

Obstetric Sepsis

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Financial disclosures

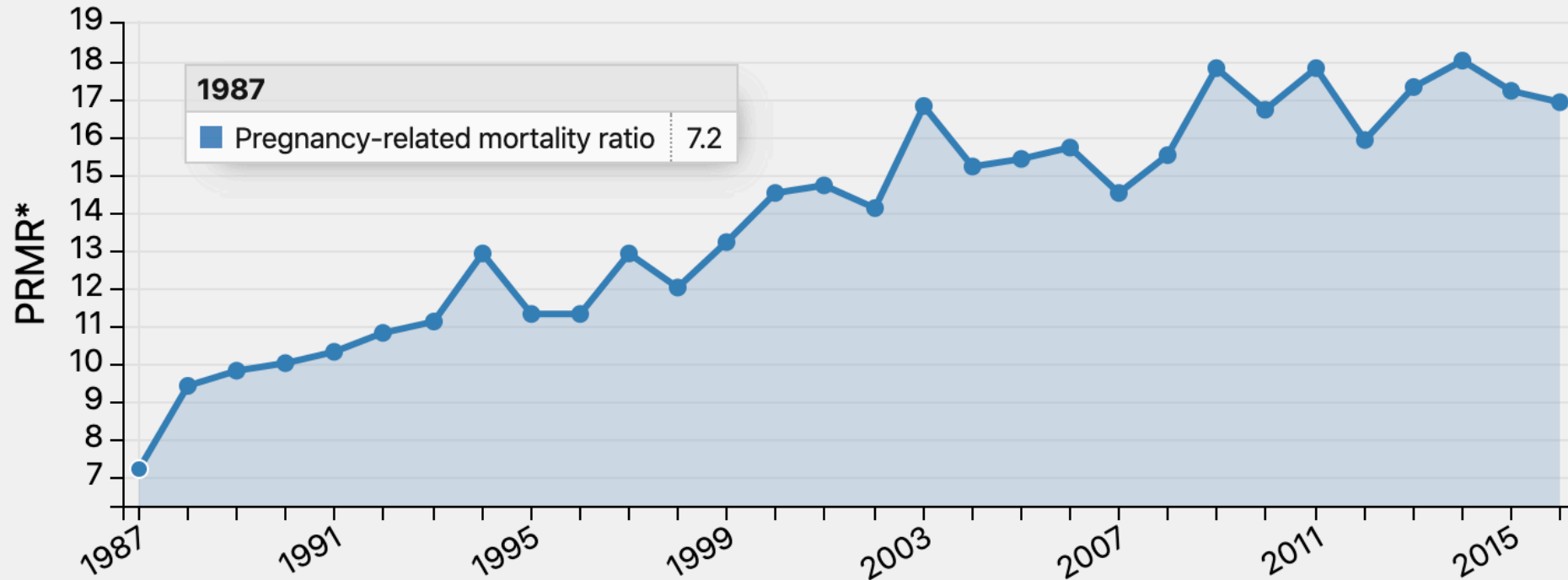
- None

Objectives

Upon completion of this course, the participant will be able to

- Describe the epidemiology of sepsis in obstetrics
- Name the barriers to diagnosing and treating sepsis in pregnant and postpartum women
- Describe strategies for evaluation and management of sepsis in obstetric patients

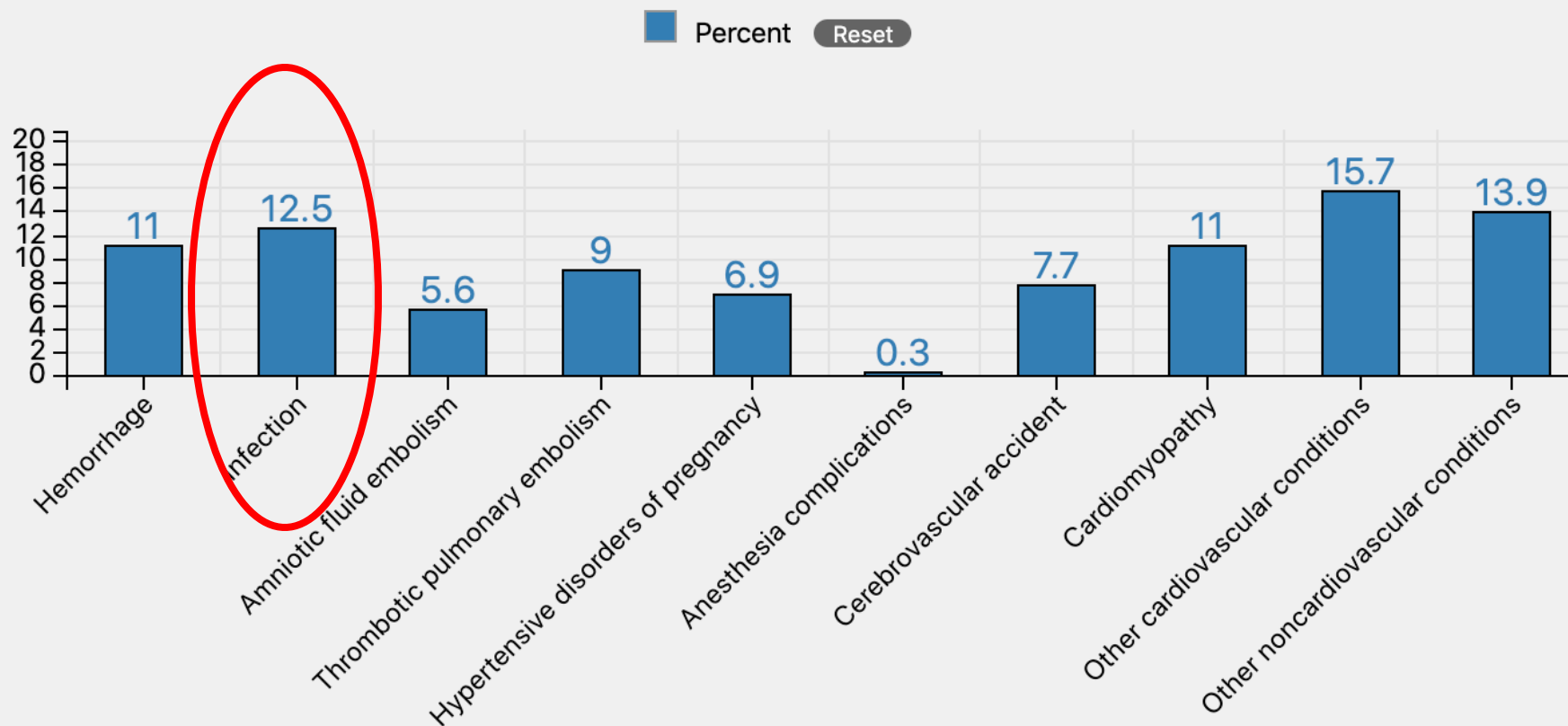
Trends in pregnancy-related mortality in the United States: 1987-2016



*Number of pregnancy-related deaths per 100,000 live births per year

■ Pregnancy-related mortality ratio

Causes of pregnancy-related death in the United States: 2011-2016



Note: The cause of death is unknown for 6.4% of all pregnancy-related deaths

Maternal death (confirmed and unconfirmed) cohort in Texas,
2011 and 2012, six leading causes of death

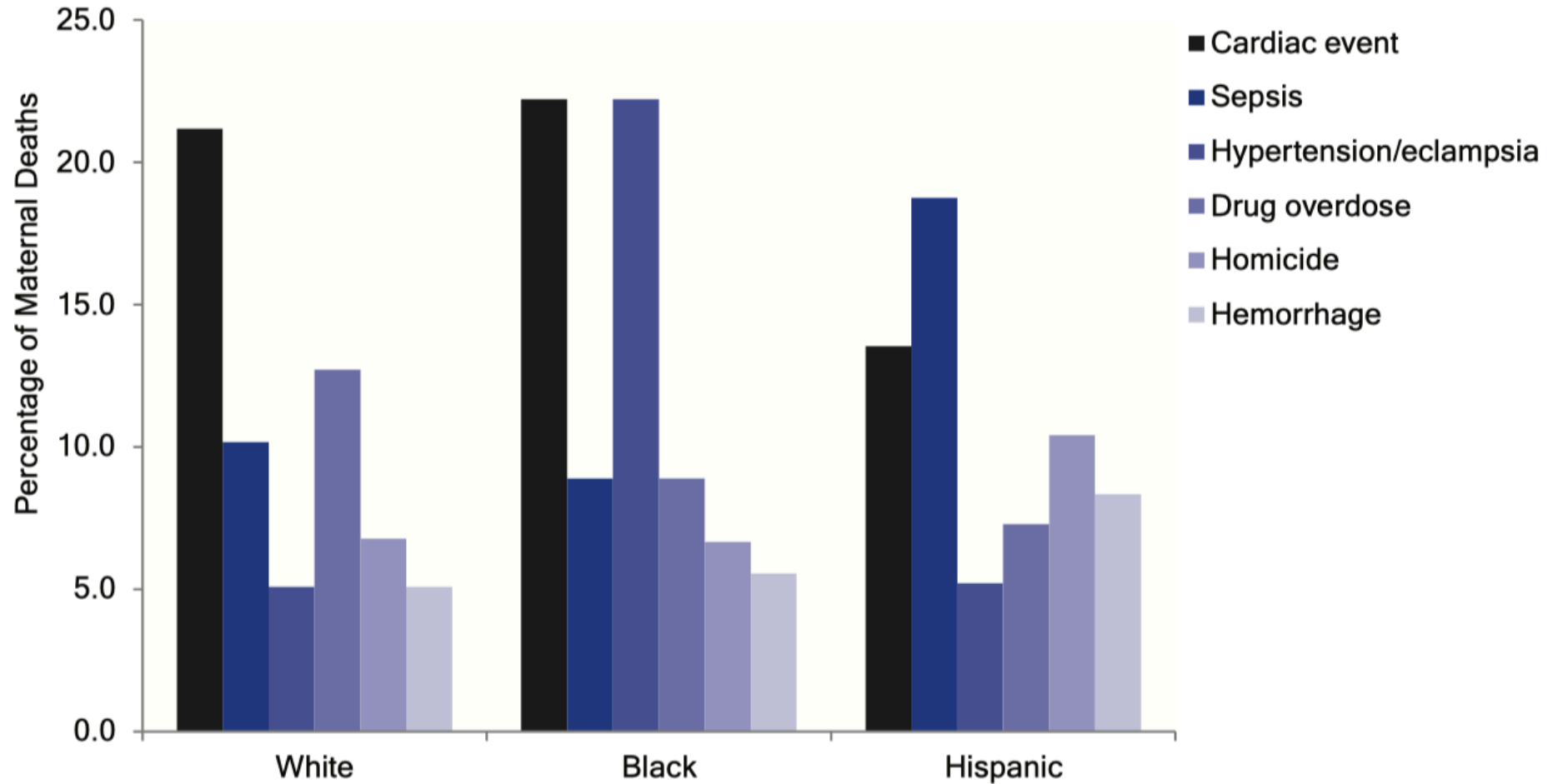
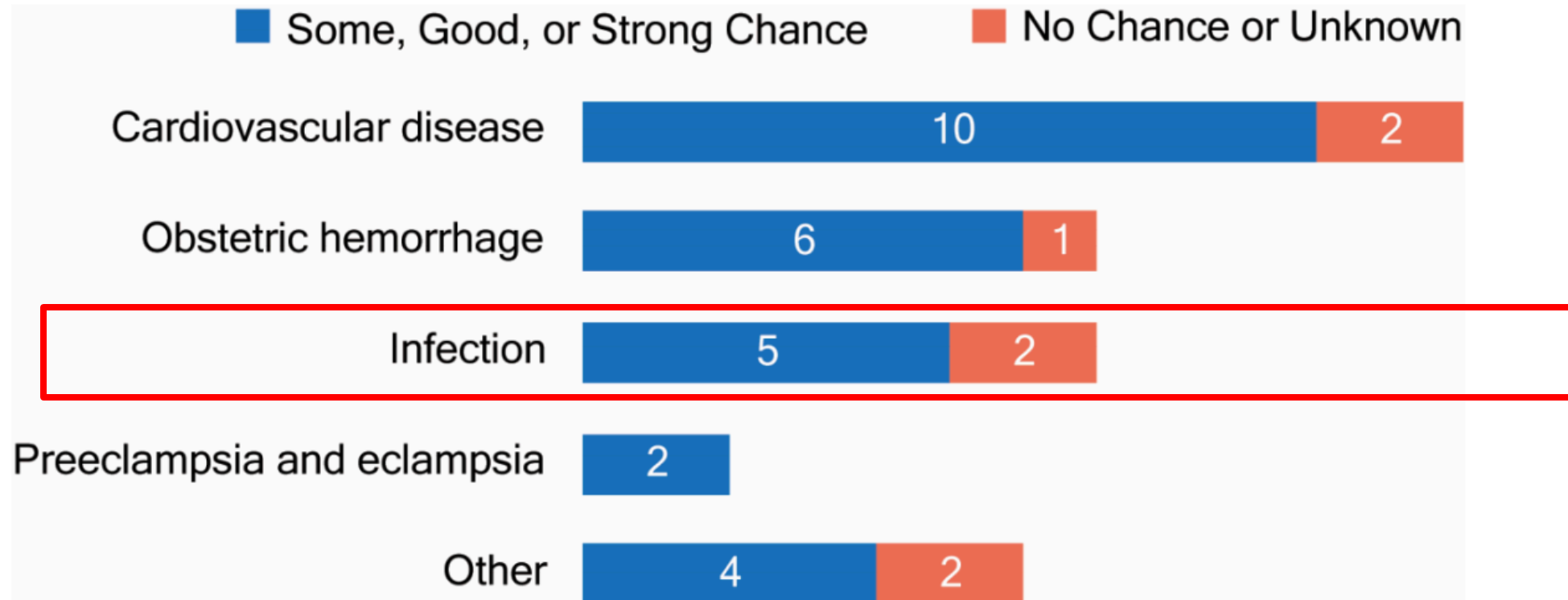


Table C1. Maternal Death by Cause and Timing of Death, Texas, 2012-2015

Cause of Death	TIMING OF DEATH					TOTAL
	While Pregnant	0-7 Days Postpartum	8-42 Days Postpartum	43-60 Days Postpartum	61+ Days Postpartum	
Drug Overdose	0	3	7	5	49	64
Other Causes	5	5	6	3	44	63
Cardiac Event	2	12	9	5	27	55
Homicide	2	1	5	2	32	42
Infection/Sepsis	1	3	14	3	11	32
Suicide	0	1	2	2	28	33
Cerebrovascular Event	0	8	9	1	9	27
Hemorrhage	3	12	2	0	3	20
Hypertension/Eclampsia	0	7	4	0	7	18
Pulmonary Embolism	2	3	4	2	2	13
Amniotic Embolism	1	9	0	0	0	10
Substance Use Sequelae (e.g., liver cirrhosis)	0	0	2	0	3	5
TOTAL	16	64	64	23	215	382

Figure B3: Task Force rating of chance of preventing pregnancy-related deaths through better care and/or management during/after pregnancy by cause of death, Texas, 2012



Barriers to diagnosing and treating sepsis in pregnant and postpartum women

Describe strategies for evaluation and management of sepsis in obstetric patients

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SEPSIS IS LIFE-THREATENING **ORGAN
DYSFUNCTION** CAUSED BY A DYSREGULATED
HOST RESPONSE TO **INFECTION**

Surviving Sepsis Campaign 2016



Recognition

Initial steps

- **Vital signs**
 - Temperature
 - Heart rate
 - Blood pressure
 - Respiratory rate
 - Oxygen saturation
- **Complete blood count (CBC)**

Scoring Systems

Sick people correctly identified Well people correctly identified

Criteria	Sensitivity	Specificity
SIRS (any two): T < 36°C or > 38°C; WBC < 4 or > 12; HR > 90; RR > 20; T	0.93	0.63
Modified MEWS (any one): SBC < 90 mm Hg; HR > 120; RR > 30; neurological changes	0.82	0.87
qSOFA (any two): RR > 22; SBC < 100 mm Hg; neurological changes; RR > 22 and SBC < 100 mm HG	0.50	0.95

Predicting in hospital mortality

TABLE 3
Area under curve (including for individual variables)

Variable	AUC
S.O.S.	0.97
Temperature	0.78
Heart rate	0.94
Systolic blood pressure	0.93
Respiratory rate	0.80
SpO ₂	0.62
Leukocyte count	0.89
% immature neutrophils	0.74
Lactic acid	0.72

AUC, area under curve; S.O.S., Sepsis in Obstetrics Score; SpO₂, blood oxygen saturation.

Albright. The Sepsis in Obstetrics Score. Am J Obstet Gynecol 2014.

Predicting ICU admission

Suggested Scoring System to Know



Step 2: Sepsis suspected

Action: If suspected infection, start source-directed antibiotics and 1-2 L of IV fluids; increase monitoring and surveillance. Move to confirmation evaluation.

NOTE:
A MAP < 65 mm Hg (persistent after 30ml/kg fluid load) in setting of infection directly defines **SEPTIC SHOCK**

Step 2: Confirmation of Sepsis Evaluation

- Respiratory: New need for mechanical ventilation *or* PaO₂/FiO₂ < 300
- Coagulation: Platelets < 100 x 10⁹/L *or* INR > 1.5 *or* PTT > 60 secs
- Liver: Bilirubin > 2 mg/dL
- Cardiovascular: SBP < 85 mm Hg *or* MAP < 65 mm Hg *or* > 40 mm Hg decrease in SBP (after fluids)
- Renal: Creatinine ≥ 1.2 mg/dL *or* doubling of creatinine *or* urine output < 0.5 ml/kg/hr x 2 hrs
- Mental Status: Agitated, confused, *or* unresponsive
- Lactic Acid: > 2 mmol/L in absence of labor

Confirmed if 1 or more criteria met

Further Assessment

Laboratory studies

Complete blood count (CBC)
Coagulation profile (PTT, PT/INR)

Complete metabolic profile (CMP) (bilirubin, creatinine)
Lactate

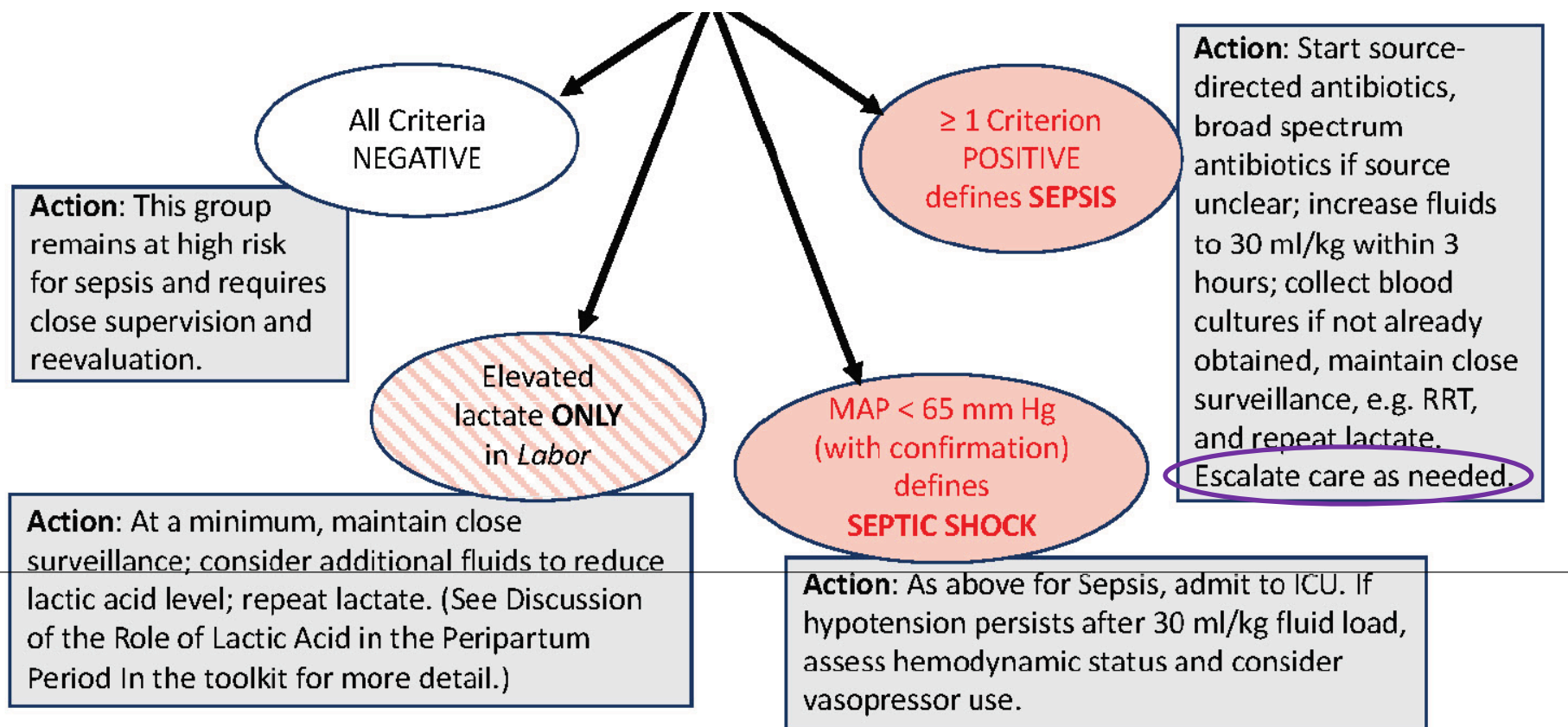
Bedside

Place Foley for urine output
Pulse oximetry (HR and SpO₂)
Mental status assessment

IV fluids and antibiotics

1 liter bolus
Antibiotic based on history/physical, suspected source

Sepsis vs Septic Shock



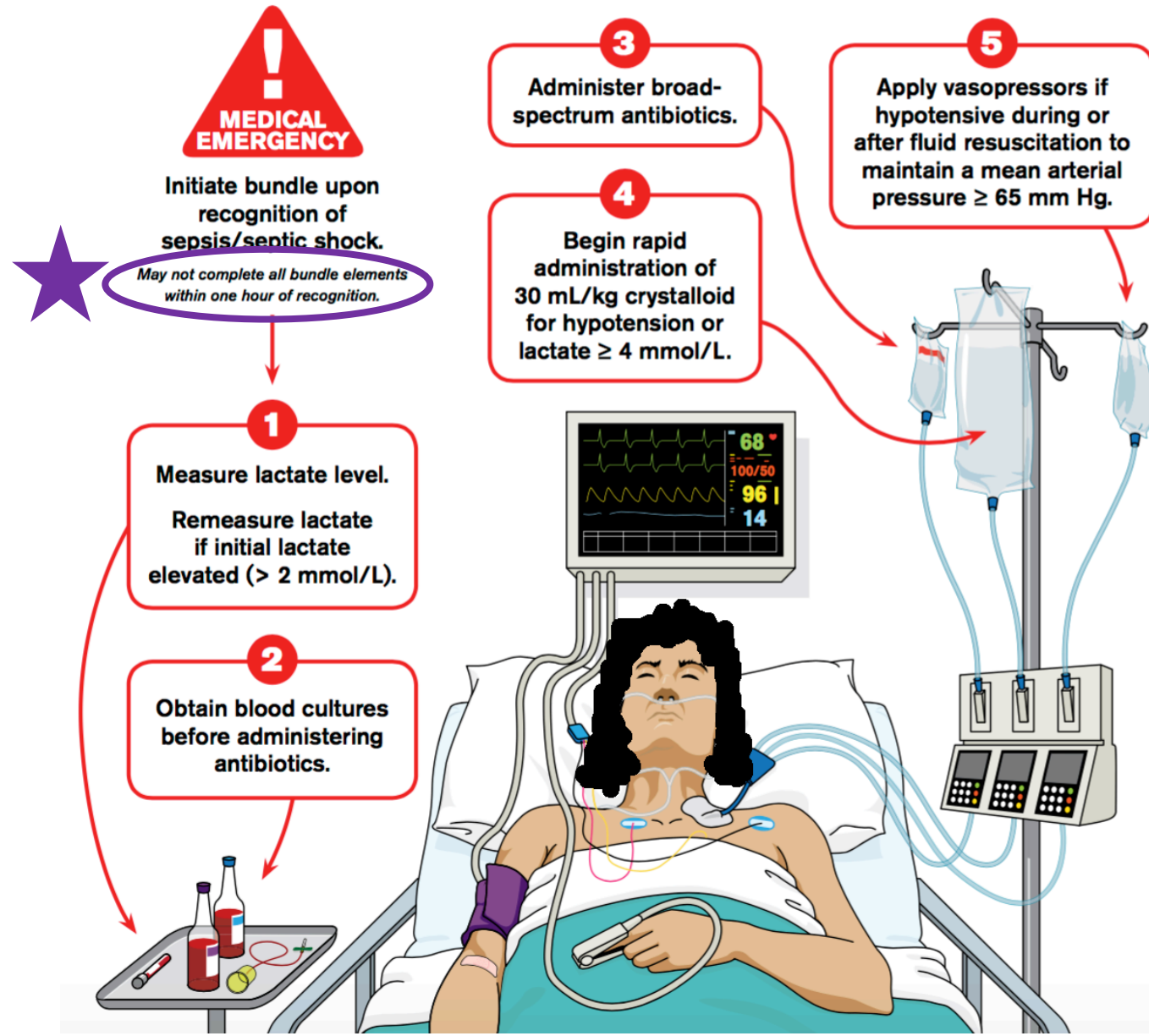
Approximate Sensitivity: $32/33 = 97\%$. (TP/TP+FN)

Approximate Specificity: $14,552 / (14,552 + 166) = 99\%$ (TN/TN+FP)

14,000 patients

Hour-1 Bundle

Initial Resuscitation for Sepsis and Septic Shock



Sepsis Management

3 Critical Initial Steps

#1 Fluid Resuscitation

(30 mL/kg IV crystalloid in the first 3 hours)

- Target MAP >65 mmHg
- Assess fluid responsiveness
- Normalize lactate (a marker of tissue hypoperfusion)

#2 Blood cultures

- Do not delay antibiotics; at least 2 sets of cultures

#3 Antibiotics

- Empiric broad-spectrum therapy with at least 2 antimicrobials aimed at the most likely bacterial (and/or viral) pathogens

Sepsis Management

Surviving Sepsis Campaign

BUNDLE

HOUR-1 BUNDLE: INITIAL RESUSCITATION FOR SEPSIS AND SEPTIC SHOCK:

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

*Remeasure lactate if initial lactate elevated (> 2 mmol/L).

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Surviving Sepsis Campaign

1. *Act quickly upon sepsis & septic shock recognition
2. Minimize time to treatment - sepsis & septic shock are medical emergencies
3. Monitor closely for response to interventions
4. Communicate sepsis status in hand-offs

*All elements of the Hour-1 bundle may or may not be completed in the first hour after sepsis recognition

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Rapid Response Team, Intensive Care Unit

Case Example

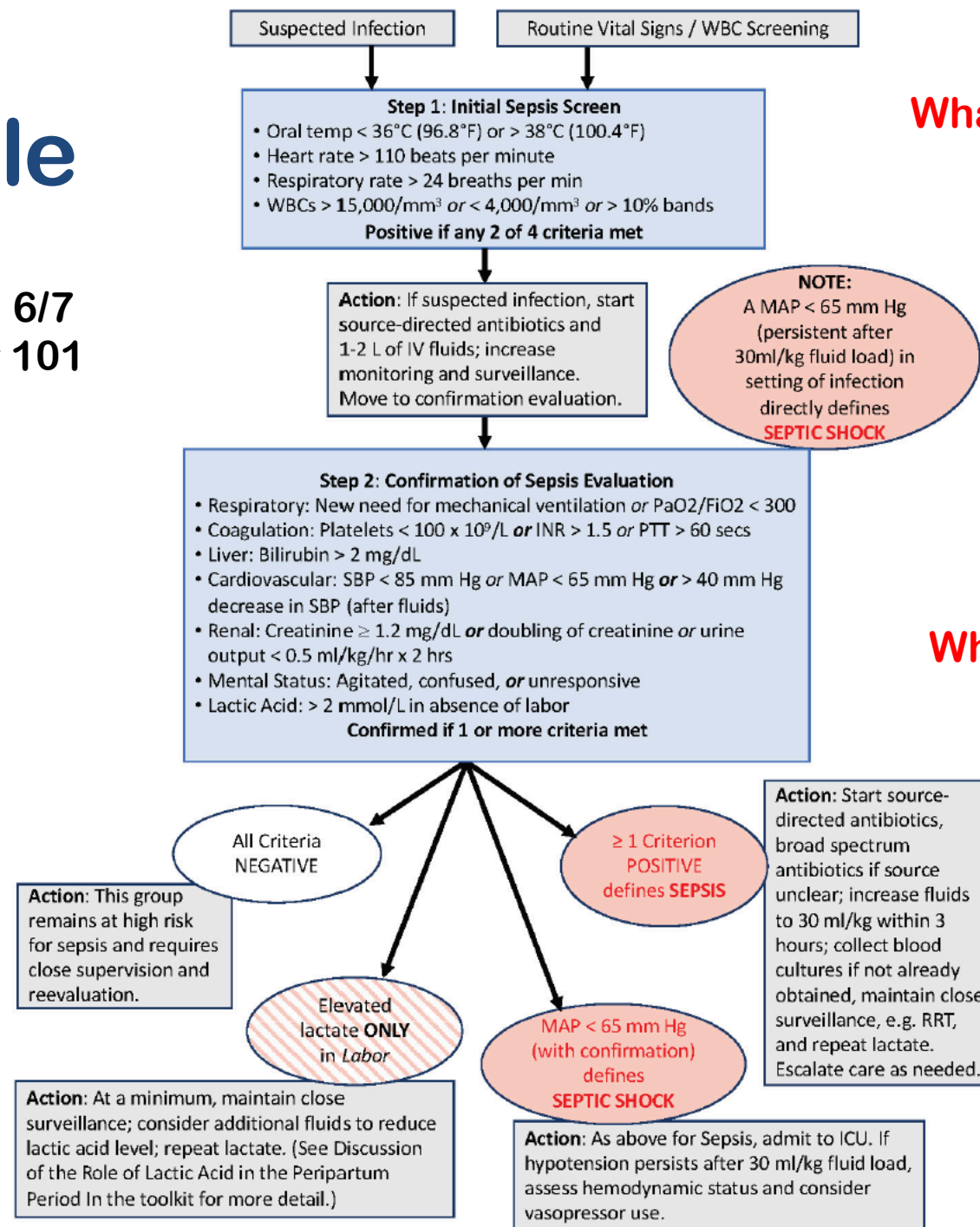
28 year old G3P2002 at 21 6/7 weeks presents with fever 101 F, HR 115, right CVA tenderness

BP 110/70 (MAP = 83)

SpO2 98%

RR 20

Weight: 86 kg



What do you want to do first?

- *Start IV fluids, send labs
 - 1 liter bolus LR
 - CBC, CMP, lactate, UA
- *Start antibiotics

Results are in: lactate 2.6, BP now 83/50 (MAP = 61)

What do you want to do next?

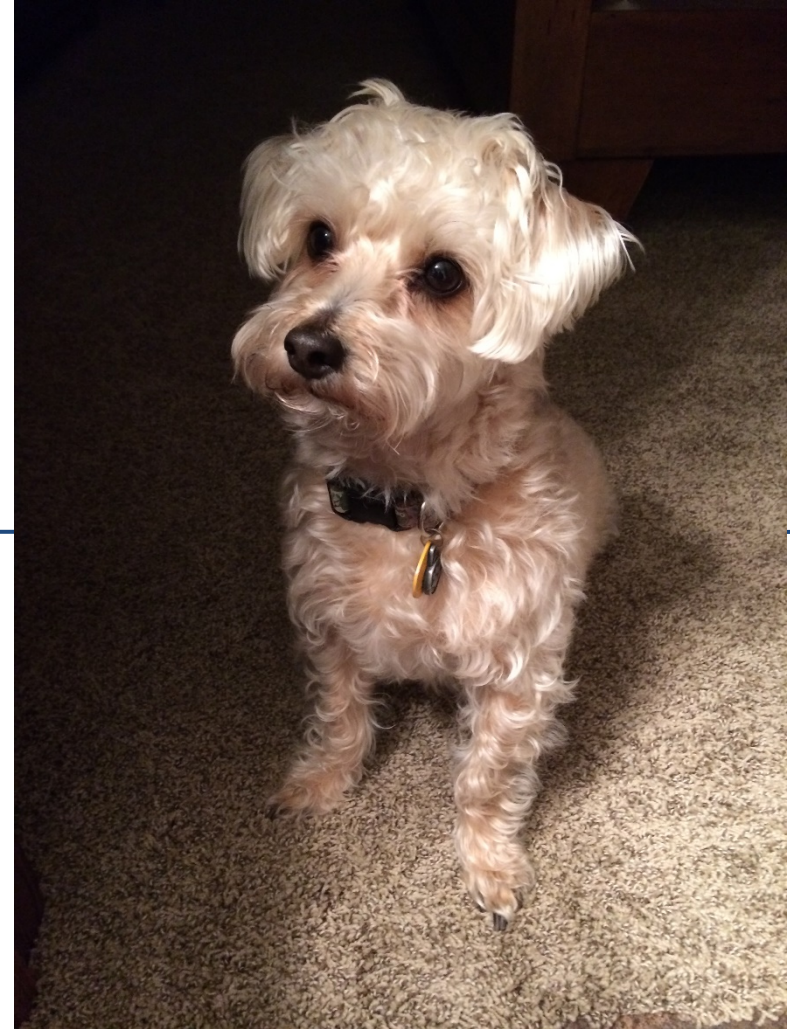
- *Send blood cultures (2)
- *Start antibiotics
- *Repeat lactate q2 hours

If remains hypotensive after fluids (2-3L; 30mL x 86 kg = 2580 mL)?

RRT/ICU, possible vasopressors

THANK YOU!

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Common Sources of Sepsis*

- Antepartum
 - Pyelonephritis
 - Pneumonia/influenza
 - Septic abortion
 - Appendicitis
- Intrapartum
 - All of the above causes, plus:
 - Chorioamnionitis
- Postpartum
 - All of the above causes, plus:
 - Endometritis
 - Wound infection
 - Mastitis

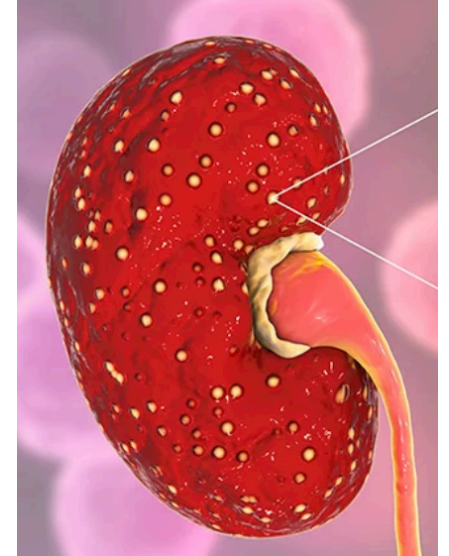
**Source of sepsis may be unknown*

Back to basics

- A thorough and thoughtful History and Physical exam are crucial identify a suspected source in women with signs of infection or sepsis:
 - Medical comorbidities
 - Surgical and obstetric complications: particularly if postpartum, and you did not attend delivery
 - Breastfeeding history
 - Outside records when relevant
 - Travel history (COVID-19, etc...)
- Pelvic examination in a pregnant or postpartum woman with signs of infection is a necessary part of the physical exam

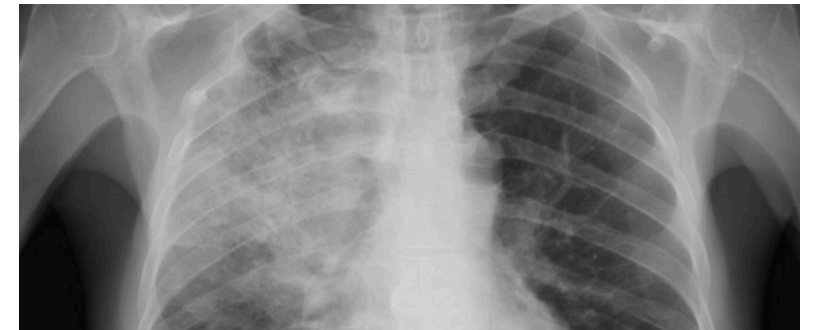
Acute Pyelonephritis (1-2%): a leading cause of ICU admission

- 80-90% in second, third trimesters or postpartum
- Up to 20% have bacteremia
- Common pathogens: *E. coli* (70-80%), *Klebsiella pneumoniae* (3-5%), *Enterobacter* or *proteus* (3-5%), gram positives (10%)
- Key: Intravenous hydration, with close monitoring of oxygen saturation
- Source control: broad spectrum antibiotics
 - **Ampicillin + gentamicin**
 - Cefazolin or ceftriaxone
- Low threshold for evaluation with renal sonography
 - *Severe infection with obstruction is an emergency*



Pneumonia / Influenza

- 10-12% of pregnant women with influenza may develop pneumonia or pneumonitis
- Common etiologies:
 - *S. pneumoniae*, *S. aureus*, *H. influenzae*, *Mycoplasma pneumoniae*
- *Evaluation of pregnant women with influenza-like illness underscores limitations in some sepsis scoring systems in obstetric patients*
 - Uncomplicated viral influenza: supportive care, oseltamivir regardless of flu swab
 - Evaluate for superimposed bacterial pneumonia if abnormal vitals signs
 - Suspected pneumonia: ceftriaxone or ampicillin-sulbactam plus azithromycin



Septic abortion, endometritis

- Diagnosed by clinical exam and ultrasound
- Retained products of conception: remove the source
- Hysterectomy required rarely
- Etiologies:
 - Normal vaginal flora
 - Group A streptococcus
 - *Clostridium perfringens* and *sordelii*
- Broad spectrum antibiotics:
 - **Clindamycin plus gentamicin**
 - OR
 - Cefoxitin or cefotetan PLUS doxycycline



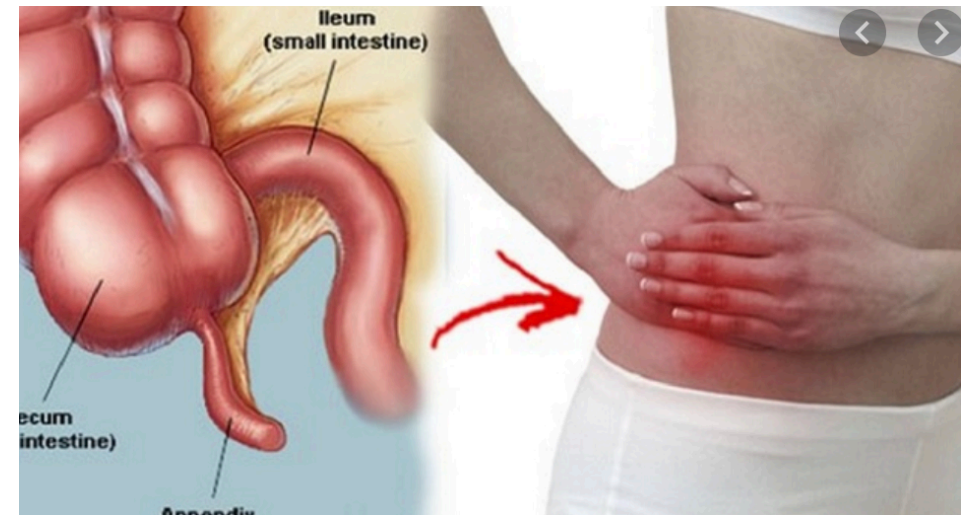
Chorioamnionitis / Intraamniotic infection

- Definitions, definitions...
- Common causative organisms:
 - Group B streptococcus (GBS)
 - Other genitourinary flora
 - *Ureaplasma sp.*
- Treatment: broad spectrum antibiotics with GBS coverage
- Consider maternal penicillin allergy when treating
 - Ampicillin + gentamicin
 - Mild PCN allergy: Cefazolin plus gentamicin
 - Severe penicillin allergy: Clindamycin (if susceptible) or vancomycin plus gentamicin
- **Source control: Delivery is required for cure**



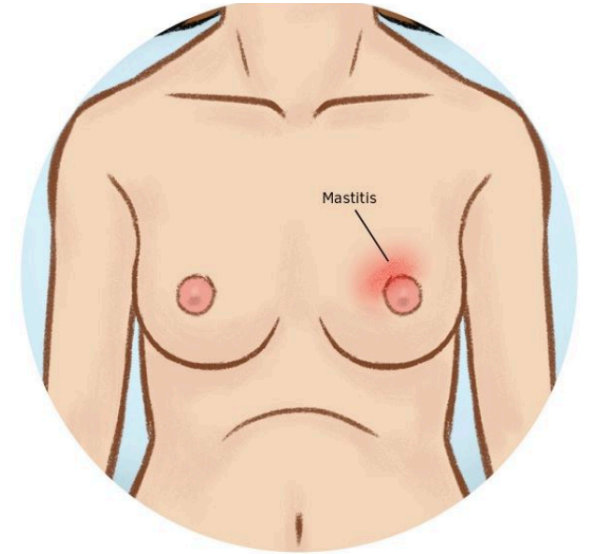
Appendicitis

- High risk of peritonitis, preterm labor if ruptured
- Suspected clinically
 - May be confirmed with ultrasound or MRI
 - General surgery consultation early
 - Intravenous hydration, NPO
 - Broad spectrum antibiotics: **cefoxitin plus metronidazole**
 - Observation for labor in antepartum patients



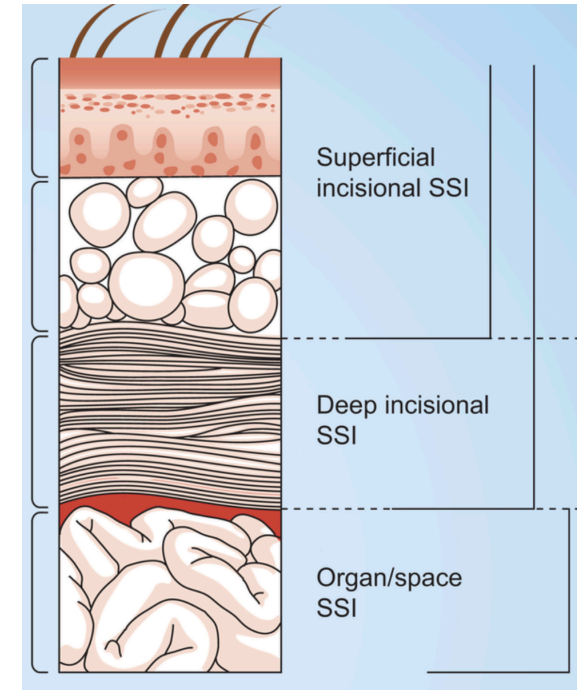
Mastitis

- Approximately 3% of postpartum breastfeeding women
- 10% of women with mastitis develop an abscess
- Common causative organisms:
 - *S. aureus* (or MRSA)
 - Coagulase-negative staph
 - Viridans streptococci
- Management:
 - Oral or intravenous antibiotics: **nafcillin** vs vancomycin (MRSA coverage)
 - Ultrasound to evaluate for breast abscess
 - Drain abscess if present
 - Continue breast milk expression!



Surgical site infections

- More common in women who had intraamniotic infection
- Common causative organisms (often polymicrobial):
 - *S. aureus*, coagulase-negative
 - Genitourinary species (*E. coli*, *proteus*, *klebsiella*, etc)
 - *Pseudomonas aeruginosa*
 - Streptococci, including *S. pyogenes* (Group A)
- Treatment:
 - **Source control: exploration and debridement**
- Broad spectrum antibiotics:
 - Ampicillin plus gentamicin plus clindamycin
 - Piperacillin/tazobactam plus vancomycin for severe infections, plus clindamycin for suspected necrotizing fasciitis
 - For known or suspected Group A streptococcus or clostridium: penicillin plus clindamycin



Conclusions

- Infection and sepsis in pregnancy are major contributors to maternal morbidity and mortality
- Sepsis is an emergency: early recognition and treatment are key while identifying the source.
- Implementing a system-wide response can improve early detection.
- A thorough History and Physical examination (with pelvic exam) are fundamental to identifying a suspected source of infection in pregnant and postpartum women