Maternal Sepsis: Why Mothers Die and How We Can Prevent It

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Disclosures

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- *NIH/NICHD UG3 HD108053 (PI)*
  - Large-scale Implementation of Community Co-led Maternal Sepsis Care Practices to Reduce Morbidity and Mortality from Maternal Infection
- *IHI Change Package Physician Lead Consultant*
- *Editor for the California Maternal Quality Care Collaborative Maternal Sepsis Toolkit*
- *Chair ACOG/AIM Sepsis in Obstetric Care*

Overview

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- Definition
- Incidence
- Why do mothers die from sepsis?
  - Delay in recognition
  - Delay in appropriate treatment
  - Delay in escalation of care

April's Story

https://www.youtube.com/watch?v=BLRAHpsVTHU&feature=youtu.be

Global Maternal Mortality Rates

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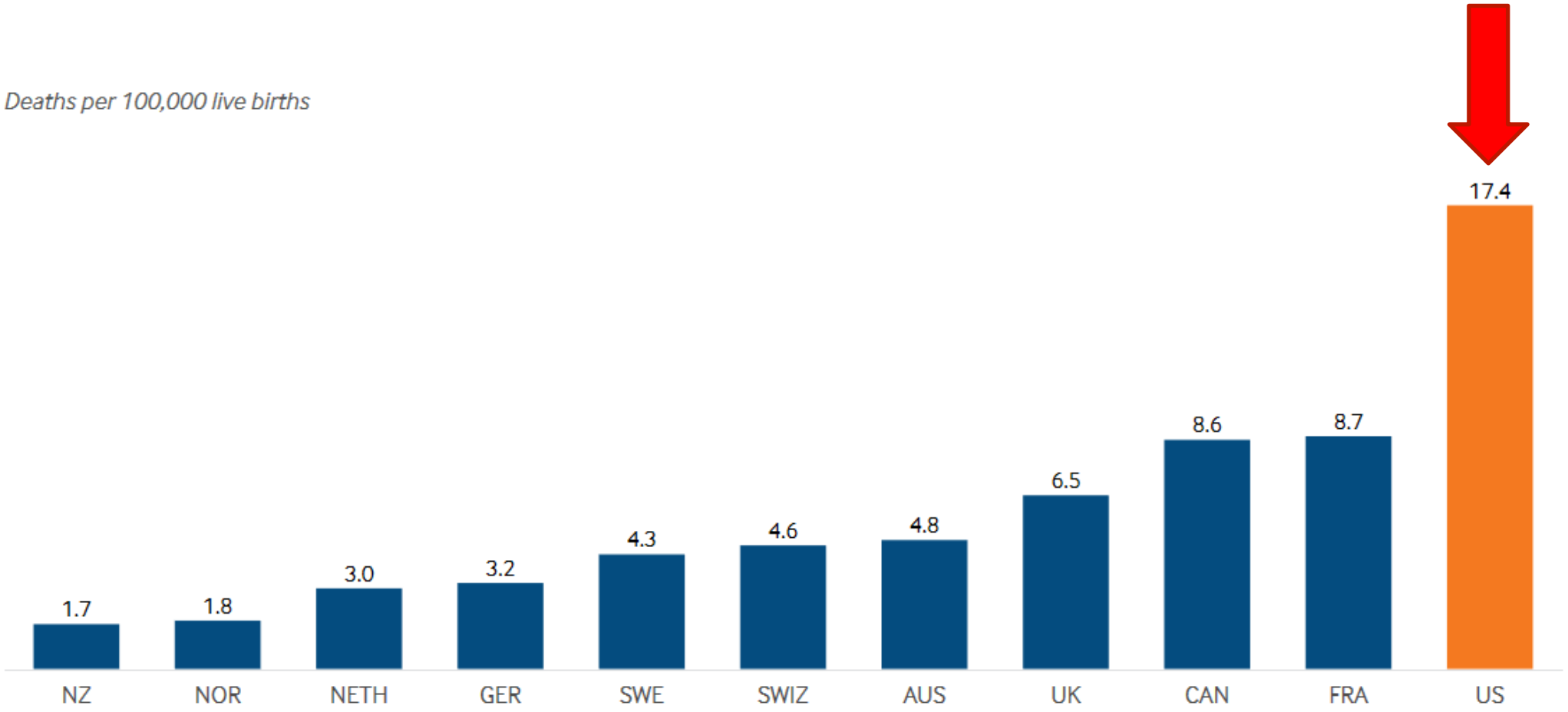

Roosa TikRoosa Tikkanen et al,. Commonwealth Fund, 2020. https//doi.org/10.26099/411v-9255

Pregnancy-related deaths due to infection

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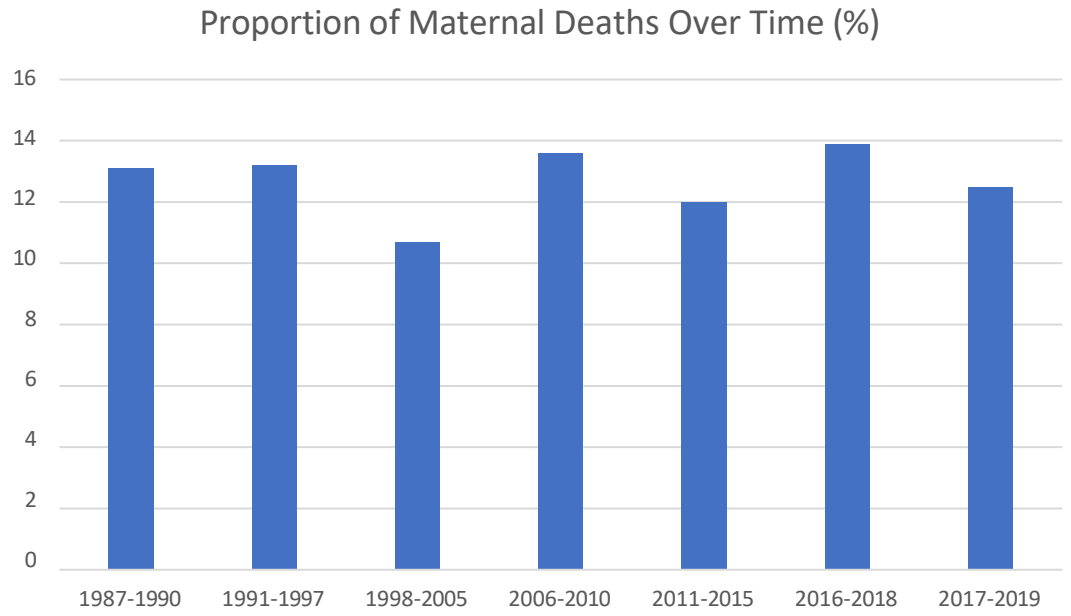
- **2nd-4th leading cause of maternal death in US, 3rd globally**
- **No change in the proportion of deaths over time (1987-2019)**
  - Despite substantial improvement in mortality in the general population



Bauer et al. *Anesth Analg* (2013)
Hensley et al. *JAMA* (2019)
Kendle et al. *AJOG* (2019

Towards a consensus definition of maternal sepsis: results of a systematic review and expert consultation

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Life-threatening condition defined as organ dysfunction resulting from infection during pregnancy, childbirth, post-abortion, or postpartum period (up to 42 days)

Incidence and Mortality

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- *Varies due to case ascertainment and definitions*
- *Sepsis incidence*
  - Sepsis (1:1000, 1:2500, 1:4200, 1:10,000)
- *Mortality*
  - 9%, 10%, 14%

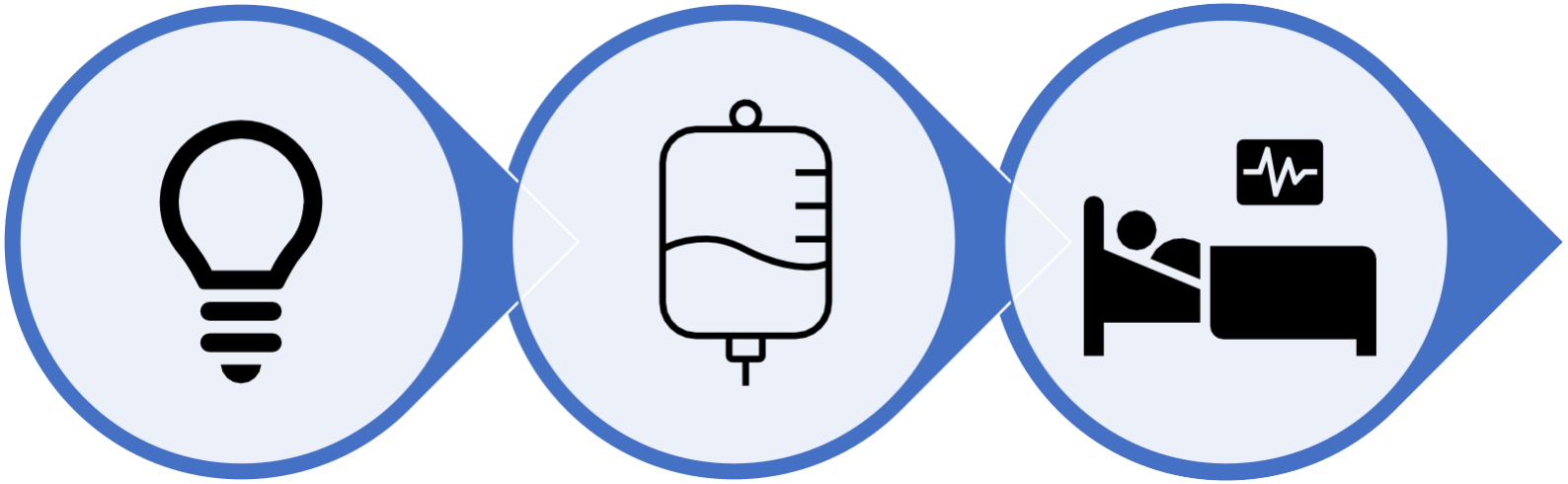
Bauer et al. *Anesth Analg (*2013)
Hensley et al. *JAMA* (2019)
Kendle et al. *AJOG* (2019)

Preventability

California	North Carolina	Michigan
39% Preventable	43% Preventable	73% Preventable

Bauer *et al. Obstet Gynecol* (2015)
Berg CJ *et al. Obstet Gynecol* (2005)
Main EK *et al. Obstet Gynecol* (2015)

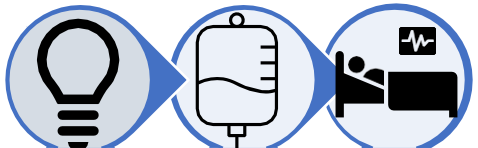
Three Deadly Delays



Recognition

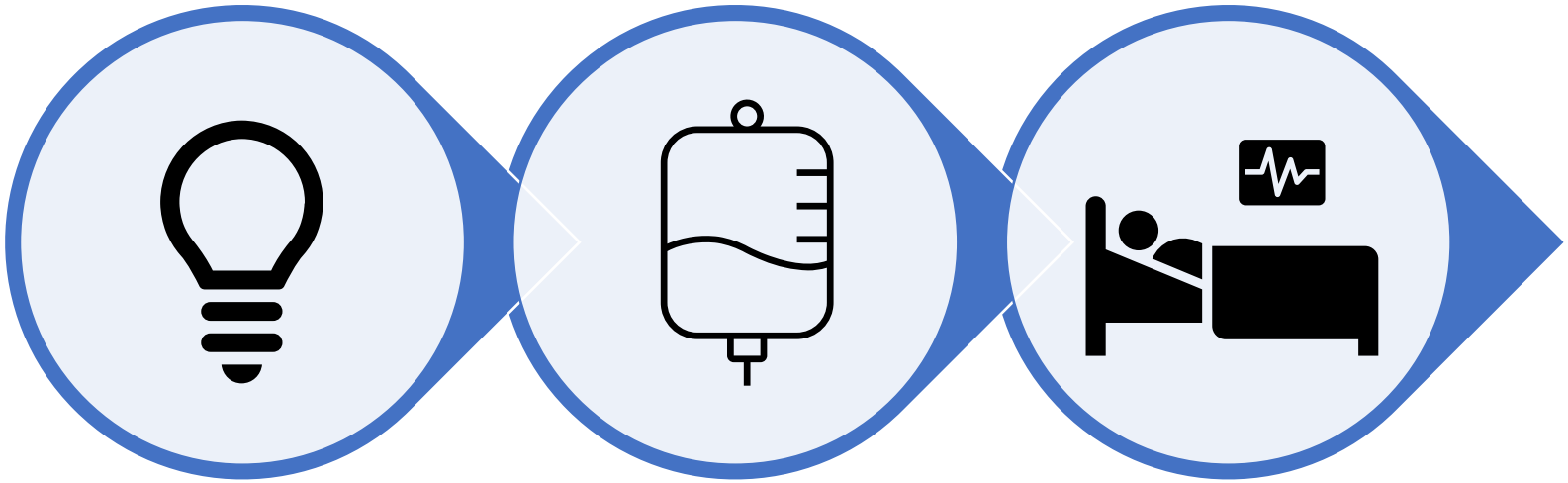
Treatment

Esclation of Care



Seacrist et al. *JOGNN* 2019
Bauer et al. *Obstet Gynecol* 2015

Three Deadly Delays



Recognition

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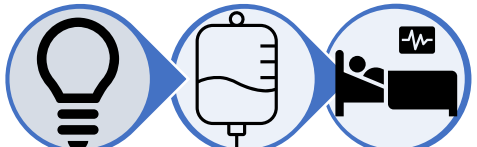

Seacrist et al. *JOGNN* 2019
Bauer et al. *Obstet Gynecol* 2015

Sepsis Bundle and Toolkit

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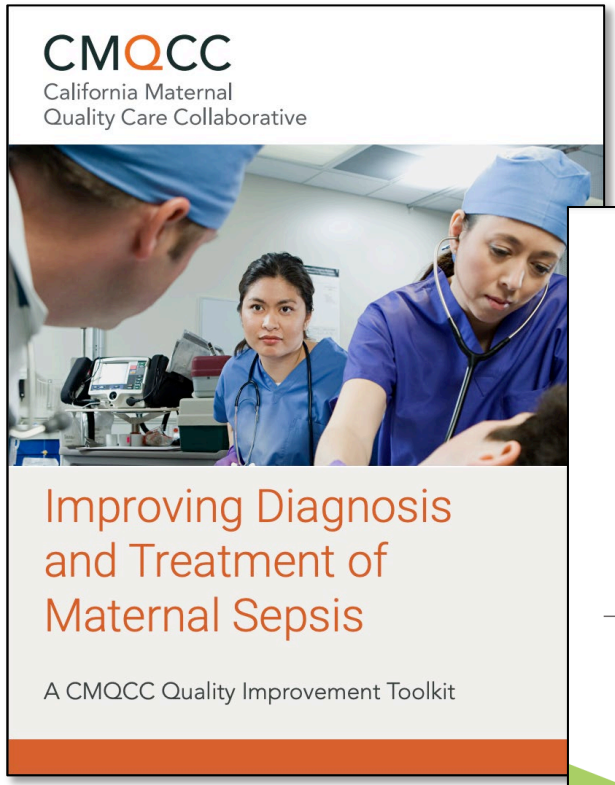
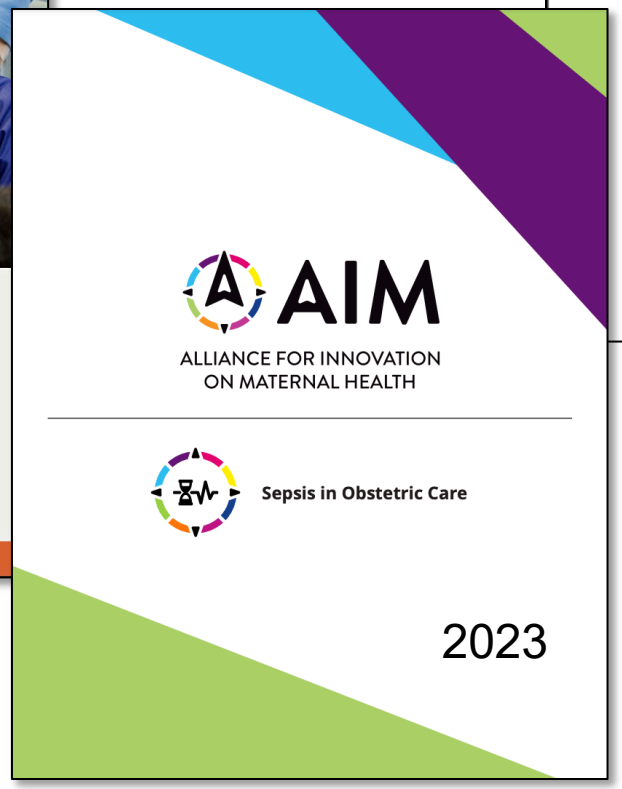


To be updated in early 2024

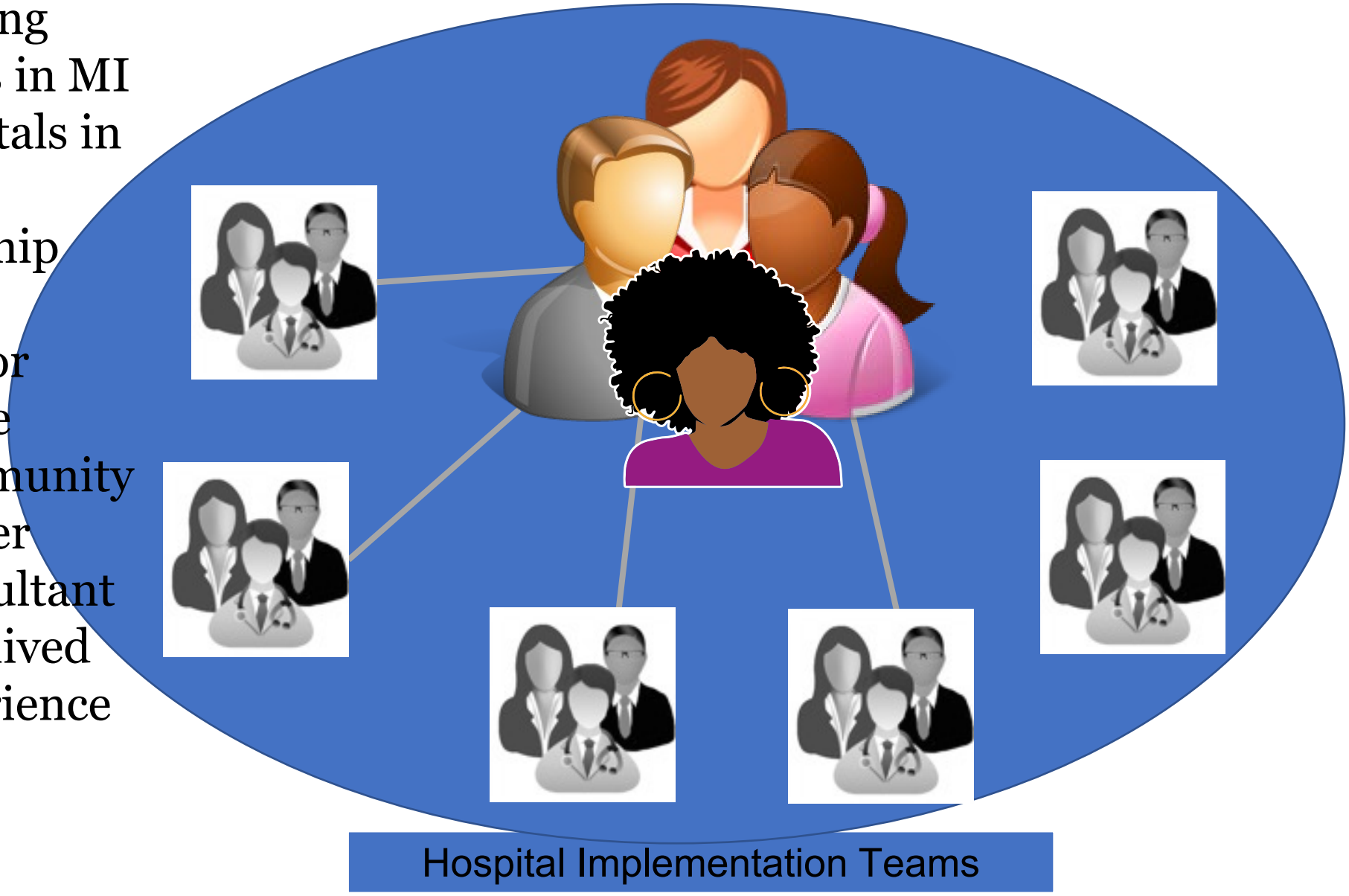
CMQCC
California Maternal
Quality Care Collaborative



Obstet Gynecol. 2023 Sep 1;142(3):481-492.

Hospital Implementation

- 63 birthing hospitals in MI
- 66 hospitals in CA
- Mentorship teams
  - Doctor
  - Nurse
  - Community Leader
  - Consultant with lived experience



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Recognition

Why is maternal sepsis different?

	Maternal Physiology	Sepsis
Heart rate	↑	↑
White blood cell count	↑	↓ ↑
Blood pressure	↓ ↑	↓
Lactic acid	↑	↑

In-hospital Recognition Pearls

- Most patients do not have any risk factors
- No fever (or hypothermia) ≠ No sepsis
- What is not in the chart can be most important

Bauer *et al.*, Anesth and Analg 2013
Bauer *et al., Obstet Gynecol* 2015.

Outside of the Hospital

- Over 50% of cases occur during postpartum readmission
- How can we also help the patient identify when to seek care?
- How can we help the patient be listened to and feel heard?

Hensley et al. JAMA 2019

Patient Barriers to Care

- 20 total interviews
  - 19 survivors with 8 support persons
  - 1 support person of a non-survivor
- Goals:
  - Identify barriers to care
  - Listen to patient's stories and lessons learned
  - Create solutions to address barriers

Patients did not remember education about warning signs

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- *"I think if when they discharged me, if they had said be on the lookout for these symptoms, if you have any of them, call and check in. If they had taken five minutes to do that, I think it would've made a huge difference."*

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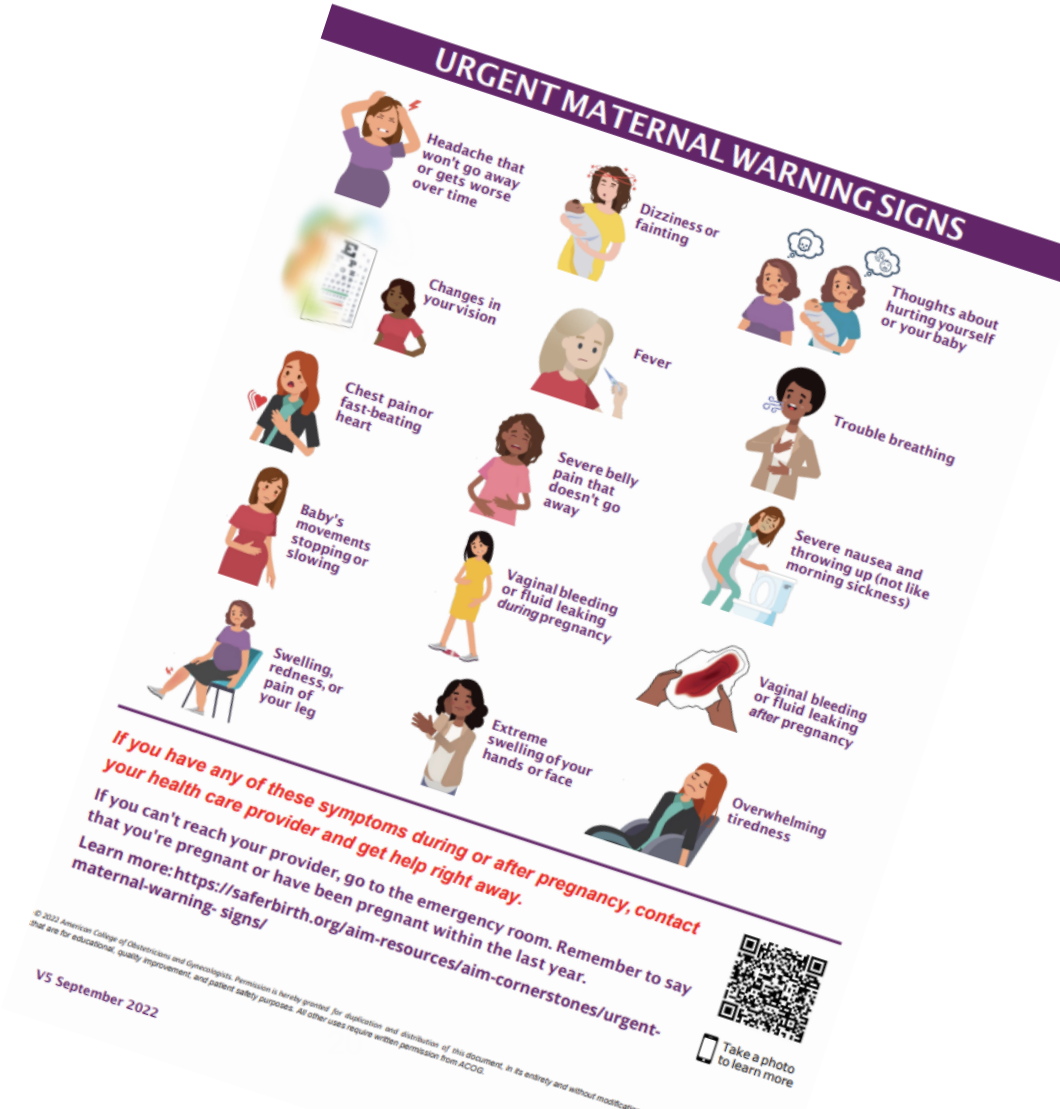
Urgent Maternal Warning Signs

- AIM Cornerstone resource, originally developed by the Council for Patient Safety in Women's Health Care
- Translated into 28 languages
- Standardized patient education

www.saferbirth.org/aim-resources/aim-cornerstones/urgent-maternal-warning-signs/



Phone Discharge Education

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ADD RESOURCES TO YOUR DEVICE HOME SCREEN

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For iPhone:
Scan QR Code on reverse side and choose:
Scroll down until **"Add to Home Screen"** appears, click on: Tap **"Add"**

For Android:
Scan QR Code on reverse side and choose:
Scroll down and tap on **"Add to Home Screen"**
Tap **"Add"**

It will now appear on your home screen.

PATIENT AND PROVIDER RESOURCES

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PATIENTS:
Urgent Maternal Warning Signs, Advocacy Language and Actions, **and More!**

PROVIDERS:
Warning Signs Follow Up Guide, Sepsis in Obstetrics Score Calculator, **and More!**

Community Dissemination

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Patient advocacy

•*“I wish someone would've explained the signs and how to advocate for themselves. Like if you call and they tell you don't come, still go. Go. It's better to go instead of waiting because hours is the difference between dire circumstances and dire consequences. ”*

Co-Created with Community and Patients with Lived Experience

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- Advocacy Language
- Advocacy Actions

Advocacy Language

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ADVOCACY LANGUAGE: List suggestions for language to provide patients (or their support person can say) who feel they are not being heard

ADVOCACY

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EXAMPLES OF ADVOCACY LANGUAGE

- I am very concerned and do not feel like I am being heard. What are my next steps or alternative options?
- This is really different for me. I have never felt this way in my life. For my benefit and my family's benefit I should be seen.
- I understand that some of these symptoms may be normal for pregnancy or postpartum, but I am very concerned and need to be evaluated.
- I have called a number of times and tried suggestions that have been provided, but I am not getting better.
- Can you please refer me to someone who can help me? I'm really worried.
- My doctor told me to call if I am experiencing X, Y, or Z. I am having X, Y, or Z. I would like to be seen.
- I want to speak to someone else to make sure that I do not have a serious condition. Can you please refer me to someone who will help me? I am really worried.
- I do not feel right, I am concerned that something bad is happening to me.

ADVOCACY ACTION TIPS

- Your concerns and feelings are valid, be persistent in getting the answers or care you need.
- If you have a medical emergency, please dial 911 or go to the nearest emergency room.
- Ask to speak to the charge nurse or patient relations if you are not being heard
- If you are not getting the response you need, you can go to triage or the emergency room. You do not need permission from anyone to do so.
- You can also go to a different hospital or urgent care facility if you are not receiving the care you need.
- Consider having another person to accompany you to help advocate for you (support person, family member, doula, etc.)
- Bring a list of your concerns you would like to be addressed.
- Start your concern with the effect that it is having such as the following: "I am so tired I am unable to get out of bed"; "I am having so much pain I cannot sleep"; etc.

Patient Concerns dismissed as normal

"She's dismissed there and throughout the whole stay whenever we brought these things up it was, 'you just had a baby, everything's okay. Don't worry, you just had a baby,' and that was the recurring theme throughout our stay."

But if they had asked further…

"I had no strength; I couldn't even go to the kitchen to get a glass of water"

"I was so weak; I couldn't stand up"

"I was short of breath after brushing my teeth and had to lie down on the bed"

Warning Signs: Questions to Ask

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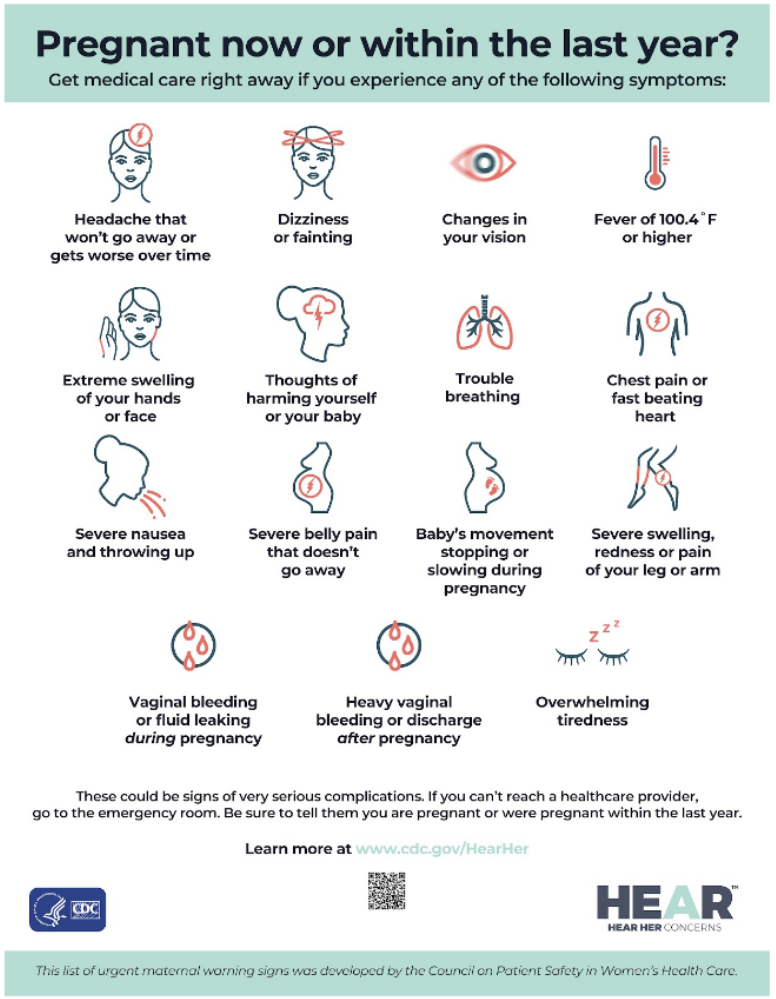
WARNING SIGNS QUESTIONS TO ASK: Please add questions to ask when patients call with one of these warning signs for assessment overall and specifically for "fever", "overwhelming tiredness", "severe belly pain that doesn't go away", "dizziness or fainting"

Im so sorry you are not feeling well. What else can you share with me about how you feel?

When a patient calls in, review this list to ask if any of the symptoms are present. If they are, ask when they started, are they constant, how long they last.

I would like to see you in person. Do you need assistance in getting a ride or child care?

Also ask what their temperature is in case it is low which can also be a problem. How does their current temperature compare to their normal temperature?



If the patient states that they "don't feel right" and requests to be seen, they should be seen. Whether that be office or hospital triage.

Red flag if the patient's partner or family member is calling on behalf of the patient

Are you able to perform normal day-to-day functions?

Are there any barriers that are preventing you from coming in to physically be seen?

To providers: Believe the patient and listen to what they are saying

To providers: Clearly state "I'm Nurse Betty and here to help you today, let me start by listening to your concerns today, please tell me your name and DOB"

How much do your symptoms worry you?

How concerned about your symptoms from a 1-10.

What prompted you to call? Is this your 1st time reporting or calling?

How is this different from your baseline?

WARNING SIGNS FOLLOW-UP GUIDE

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BACKGROUND

These questions, tips, and red flags were created based on near-miss cases of patients who suffered severe maternal morbidity.

Many patients called in with symptoms but were met with reassurance that symptoms were typical of pregnancy or postpartum rather than follow up questions that would have identified severe illness to allow prompt treatment.

FOLLOW UP QUESTIONS

These follow up questions are suggested to evaluate when patients call with symptoms of concern.

- Please tell me in your own words what is wrong.
- Is this your first time calling about this?
- How long has this been going on?
- Is it getting better, staying the same, or getting worse?
- On a scale of 1 to 10 (worst) how bad is _____? (pain/tiredness/symptoms of concern)
- Are you able to perform your normal day-to-day activities and take care of yourself?
- Are you able to eat, drink, urinate, pass gas, have bowel movements?
- Can you explain how this is limiting you?
- What prompted you to call?
- Have you had this before?
- Can you explain how you are feeling and how this is different from your baseline?
- Are there any barriers to coming in today?

ACTION ITEMS

- If the patient does not need assessment now, explain red flag warning signs when the patient should call back or come in for evaluation.
- Express empathy and concern. Many patients reported feeling like a burden and not feeling heard and subsequently delayed calling and seeking care when symptoms worsened.
- Keep track of a list of patients to reach back out to follow up on and encourage them to call back if not improving or getting worse.

RED FLAGS (should prompt in-person evaluation)

- Patient reaching out multiple times with concerns.
- A support person calling on behalf of the patient with concerns.
- Patient requests to be seen.
- Symptoms that are worsening over time.
- Patient unable to perform activities of daily living (climbing stairs, showering, brushing teeth, holding baby, etc.)
- Signs of severe dehydration: inability to urinate, inability to make tears, abrupt stopping of milk production.
- Severe pain.

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Treatment

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Antibiotics

Importance of prompt antibiotic therapy In Pregnant Patients

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- Antibiotics within one hour
  - 8% mortality
- Antibiotics after one hour
  - 20% mortality

Bauer ME *et al.* Anesth Analg (2018)

CMQCC Toolkit

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TABLE 9. Proposed Empiric Antibiotic Coverage for Patients with Sepsis of Unknown Source (with End Organ Injury) or Septic Shock

Antibiotic Choices *Empiric coverage for sepsis of unknown source or for septic shock should include at least one antibiotic for Gram-negative and anaerobic coverage **PLUS** one for Gram-positive coverage*	Duration
Gram-negative plus anaerobic coverage Piperacillin/tazobactam 3.375 g IV q8h (extended infusion) or 4.5 g IV q6h **OR** Meropenem 1 g IV q8h (if recent hospitalization or concern for MDRO organisms) **OR** Cefepime 1-2g IV q8h plus metronidazole 500 mg IV q8h **OR** Aztreonam 2 g IV q8h (for women with severe penicillin allergy) Plus metronidazole 500 mg IV q8h **OR** Aztreonam 2g IV q8h plus clindamycin 900 mg IV q8h **PLUS** **Gram-positive coverage** Vancomycin 15-20 mg/kg q8h-q12h (goal trough 15-20 mcg/mL) **OR** Linezolid 600 mg IV/PO q12h (for women with severe vancomycin allergy)	7-10 days is adequate for most infections

Surviving Sepsis Campaign: International Guidelines for Management of Sepsis and Septic Shock 2021

Recommendations
12. For adults with possible septic shock or a high likelihood for sepsis, we **recommend** administering antimicrobials immediately, ideally within one hour of recognition.
Strong recommendation, low quality of evidence (septic shock)
Strong recommendation, very low quality of evidence (sepsis without shock)

Evans et al. *Critical Care Med* (2021)

Maternal Deaths Due to Sepsis in the State of Michigan, 1999–2006

Only 13% (2/15) patients received appropriate initial antibiotics

After ICU or ID consult, 67% (10/15) were appropriate for clinical situation

20% (3/15) did not live long enough for subsequent therapy
13% (2/15) appropriateness was unable to be determined

Bauer et al. *Obstet Gynecol* (2015)

Combination therapy

- *Clindamycin with β-lactams to inhibit exotoxin production*
  - Group A streptococcus (7-10% of cases)

Systems-based solutions

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- Automated dispensing system availability
- IV access
- Pharmacy
- Waiting for transport

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Fluid administration

Surviving Sepsis Campaign: International Guidelines for Management of Sepsis and Septic Shock 2021

5. For patients with sepsis induced hypoperfusion or septic shock we **suggest** that at least 30 mL/kg of IV crystalloid fluid should be given within the first 3 hours of resuscitation.

Weak recommendation, low-quality evidence.

7. For adults with sepsis or septic shock, we **suggest** guiding resuscitation to decrease serum lactate in patients with elevated lactate level, over not using serum lactate.

Weak recommendation, low-quality evidence.

Remarks:

During acute resuscitation, serum lactate level should be interpreted considering the clinical context and other causes of elevated lactate.

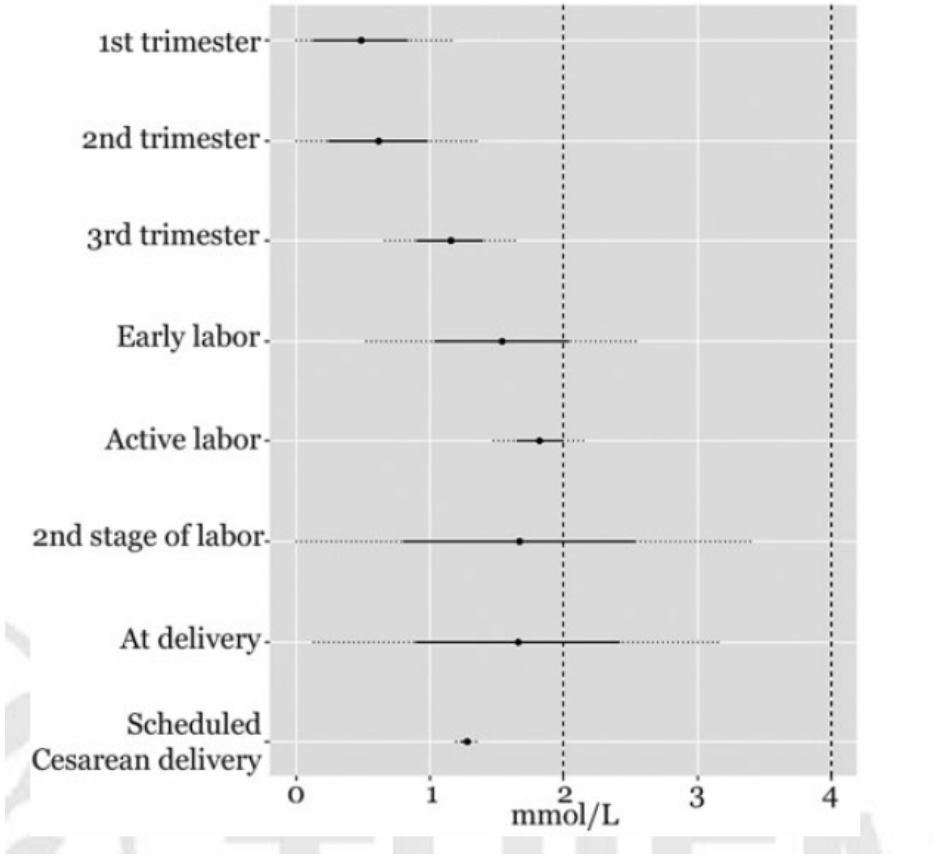
Evans et al. *Critical Care Med* (2021)

Normal Range for Maternal Lactic Acid during Pregnancy and Labor: A Systematic Review and Meta-Analysis of Observational Studies

- 22 studies
- 1,193 patients
- 2,008 observations

Bauer Am J Perinatol (2018)

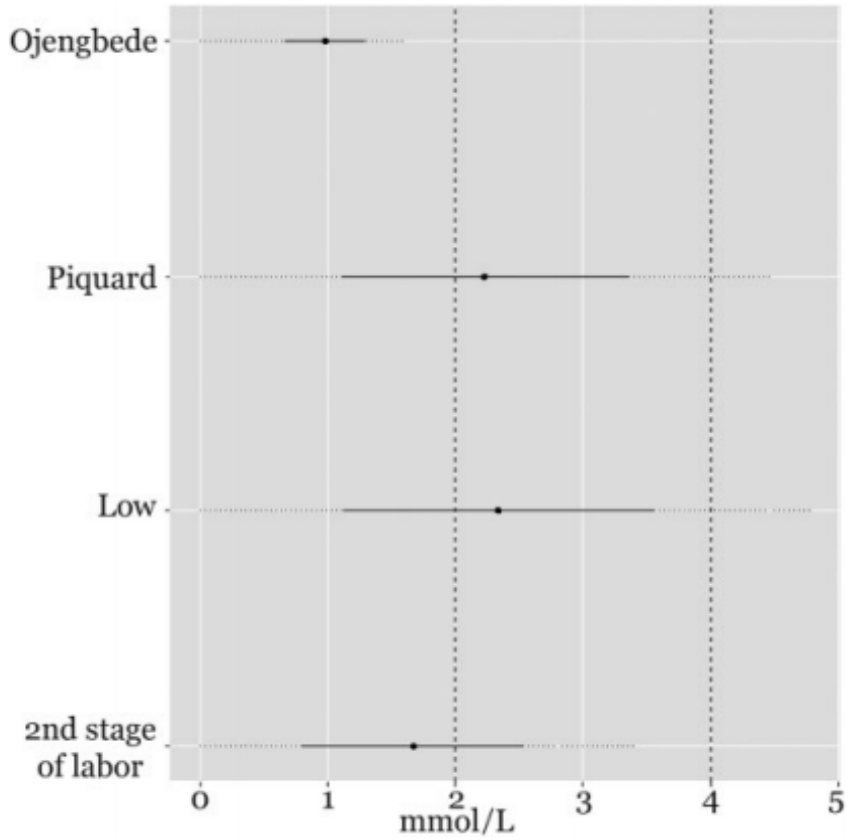
During Pregnancy



Outside of labor
<2 mmol/L

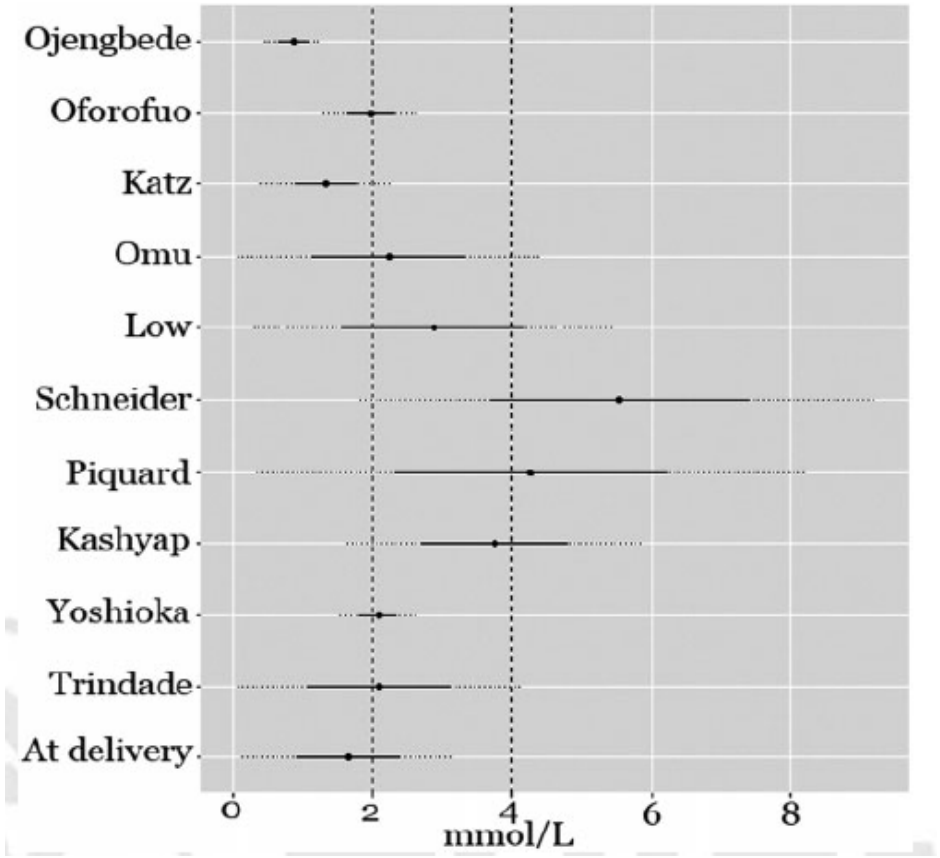
Bauer Am J Perinatol (2018)

2nd stage of Labor



Bauer Am J Perinatol (2018)

At Delivery



Should return back to
< 2 mmol/L
within 30- 60 minutes
After delivery

Bauer Am J Perinatol (2018)

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Escalation of Care

Sepsis in Obstetrics Score

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FIGURE 1
Sepsis in Obstetrics Score

Variable	High abnormal range				Normal	Low abnormal range			
Score	+4	+3	+2	+1	0	+1	+2	+3	+4
Temperature (°C)	>40.9	39-40.9		38.5-38.9	36-38.4	34-35.9	32-33.9	30-31.9	<30
Systolic Blood Pressure (mmHg)					>90		70-90		<70
Heart Rate (beats per minute)	>179	150-179	130-149	120-129	≤119				
Respiratory Rate (breaths per minute)	>49	35-49		25-34	12-24	10-11	6-9		≤5
SpO_2 (%)					≥92%	90-91%		85-89%	<85%
White Blood Cell Count (/μL)	>39.9		25-39.9	17-24.9	5.7-16.9	3-5.6	1-2.9		<1
% Immature Neutrophils			≥10%		<10%				
Lactic Acid (mmol/L)			≥4		<4				

Scoring template for S.O.S., a sepsis scoring system designed specifically for obstetric patients.

S.O.S., Sepsis in Obstetrics Score; SpO_2, blood oxygen saturation.

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

Albright *et al. AJOG* (2014)

Sepsis Calculator

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Sepsis Obstetrics Scoring System			
Temperature (Centigrade) (° C) 36 - 38.4 C (96.8 - 101.1 F)		SpO2% blood oxygen saturation >= 92%	
Systolic blood pressure (mmHg) > 90		White blood count uL 5.7 - 16.9	
Heart Rate (beats per minute) <=119		% Immature Neutrophils <10%	
Respiratory Rate (breaths per minute) 12 - 24		Lactic Acid (mmol/L) <4	

Calculate Sepsis Obstetrics Score (S.O.S)

http://perinatology.com/calculators/Sepsis%20Calculator.htm

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Provider Materials

The materials below are designed to support medical professionals with educating patients about the leading signs and symptoms of severe maternal events that could lead to complications and/or death. Materials are available to help providers communicate with patients about their condition.

Southeast Michigan Perinatal Quality Improvement Coalition (SEMPQIC)

Detroit Health Equity Education Resource

Escalation of care resource: Sepsis in Obstetrics Score Calculator

Action Items

- Recognition
  - Develop sepsis screening (prior lecture)
- Treatment
  - Work with pharmacy to obtain prompt antibiotics
  - Antibiotic selection
- Escalation of care
  - Have criteria for escalation of care

Thank you

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- Twitter: @MelissaEBauer1