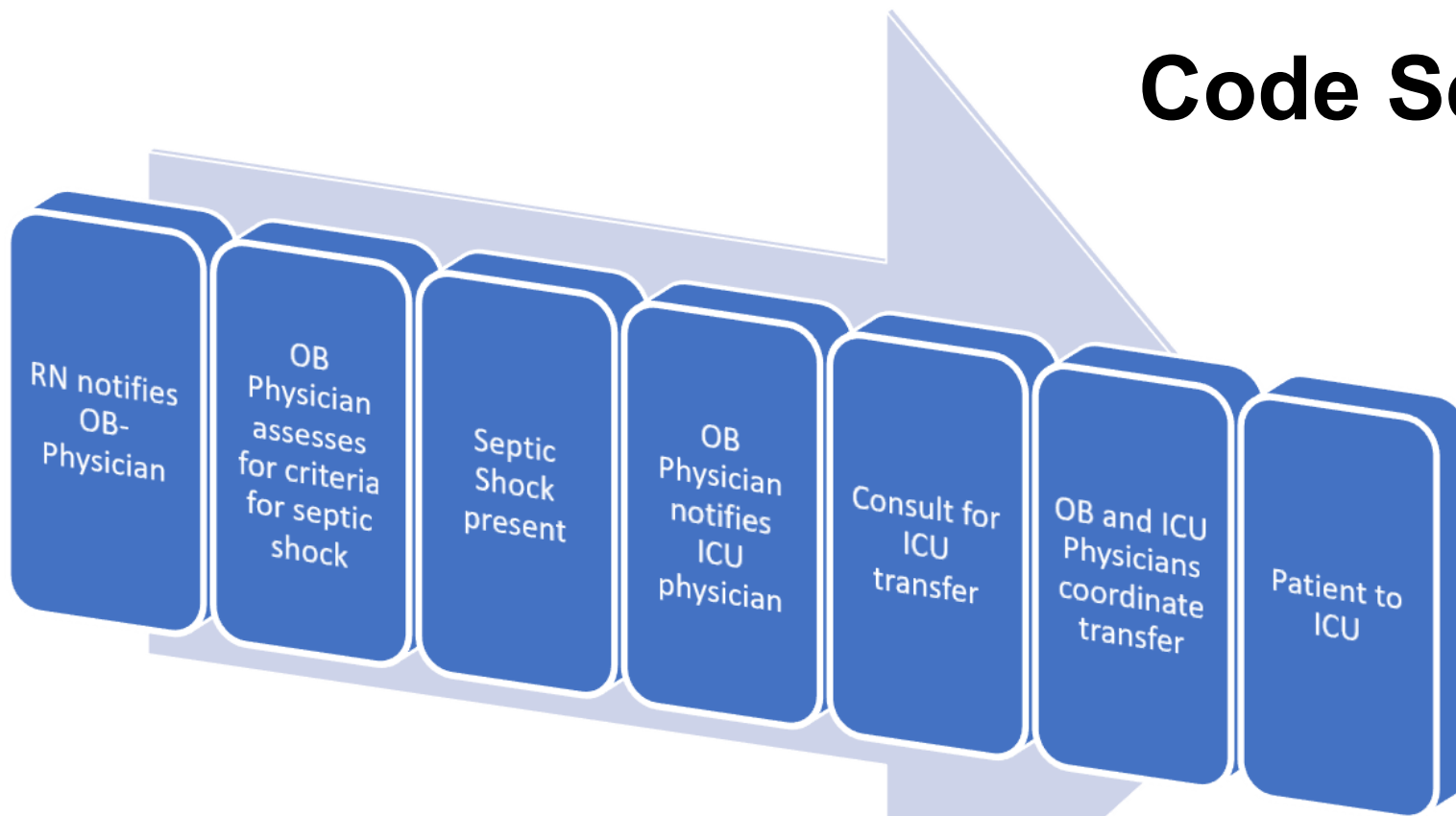
ALERT - Sepsis [14]





The next slide will depict a code sepsis with the typical progression and providers involved; it is certainly not limited to the people stated. Ask for further help you may need!

Code Sepsis





Decoys - Dismissing Abnormal SIRS [\[14\]](#)

Abnormal SIRS criteria are often seen and disregarded in postpartum states:

1. **Fever** - elevated metabolic demand
2. **Tachycardia** - relative hypovolemia
3. **Leukocytosis** - stress of delivery
4. Mild **hypotension** can even be dismissed especially with woman who may be **hypovolemic**, dismissing as a young woman with physiologically low blood pressure.



Keep an eye out for these!





Early recognition of maternal sepsis is key! Here are some things to do [14]:

- Nursing staff should initiate sepsis screening at every shift.
- Intervene early for all patients who screen positive for maternal sepsis.
- Bring in the rapid response team and further evaluation with an intensivist as needed.
- Create protocols with SIRS criteria for maternal sepsis.
- Notify the OB Physician

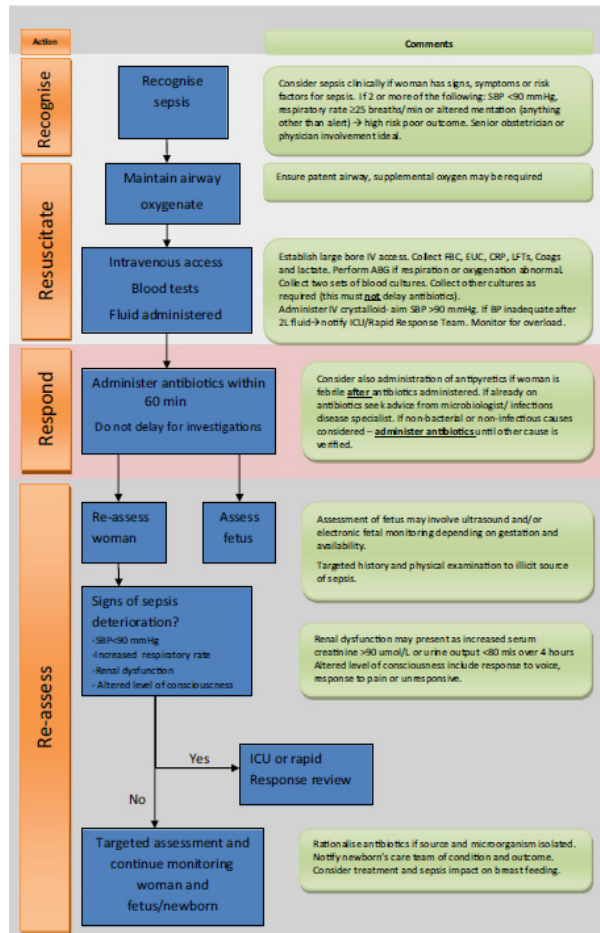




Make sure to also address these barriers to help early recognition of maternal sepsis [14].

- Just because a patient is young and healthy and doesn't look septic doesn't mean she isn't. Double check!
- Utilizing bundles that may lead to over-treatment.
- When pulmonary edema is present, risk is raised.
- Fevers may occur with women who undergo epidural anesthesia.
- The laboring woman normally has an elevated lactate.
- Make sure to screen women in the second stage of labor for sepsis. It can happen here too.





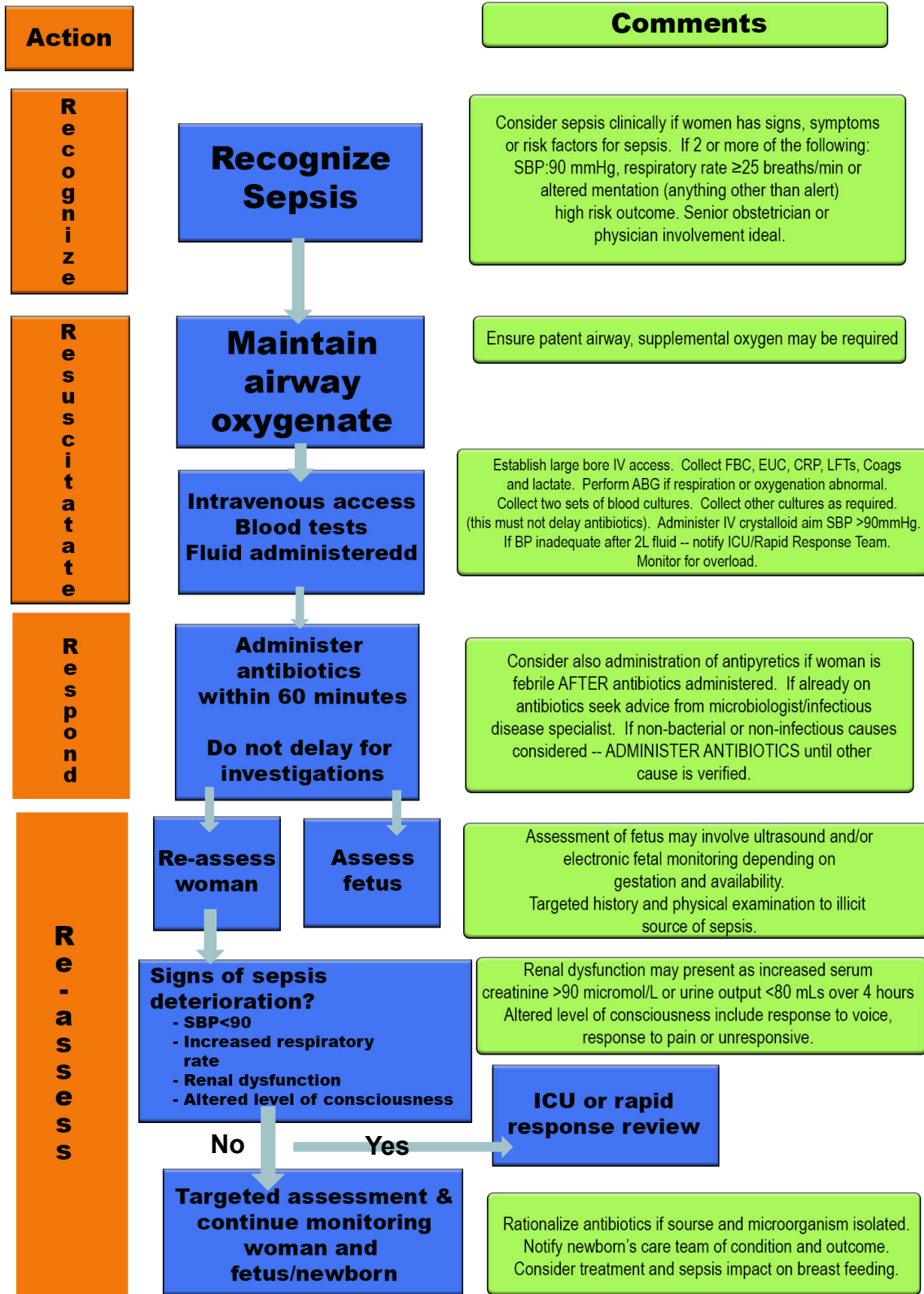
Flowchart for the assessment and management of sepsis in pregnancy.

Click the image for a larger view.

The clinically important steps are noted in blue boxes and comments relating to the steps are in neighboring green boxes.



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.](#)



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1. This figure and the associated guidelines should be considered together
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Step 1: Recognize Sepsis

Calculate omqSOFA

Is the score above 2?

- Yes - involve senior obstetrician or physician
- No

The first step is to recognize maternal sepsis. The definition of omqSOFA is obstetric modified quick sequential.

Click on Calculate omqSOFA link to view the table to calculate the score.



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 2: Resuscitate

- Maintain airway
- Consider supplemental oxygen
- IV access - 2 large bore ($\geq 18g$) cannulas
- Send bloods ([FBC](#), [UEC](#), [CRP](#), [LFT](#), [COAGS](#), Lactate)
- [ABC](#) if respiration or oxygenation is abnormal
- SEPTIC screen as indicated:
 - Urine [MCS](#)
 - Vaginal swabs MCS
 - Sputum MCS
 - Stool MCS

Ensure the patient airway is maintained. Supplement with oxygen when necessary. Click the links for definitions.



Step 3: Respond

- Administer IV antibiotics within 60 minutes (follow local guidance)
- Consider antipyretic if febrile AFTER antibiotics
- Administer IV crystalloid (Aim SBP >90)
- Is BP < 90 SBP after 2L IV Fluids?
 - Yes - call ICU
 - No

Respond with antibiotics. Click the links for definitions.



Step 4: Re-Assess:

- History
 - Targeted to elicit cause of sepsis
- Examination
 - Targeted to elicit cause of sepsis
- Calculate [omSOFA](#) ([details on the next page](#)).
- Are there signs of deterioration?
 - Yes? Call ICU
 - No
 - [SBP](#) >90
 - [RR](#) >25
 - Renal dysfunction ([Cr](#) >90 or urine output <80 mL/ 4 hours)
- Altered mentation
- Fetal assessment
- Ultrasound for growth and welfare
- [CTG](#)
- Notify newborn care
- Consider antibiotic use with breastfeeding

**Time to re-assess. Is the patient getting better?
Also, click the links for acronym definitions**



Use of the obstetrically modified quick Sequential (sepsis-related) Organ Failure Assessment score (omqSOFA) (Table 1) is recommended.

The obstetrically modified SOFA (omSOFA) score should be used for subsequent, more thorough assessment (Table 2). ([Bowyer, et al, 2017](#))

Table 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

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FIO₂ fraction of inspired oxygen (expressed as a decimal); MAP, mean arterial pressure; mmHg, millimeters of mercury; PaO₂, partial pressure oxygen (in mmHg); SOFA, Sequential (sepsis-related) Organ Failure score



Consider the Sepsis Six ^[17]



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





[3]

- The majority of women who died from sepsis had a delay in escalation of her care.
- Most were afebrile, possibly delaying the recognition of sepsis being present.
- Shockingly, even after diagnosis, 73% of women were started on antibiotics providing inadequate coverage.
- Involving an expert in infectious disease may help save her life.
- Implementation of protocols are critical.

Can deaths from maternal sepsis be prevented? Of course! Here's how:



[18]

- Educate her on risks of contact with young children and risk of exposure to pharyngitis
- Hand washing and perineal hygiene education should be reviewed
- Treatment of other infections promptly
- Before surgery, ensuring a shower occurs with antiseptic agent
- Within 30 days of surgery, she should avoid smoking
- Control of glucose levels
- Prophylaxis for antimicrobials
- PROM (premature rupture of membranes) should require antenatal prophylaxis for less than 37 weeks gestation
- PROM at greater than 37 weeks gestation should require antibiotics
- When she requires cesarean delivery, antibiotic prophylaxis should be given
- When she has a 3rd or 4th degree laceration, broad spectrum antibiotics should be given

Here are some identifiers to prevent infections in pregnancy.





In Conclusion [\[3\]](#)

- Sepsis and septic shock are considered medical emergencies requiring immediate treatment and resuscitation.
- Sepsis should be considered 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, ideally within the hour of diagnosing or suspecting sepsis.
- Cultures should be obtained: Blood, urine respiratory, wound, or any other culture as indicated
- Early administration of crystalloid solutions when sepsis is complicated by hypotension or suspected organ hypo-perfusion
- 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.





**Congratulations! You
have successfully
completed this module!**

Click in the 'X' to take the post-test for this course. If you do not attain a passing score after two attempts at the post-test, the entire program must be repurchased.



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