



SEPSIS ALLIANCE<sup>®</sup>

*Suspect Sepsis. Save Lives.*

# Maternal Sepsis

## Speakers:



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Maternal Sepsis Survivor

# Maternal Sepsis Day May 15



**Pregnancy & Childbirth and Sepsis**

Maternal sepsis is a leading cause of pregnancy-related deaths in the United States.

What is maternal sepsis? It is a life-threatening condition defined as organ dysfunction resulting from infection during pregnancy, childbirth, post-abortion or miscarriage, or postpartum period. Early recognition of sepsis is key to saving mothers' lives.

**What to look out for if you are pregnant or recently gave birth:**

- Fever above 100.4 F
- Foul smelling discharge from the vagina or a wound
- Difficulty breathing or shortness of breath
- Chest pain
- Feeling confused or just "not right"
- Non-specific or general maternal pain that worsens, or gets much worse suddenly

**If you experience a combination of these symptoms, call 911, or seek emergency care and say, "I'm concerned about sepsis!"**

Watch out for urinary tract infections (UTIs) as they are a common cause of maternal sepsis.

**Risk Factors:**

You are at a greater risk of developing maternal sepsis if you have:	Or had:
<ul style="list-style-type: none"> <li>Diabetes</li> <li>Mastitis (inflammation and/or infection in the breast tissue)</li> <li>Viral or bacterial infection, such as a UTI</li> </ul> <p>*Obesity may also increase your risk of developing sepsis.</p>	<ul style="list-style-type: none"> <li>A cesarean section</li> <li>Phlebotomy or intravenous lines</li> <li>Thrombotic-related membranes</li> <li>Cervical conical ablation</li> <li>Perineal abscess (genital tract area from the vaginal canal)</li> <li>Organic surgery</li> <li>Miscarriage or induced abortion</li> <li>Unlaid or nonsterile care</li> </ul>

For more information, please visit [sepsis.org](http://sepsis.org)

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Maternal Sepsis infographic



## Maternal Sepsis Fact Sheet

**Definition:** Sepsis is the body's overwhelming and life-threatening response to infection, which can lead to tissue damage, organ failure, and death.

According to the World Health Organization **maternal sepsis** refers to sepsis that results from infection during pregnancy, childbirth, post-abortion, or postpartum period.<sup>1</sup>

**Who it Hurts:** While sepsis is an equal-opportunity killer, impacting the sick, the well, and people of all ages, some groups are more likely to be affected. These include very young children, older adults, and those with a weakened immune system.

**Prevention:** The risk of sepsis can be reduced by preventing or quickly identifying and managing infections. This includes practicing good hygiene, staying current with vaccinations, and seeking treatment when infections are suspected.

**Treatment:** Sepsis is a medical emergency that requires urgent attention and rapid treatment for survival. Sepsis can be treated and, in many instances, lives are saved by using existing and proven protocols.

**Recovery:** Many individuals fully recover from sepsis, while others may have long-lasting effects, such as amputations or organ dysfunction, like kidney failure. Other after-effects of sepsis are less obvious, such as memory loss, anxiety, or depression.

Maternal Sepsis Fact Sheet



Dr Katarina Lannér-Cusin  
Lori Olvera DNP

**Maternal Sepsis**



Megan died  
of SEPTIC  
SHOCK while  
in Labor..



LeeAnna  
Septic Shock  
Survivor.....

# History of Sepsis and the Perinatal Population

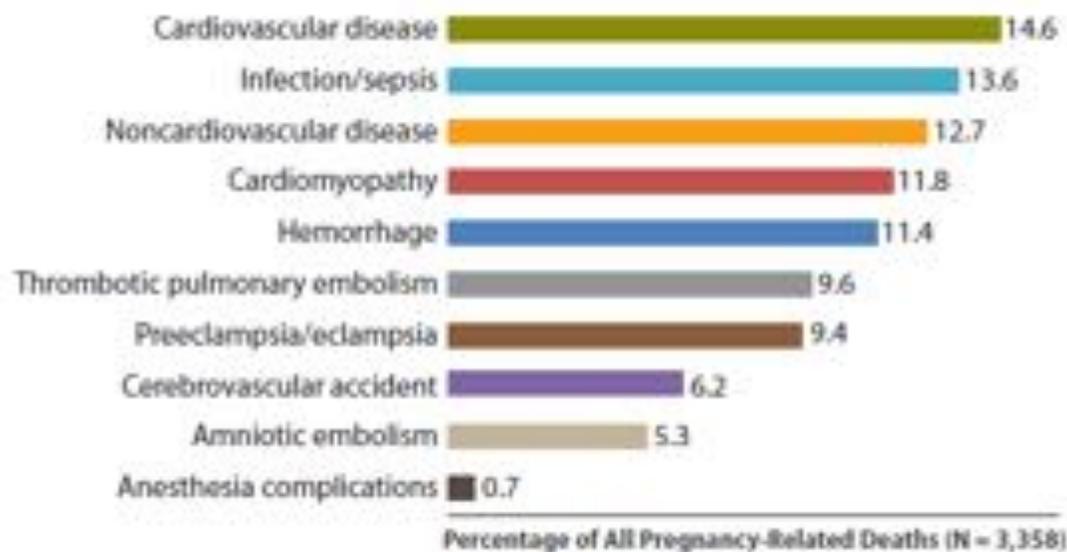
2001 Rivers Study

2004 Sepsis Guidelines

The Perinatal Population

CMS Measure

Causes of Pregnancy-Related Death in the United States, 2006-2010



Notes: The cause of death is unknown for 4.7% of all pregnancy-related deaths. "Noncardiovascular disease" refers to endocrine, hematologic, immunologic, and renal conditions.

[www.cdc.gov](http://www.cdc.gov)

Rivers, E. et al.(2001). Early goal-directed therapy in the treatment of severe sepsis and septic shock. *The New England Journal of Medicine*

# Maternal Deaths in Michigan



## Method

Retrospective reviews of maternal deaths in Michigan

## Results

- **15%** of deaths due to maternal sepsis (22/151)
- Of **22** deaths, **13** women presented to hospital with sepsis, **two** developed sepsis while in hospital, and **seven** developed sepsis at home without admission to hospital
- Hospital Records (15): **73%** revealed delays in initial appropriate ABX treatment
- **53%**-delay in escalation of care!

## **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”**

**Barton & Sibai (2012). Severe Sepsis & Septic Shock in Pregnancy.  
*Obstetrics & Gynecology***



# What do we know about SEPSIS?



- Pregnant women are more **vulnerable** to **infection** and susceptible to serious complications
- Clinical signs may be insidious and patient appear deceptively well before rapidly deteriorating
- Early detection of sepsis is essential for best outcomes for the mother and her baby
- Septic patients, if left untreated, may progress to develop septic shock, multi-organ failure and death

## **FACTS:**



- **50% of deaths from sepsis are related to Group A streptococcus**
- **E.Coli is the most common cause of maternal bacterial infection**
- **Sepsis can occur anytime during pregnancy and often associated with a delay in diagnosis**
- **The normal physiological changes may mask early signs of sepsis**
- **Maternal sepsis with or without hemodynamic instability may present with fetal distress as the uteroplacental circulation is not auto-regulated**
- **Consideration for treatment options has to be given to the impact of the condition as well as the effect on the fetus**

# Sepsis 3 Definition



## **SEPSIS:**

**Currently no gold standard diagnostic test exists to confirm the presence of sepsis**

**Broadly defined as life-threatening organ dysfunction caused by a dysregulated host response to infection**

## **SEPTIC SHOCK:**

**Subset of sepsis with circulatory and cellular/metabolic dysfunction associated with higher risk of mortality**

# Pregnancy and Sepsis

## Incidence:

- **Septic Shock is rare in pregnancy 0.002-0.01%**
  - **Of all septic patients, 0.3-0.6% are pregnant**
- **Overall increase in severe sepsis and septic shock due to changes in demographics of pregnant women:**
  - **Advanced maternal age**
  - **Obesity**
  - **Diabetes**
  - **Placental abruption**
  - **Placental abnormalities**
  - **Assisted Reproductive Technology (ART)**
  - **Emerging Infections Diseases**

# Risk Factors



## Antepartum

- Obesity
- Lack of PNC
- Anemia
- Impaired immunity
- Hx of group B colonization or infection
- Invasive procedures, Multiple Gestation
- Diabetes/CHTN
- Use of ABX 2 weeks prior to presentation

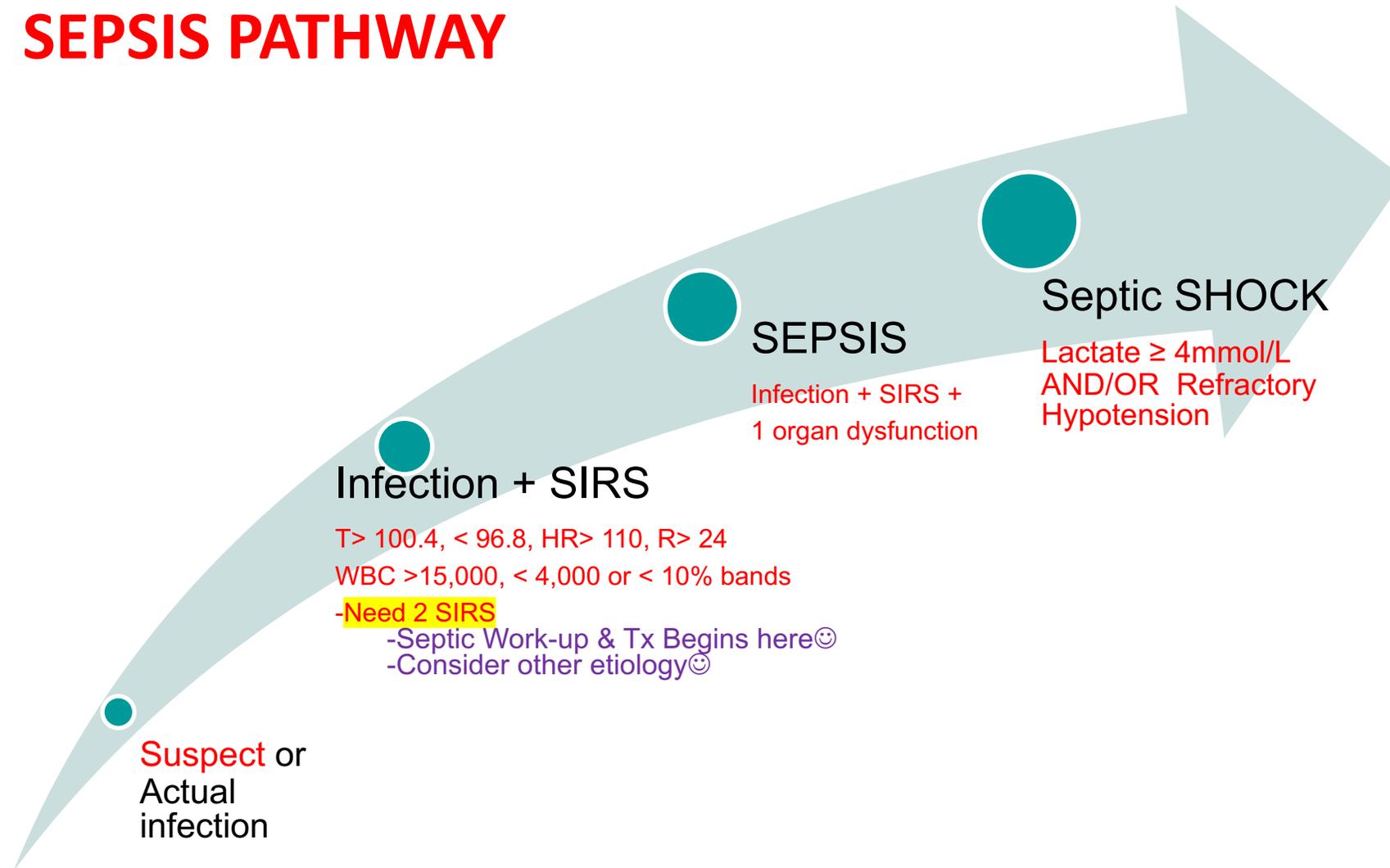
## Intrapartum

- Protracted Active Labor especially in nulliparous
- Prolonged ROM
- More than 5 vaginal exams
- Perineal manipulation during the 2<sup>nd</sup> stage of labor
- Instrumentation
- Unscheduled C/S

## Postpartum

- Retained placental fragments
- Cracked nipples
- Operative delivery
- C/S delivery
- Failure to recognize severity

# SEPSIS PATHWAY



# Suspected or documented Infection



**Chorioamnionitis**

**Pyelonephritis  
UTI**

**Endomyometritis**

**Pneumonia**

**Other:  
Necrotizing fasciitis  
Unknown**

# The Source of Infection in Perinatal Patients Diagnosed with *Sepsis* during Pregnancy



**Sutter Medical Center Sacramento  
April 2014-January 2015**

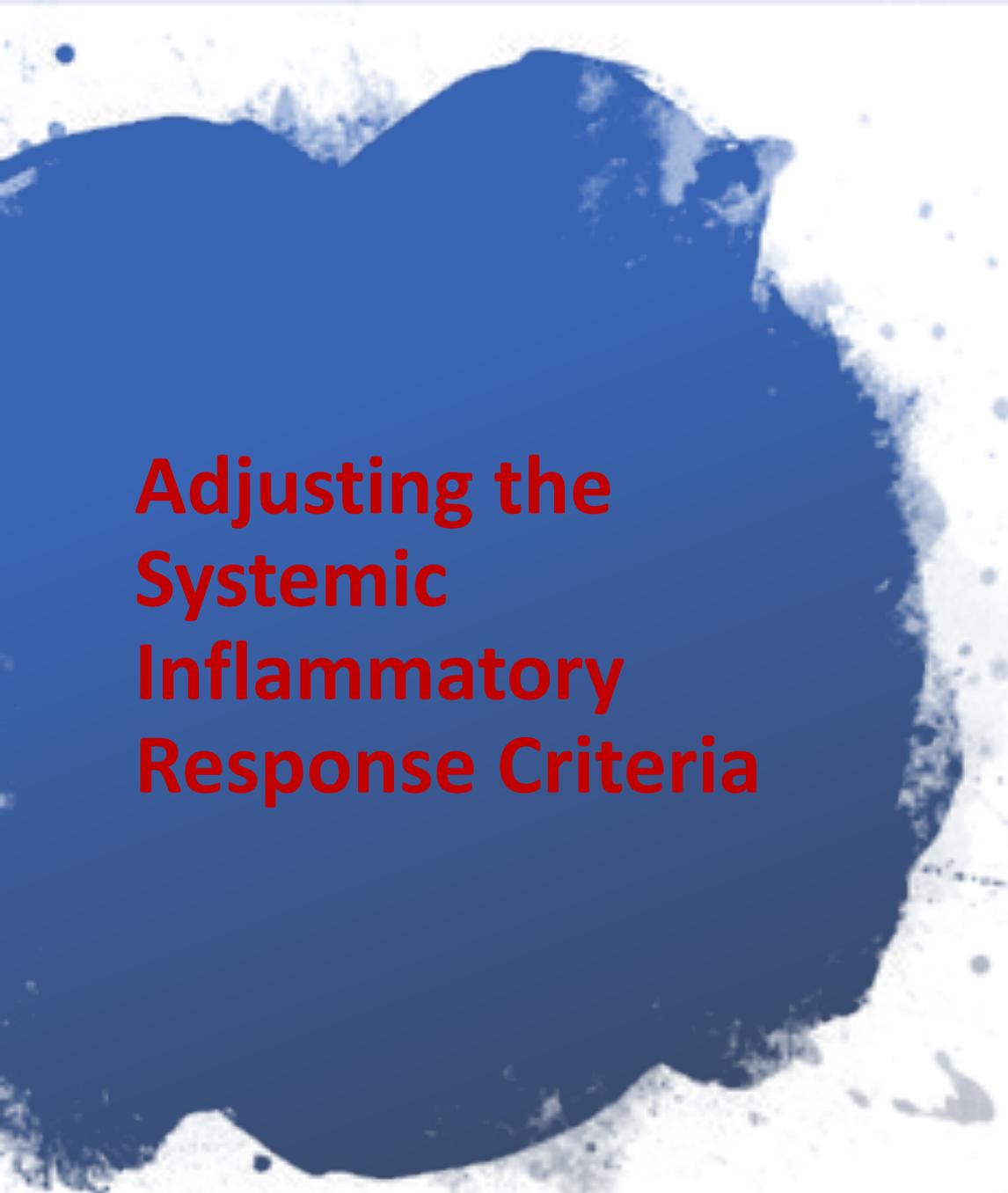
	<b>Frequency (N=99)</b>	<b>Percent</b>
<b>Chorioamnionitis</b>	<b>45</b>	<b>46.4 %</b>
<b>Pyelonephritis</b>	<b>14</b>	<b>14.4 %</b>
<b>Endometritis</b>	<b>5</b>	<b>5.2 %</b>
<b>Urinary Tract Infection</b>	<b>5</b>	<b>5.2 %</b>
<b>Unknown</b>	<b>29</b>	<b>29 %</b>



# **Systemic Inflammatory Response**

## **Definition**

**A clinical manifestation resulting from an insult, infection, or trauma, that includes a body-wide activation of immune and inflammatory cascades**



## **Adjusting the Systemic Inflammatory Response Criteria**

**Because of the physiology of pregnancy, the screening criteria was adjusted for perinatal population**

- **Increase in blood volume increases maternal heart rate by 10-20 bpm**
- **Minute volume (RR x Tidal Volume) increases 50% due to an increase in respiratory rate and tidal volume**
- **The position of the diaphragm decreases lung volume and increases the respiratory rate**
- **Increase in WBC (leukocytosis) in labor and immediate postpartum**
- **Increase in perfusion to the kidneys causes a decrease in the creatinine level**

# Sepsis 1 Screening Criteria



## SEPSIS 1 Screen

- Suspected source of clinical infection
- Two or more SIRS Criteria
  - Temp  $>38.3$  C/ $101$  F or  $< 36$  C  
 $96.8$  F
  - HR  $>90$ /min
  - RR  $>20$  breath/min
  - WBC  $> 12,000$  mm<sup>3</sup> or  $< 4,000$  mm<sup>3</sup> or  $> 10\%$  bands

93% Sensitivity  
63% Specificity

## Center for Medicaid and Medicare Services OB Screen

- Suspected or known infection
- Two or more SIRS Criteria
  - Temp  $\geq 38$  C/ $101.4$  F or  $<36$  C/ $96.8$  F
  - HR  $>110$ /min
  - RR  $>24$  breaths/min
  - WBC  $> 15,000$  mm<sup>3</sup> or  $< 4,000$  mm<sup>3</sup> or  $> 10\%$  immature neutrophils (bands)
  - Altered Mental Status

# Organ Dysfunction Assessment



## SEPSIS 1 Values

- SBP < 90 mmHg, or more than 40 mmHg below baseline -OR- MAP < 65 mmHg
- Acute respiratory failure evidenced by a new need for invasive or non-invasive mechanical ventilation
- Cr  $\geq$  2 mg/dL or UO < 0.5 ml/kg/hour for 2 hours (excludes ESRD)
- Bili > 2
- Platelet count < 100,000
- INR > 1.5 or PTT > 60 (excludes anticoagulation)
- Lactate > 2

## Sutter OB Values

- SBP < 90 mmHg or 40 mmHg below base line -OR- MAP < 65 mmHg
- Increased O<sub>2</sub> requirements to maintain SpO<sub>2</sub> > 92%
- Creatinine > 1.5 -OR- UO  $\leq$  30 ml/hour for 2 hours
- Altered mental status
- Bili > 2
- Platelet Count < 100,000
- INR > 1.5 or PTT > 60 seconds
- Lactate > 2

# System Comparisons

	Surviving Sepsis Campaign	Sutter Health	Dignity	Kaiser	UC Davis
<b>Temperature</b>	> 38 (100.4) or < 36C (96.8F)	> 38 (100.4) or < 36C (96.8F)	> 38 (100.4) or < 36C (96.8F)	> 38 (100.4) or < 36C (96.8F)	> 38 (100.4) or < 36C (96.8F)
<b>Maternal Heart Rate</b>	> 90 BPM	> 110 BPM	> 110 BPM (Excluding during pushing)	> 110 BPM	> 110 BPM
<b>Respiratory Rate</b>	> 20 BPM	> 24 BPM	> 24 BPM	> 24 BPM	> 24 BPM
<b>White Blood Count</b>	> 12,000, < 4,000, > 10% Bands	> 15,000, < 4000 or > 10% Bands	> 15,000, < 4000 or > 10% Bands with normal CBC	> 15,000, < 4000 or > 10% Bands	> 15,000, < 4000 or > 10% Bands
<b>Altered Mental Status</b>	AMS Present	AMS present	Confusion, Agitation, Combativeness	AMS present	N/A
<b>Glucose</b>	> 140 in absence of DM	> 140 in absence of DM	> 140 in absence of DM	N/A	N/A
<b>Fetal Tachycardia</b>	N/A	N/A	FHR > 160 bpm (gest age > 20 wks)	> 160 BPM X 10 minutes	N/A

# Septic Shock-Defined.....



- Suspected infection
- Hypotension (systolic blood pressure < 90 mmHg or MAP < 65 mmHg) unresponsive to 30 ml/kg fluid bolus **-and/or-**
- Lactate  $\geq 4$

**Sepsis, Severe Sepsis and Septic Shock  
Sutter Medical Center Sacramento  
April 2014-January 2015**



	<u>Observation</u>		<u>Observation</u>
Sepsis Screen Positive	<b>0.024%</b> <b>(99/4000)</b>	Sepsis Screen Positive, confirmed	<b>98%</b> <b>(97/99)</b>
Severe Sepsis	<b>0.012%</b> <b>(47/4000)</b>	Severe Sepsis Screen Positive	<b>48.5%</b> <b>(47/97)</b>
Septic Shock	<b>0.002%</b> <b>(7/4000)</b>	Septic Shock Screen Positive	<b>7.2%</b> <b>(7/97)</b>

# SURVIVING SEPSIS CAMPAIGN



## Bundles

Elements when used together, improve outcomes more than when used separately!

Evidence based



# Severe Sepsis Bundle: TO BE COMPLETED WITHIN 3 HOURS



**Goal= 1 hour**

**Time zero = time of confirmed positive sepsis screen**

- Measure lactate level
- Obtain blood cultures **prior** to administration of antibiotics
- Administer broad spectrum antibiotic(s)
- Administer 30 mL/Kg crystalloid for hypotension **or lactate  $\geq 4$ mmol/L**

CMS GUIDELINES

# Treatment

Shock- Goal < 6 hours



- **Fluid resuscitation (if not already completed)**
- **Vasopressors for hypotension**
- **Focused exam or Tissue Perfusion assessment**
  - **CVP**
  - **Central venous oxygen measurement**
  - **Bedside CV ultrasound**
  - **Passive leg raise or fluid challenge**

CMS GUIDELINES

# Identify Risk of Morbidity from Sepsis in Pregnancy



This study assessed risk of morbidity associated with maternal lactic acid in women with possible sepsis in pregnancy

- **Design**: Retrospective cohort of pregnant and postpartum patients with signs of sepsis (159 had lactic measured out of 850 women)
- **Conclusion**: Elevated lactic Acid in pregnancy is associated with adverse maternal outcomes from presumed sepsis. In this cohort, lactic acid measurement was a marker of a more severe infection

**American Journal of Perinatology. Albright, Ali, Lopes, Rouse, and Anderson, 2014**

# MORTALITY RATE INCREASES WITH DELAY OF ADMINISTRATION OF ANTIBIOTICS



The mortality rate for those who received antibiotics within 1 hour of diagnosis was 8.3%. The mortality rate was 20% for the patient who received antibiotics after > 1 hour



Common organisms were E. coli (14.6%), Gram-negative rods (9.8%), and group Strep A (7.3%)



Antibiotics are selected according to the source of infection



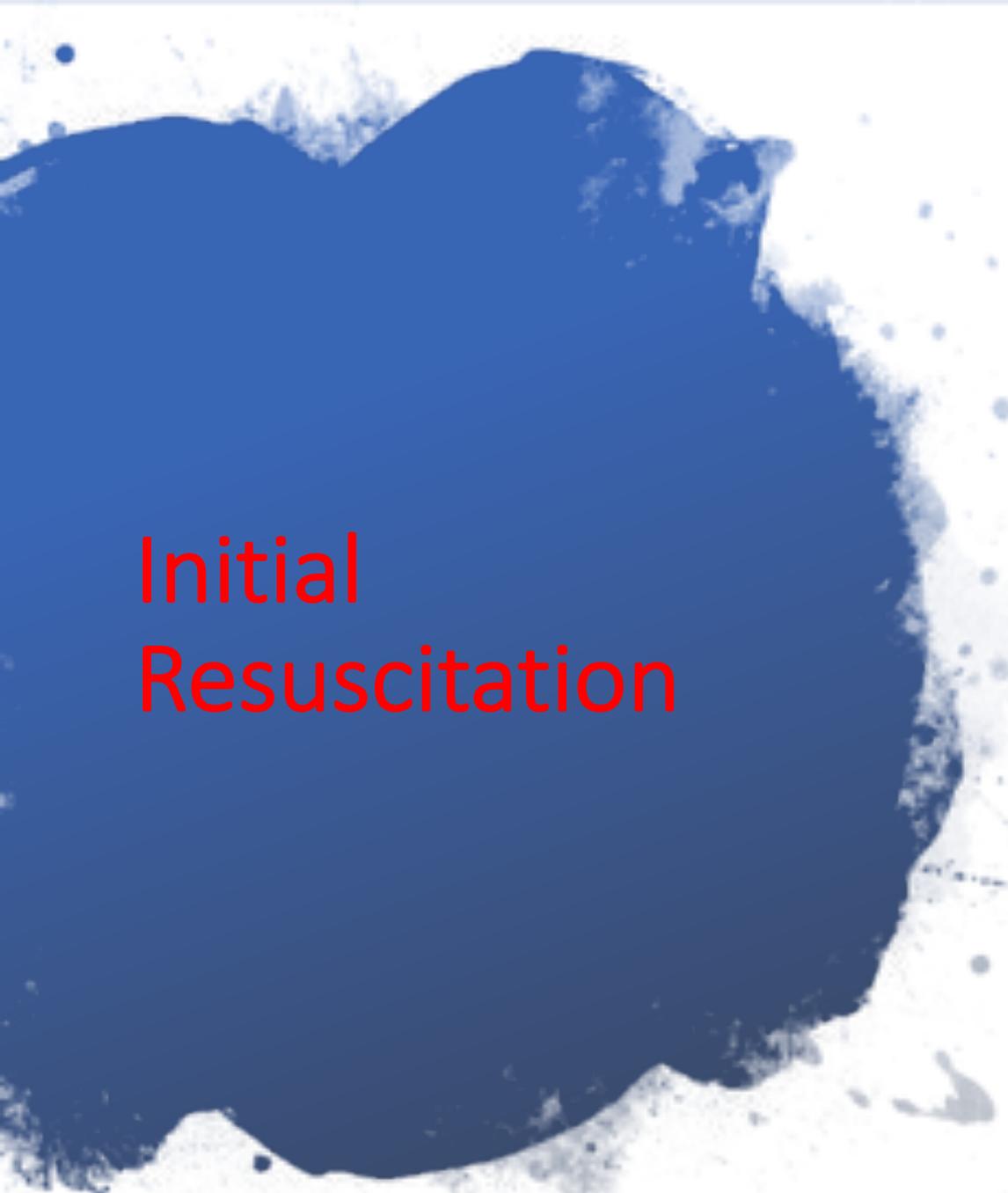
Source control is a priority and may involve abscess drainage or delivery of the fetus



For unknown source, use ANTIBIOTICS with broad spectrum coverage



De-escalate to appropriate ANTIBIOTICS when source is identified



# Initial Resuscitation

- **We recommend that in the resuscitation from sepsis-induced hypoperfusion, at least 30ml/kg of intravenous crystalloid fluid be given within the first 3 hours.**

(Strong recommendation; low quality of evidence)

- **We recommend that following initial fluid resuscitation, additional fluids be guided by frequent reassessment of hemodynamic status.**

(Best Practice Statement)

# Viral Conditions-Influenza



Tamiflu 75 mg PO BID X 5 days

Low rate of transplacental transfer

In the setting of H1N1, early antiviral therapy in pregnant women is associated with 84% reduction in admissions to ICU

Yates, Pierce, Stephens, et al(2010). Health Technol Assess

# Non-Invasive Cardiac Output Monitoring?



 Non-invasive Cardiac Output Monitoring

 Is used to obtain hemodynamic values *without* an invasive line

 Measures stroke volume index and cardiac output

 Is used to objectively guide fluid resuscitation

 Meets criteria for Reassessment of Perfusion per CMS guidelines for sepsis (6 hour bundle element)

# How can you use Non-Invasive Cardiac Output Monitoring on perinatal units?



Most often, ED, ICU and RRT nurses are trained to use the Non-Invasive cardiac Output Monitoring

In your unit, you might see RRT bring the monitor and perform a dynamic assessment on your septic OB patient

This is done if there is a concern for giving the initial full 30ml/kg bolus  
-or-

If the patient has received the initial 30ml/kg bolus and there is a continued perfusion issue (i.e. BP, lactates)

RRT will document, interpret and relay the results to the physician to discuss additional orders, if needed

# Maternal Sepsis Pathway

Screen in triage, upon admission, every shift (within first 2 hours of shift) and PRN suspected infection  
Document in OB Sepsis Summary Flowsheet.



Sepsis Screening  
Increased Surveillance  
Escalate Care

- OB Screening Criteria**
- Temp > 100.4°F (38°C) **OR** Temp < 96.8°F (36°C)
  - HR > 110
  - RR > 24
  - WBC > 15,000
  - WBC < 4,000 **OR** > 10% bands (CBC differential)

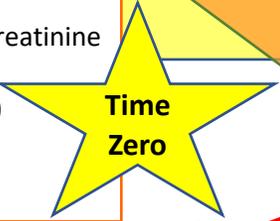
2 or more positive **OB SCREENING** Criteria **AND** **SUSPECTED** source of infection\*  
= dx of **AT RISK FOR SEPSIS**

- INTERVENTIONS for 1<sup>st</sup> HOUR**
- Notify RRT and OB provider
  - Draw Lactate, CBC, CMP, PT, PTT\*\*
  - Blood Cultures X2 (before ABX)\*\*
  - MD eval/bedside assessment
  - Give broad spectrum antibiotic\*\*
  - Implement pulse oximetry, strict I/O
  - Chest XRAY (if suspected lung infection)
  - Collect UA if suspect urinary source of infection
  - Vital Signs Q30 x2, Q1Hx2, Q2 x2, then Q4H
  - Give 1 liter of NS/LR
  - Mental status assessment

- ACUTE ORGAN DYSFUNCTION EVALUATION**  
Evaluate for 1 or more **ACUTE ORGAN DYSFUNCTION** Criteria due to infection
- Lactate ≥ 2 mmol/L
  - Oxygen Sat < 92%
  - SBP < 90 mmHG<sup>o</sup> or MAP < 65
  - SBP decrease < 40mmHG from baseline
  - Urine output ≤ 30 ml/hr for 2 hours
  - Creatinine ≥ 1.2 mg/dL **OR** doubling of creatinine
  - Platelet count < 100,000
  - Coagulopathy (INR > 1.5 or PTT > 60 sec)
  - Agitation, confusion, unresponsiveness
  - Bilirubin > 2mg/dL

**SEPSIS + 1 or more** positive acute organ dysfunction  
= dx of **SEPSIS**

- SEPSIS INTERVENTIONS**
- Consider IV Fluids N/S or LR 30 mL/kg; each liter over 60 min (Lactate 2-3.9)
  - Blood Cultures (if not previously drawn)
  - Repeat lactate every 3 hours until lactate < 2 mmol/L
  - SpO2 per protocol, titrate oxygen to ≥ 92%
  - Consult with RRT
  - MD eval/bedside assessment
  - Vital signs Q30 x2, Q1H x2, Q2x2, then Q4h



- SEPTIC SHOCK CRITERIA**  
Evaluate for **SEPTIC SHOCK** Criteria
- Lactate ≥4 mmol/L **OR**
  - BP Systolic < 90, MAP < 65 despite fluid resuscitation
  - Clinical features are the same as **SEPSIS**

- SEPTIC SHOCK INTERVENTIONS**
- MD eval/bedside assessment/escalation of care
  - RN- Call RRT
  - Broad spectrum antibiotic
  - RRT/ICU MD determine if ICU admission required
  - IV fluids NS or LR bolus 30ml/kg NOW for lactate ≥ 4 mmol/L or hypotensive (if not previously done)  
Use pressure bag
  - Vital signs q 30 min

- \*Consider source of infection**
- Chorio
  - Endometritis
  - Pneumonia
  - Intrauterine Fetal Demise
  - Pyelonephritis
  - UTI
  - Other

**\*Notes for OB provider:**

- Add "Sepsis" to problem list.

**Lactate in labor**

- Not used in diagnosis of SEPSIS
- Used to trend, give fluids, & closely monitor

# Sara's Sepsis



- 25 year-old prime
- GBS negative, no risk factors
- Admitted for labor-4cm, SROM-clear fluid

# Sara's Sepsis

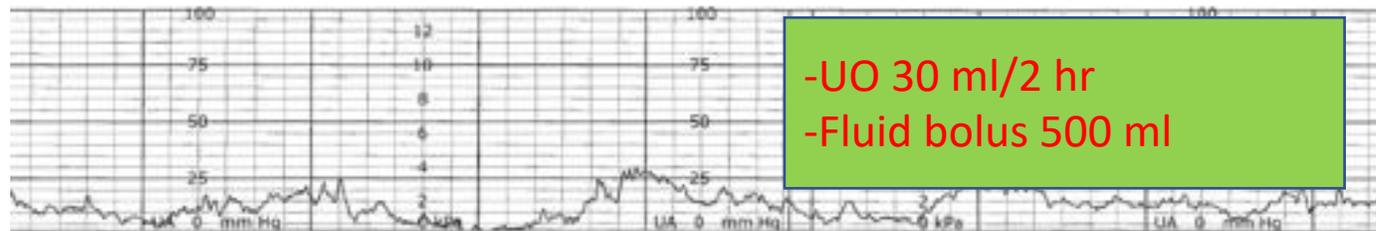
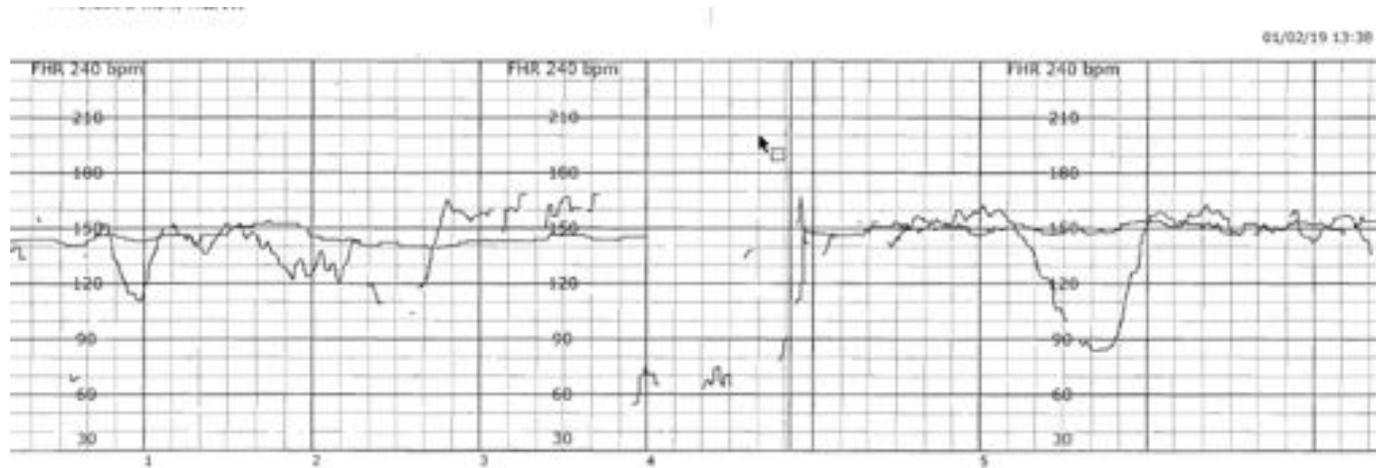


Time	VS	Labor	Treatments/labs/meds	Notes
1106	100.4, 112, 22, 101/56 <b>(NOTE: +Sepsis Screen)</b>	FHR 160, min var., cat2, SVE 8 cm epidural	Lactate 2.4 WBC 22.4 Tylenol 1000mg IV NS 1000ml Cefoxitin	MD refuses additional labs and RRT
1200	HR-126, 111/56, 22	FHR 150, mod, accels, var, UC 14/30, mod SVE 9cm	Pitocin started- 8cm	MD at bs

# Let's look at the baby's response..

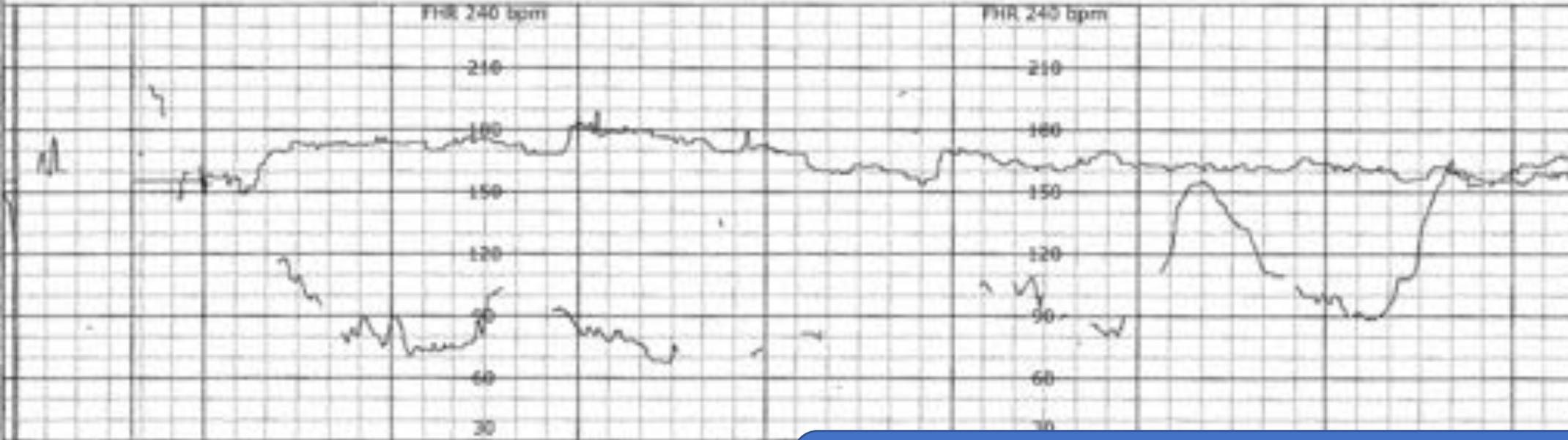


**T- 101.8,  
BP-118/53, RR-26  
-SVE 10cm  
-FSE, Pitocin off  
Oxygen @10L  
mask continuously**

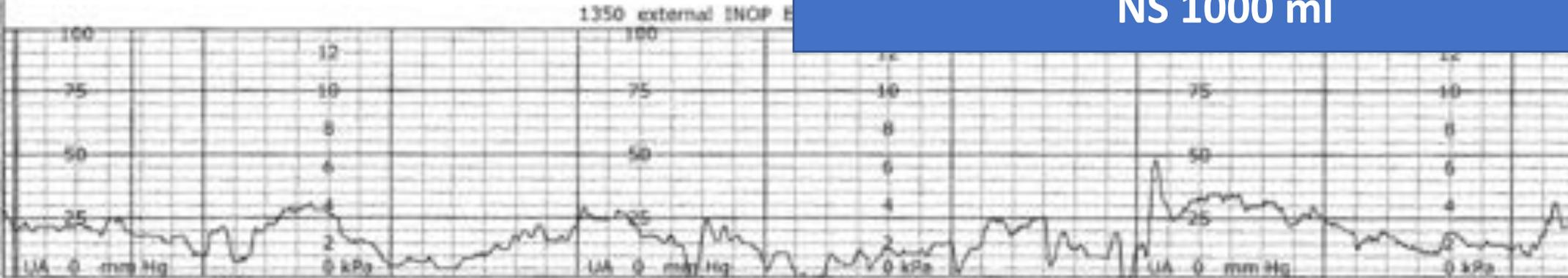


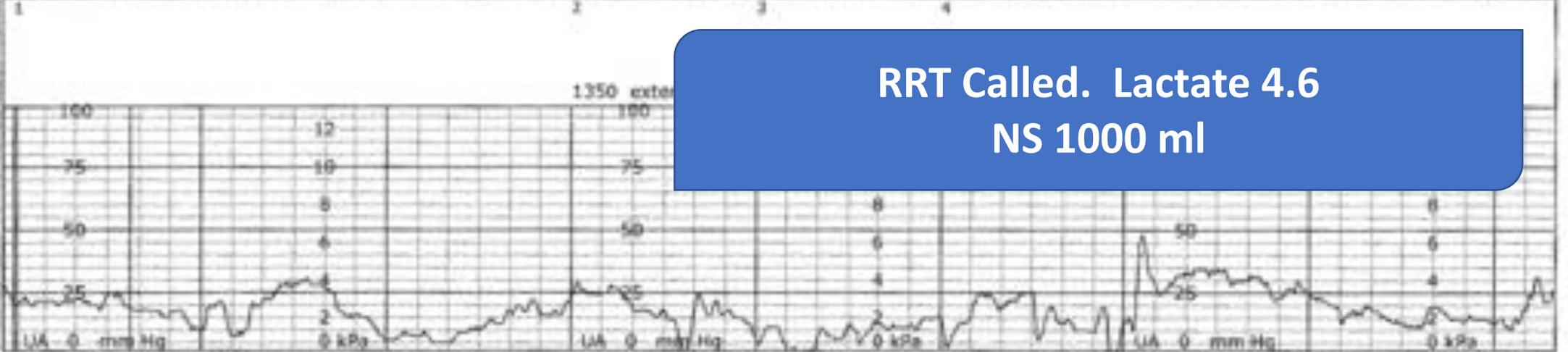
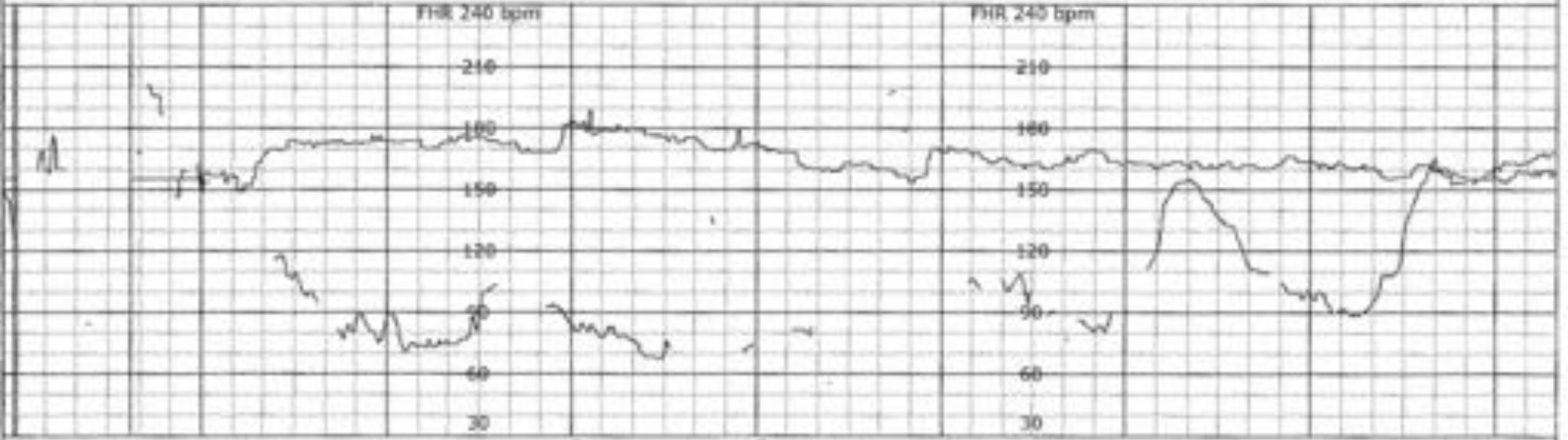
**-UO 30 ml/2 hr  
-Fluid bolus 500 ml**

**MD &  
CHARGE RN  
AWARE**



**RRT Called- Lactate 4.6  
NS 1000 ml**

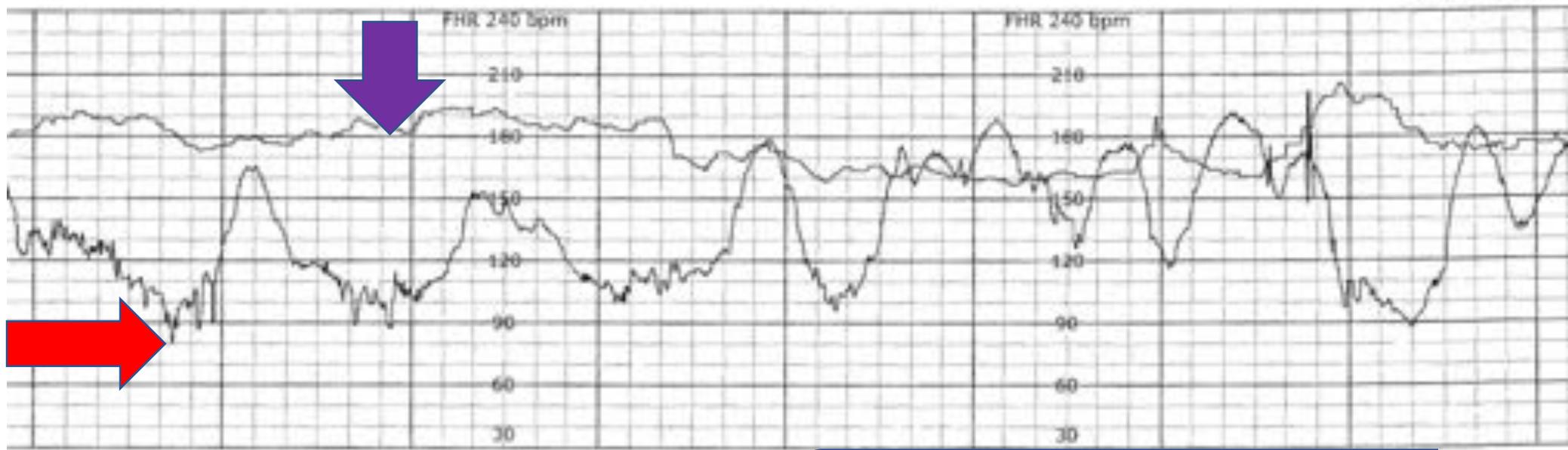




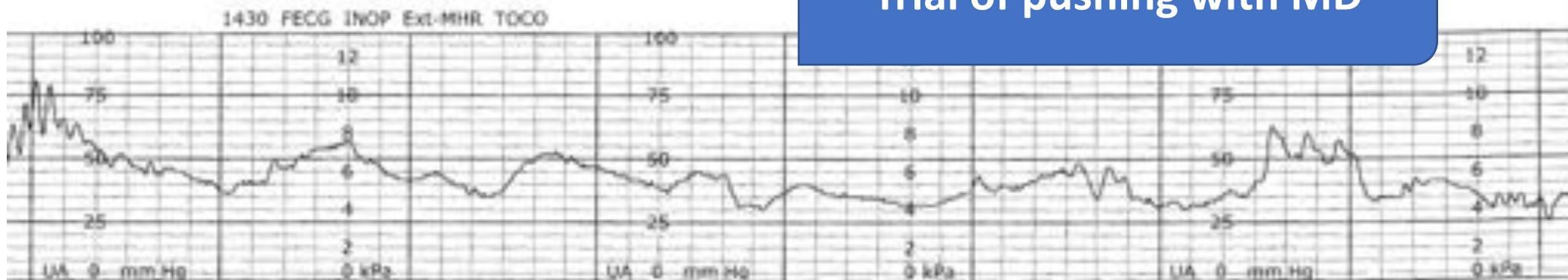
**RRT Called. Lactate 4.6  
NS 1000 ml**

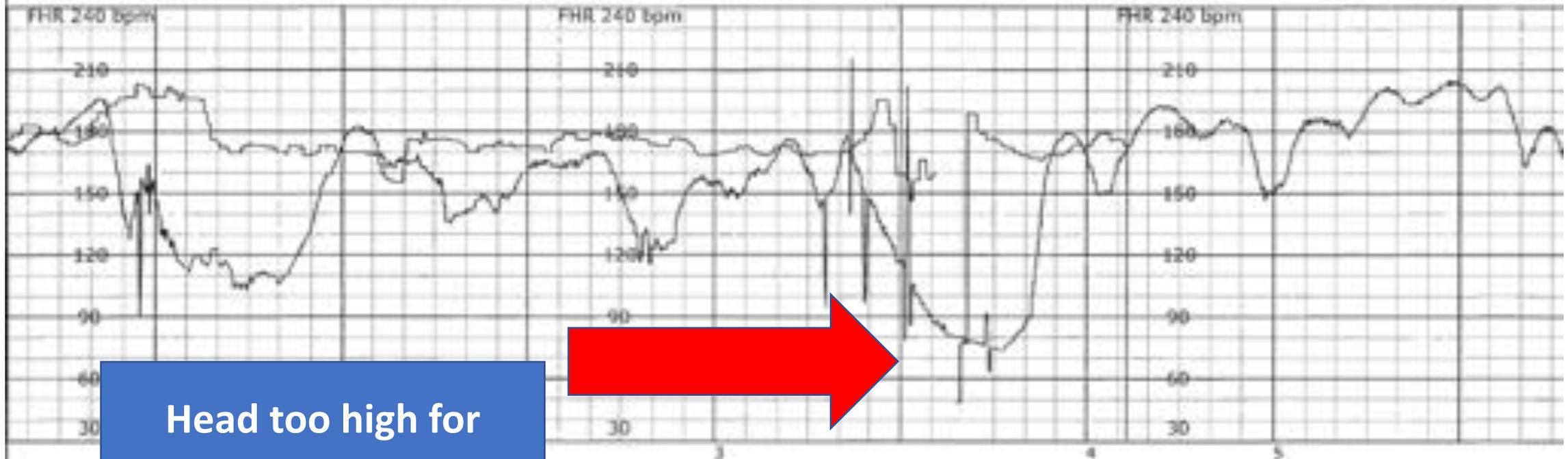
# Sinusoidal?? Mom vs. Baby's heart rate?



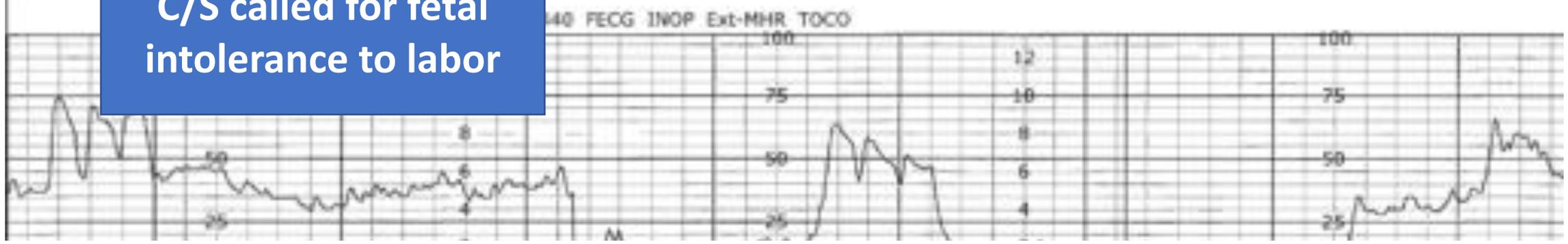


**Trial of pushing with MD**

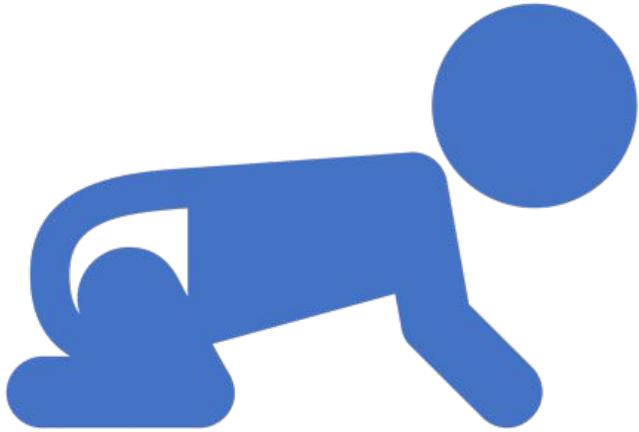




**Head too high for vacuum  
C/S called for fetal intolerance to labor**



# Baby Condition



- Outcome Baby: Apgars 4/7,
- Venous Cord Gas: pH 6.9
- NICU; abnormal neuro;  
admitted to NICU for  
Encephalopathy workup

# In the PACU

Time	Vitals	Treatments	Notes
1531	T-101.7, HR-166, BP-103/56, RR-22, O2 sat-92%	RRT called, O2 placed at 5L per mask, NS bolus 2100ml	Lactate 3.3; altered mental status Pt thought her nurses were dog-walkers!!! WBC 15.6 (later increased to 30.2) Blood cultures drawn; RRT stayed at bedside; Amniotic fluid was cloudy and foul-smelling
1700	T-102.9, 134, 89/55 (67), RR-34, O2 sat 95%	Cefoxitin and clindamycin given	ICU MD at bedside to arrange transfer to ICU/assessment
1800	HR-131, 85/45(58), 95%	NICOM was done- indicated patient was fluid responsive	. Blood cultures WERE POSITIVE FOR GROUP B STREPTOCOCCUS
1830	Transferred to ICU	Hypotensive, tachycardic with altered mental status	

# Let's Begin the Campaign to promote Early Recognition and Management of Maternal Sepsis



Think  
**Sepsis.**  
Save a  
**Life.**

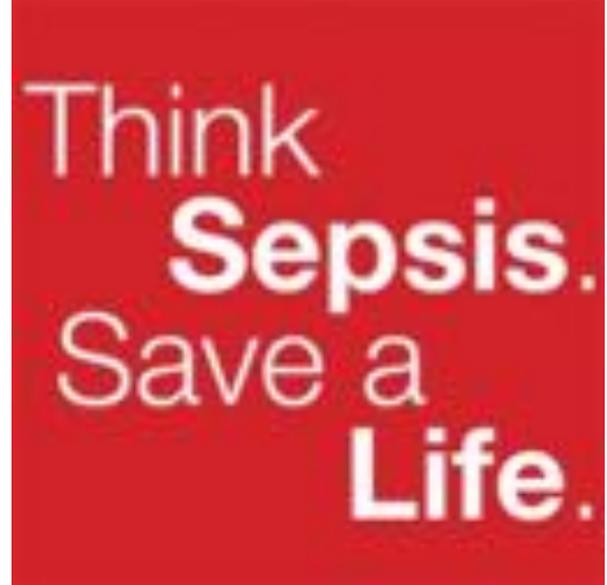
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Graciela: "I believe that we experience moments in our lives that define who we will become. For me, that moment happened when I coded 5 days after my C-Section from septic shock."



# Any Questions?



Think  
**Sepsis.**  
Save a  
**Life.**



# Sepsis: Across the Continuum of Care

## Webinar series

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