Maternal Sepsis

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Disclosures

- I have no disclosure related to the subject matter of Sepsis
- I am the Principal Investigator for a grant from HRSA to expand the focus on Obstetrical complications and Social determinants in Kentucky that impact pregnant women including sepsis.

Objectives

- To thank the KHA for the work you do and for opportunity to work with you on improving Maternal outcomes across the state
- To describe the KY MMM TF and its activities specifically related to Sepsis
- To define why Sepsis is unique in pregnancy
- To describe the opportunity for Protocol development for pregnant patients regarding Sepsis
- To describe probable future programming related to Sepsis and other opportunities for KHA members to improve Maternal Health across KY

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Ky MMM TF

- Attempts to respond to the KY Maternal Mortality Review Committee (KY MMRC) Recommendations for system concerns related to detailed root cause analysis of maternal mortality
- Addresses key concerns leading to adverse outcomes in pregnancy across KY
  - Two arms with 12 committees focusing on Women's health
    - Obstetrical Complications (OB arm-5 committees)
      - Sepsis – Dr. Maureen Marra as the new Chair of that Committee
      - Hypertensive Disorders in Pregnancy – Blue Band Project
      - Hemorrhage Work Group
      - Cardiac Conditions
      - Cesarean Delivery
    - Social Drivers of Health in Pregnancy (SDOH arm, spearheaded by C. White, MD, 7 committees)
      - Mental Health
      - Substance Use
      - Postpartum transitions
      - Others
- Focuses on AIM Bundles of Care
  - AIM Bundles are developed by HRSA in collaboration with ACOG
  - Provide simulation for pregnancy related adverse outcomes
  - Help to Provide Protocols for specific disease states in pregnancy and toolkits

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KY MMM TF, its Place…

- **KY MMRC** – Select Committee supported by action of the KY legislature, federally funded. Details structural concerns related to Maternal Mortality outcomes and provides recommendations.
  - In Ky, 85-90% of maternal mortalities are preventable.
- **KY PQC** – A collaborative which expands health initiatives working primarily between state government and hospitals. Ky PQC work includes a Substance Use initiative to increase screening, AIM bundle expansion, increased Mental Health screening and referral particularly postpartum, and others.
- **KY MMM TF** – An expansive all-comers approach open to anyone interested in improving outcomes for pregnant patients in our state who desire to make pregnancy and postpartum safer. We focus on severe morbidities in addition to maternal mortality. We provide a voice for community groups, patients with lived experience, hospitals, health care providers….anyone interested in addressing needs to improve maternal outcomes is welcome to engage their PASSION!

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KHA and Maternal Morbidity and Mortality

- Plays a VITAL role
- Advocacy for KY Moms
- Engaging with Hospital programs focused on Maternal Health
- Data collection and dissemination

- Improving population health in KY will come with the assistance of the KHA

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Maternal Health as a Key Metric for Population Health

- The Maternal Mortality Rate has historically been utilized as a key comparator of outcomes across states in the US and between countries
- Describes outcomes for a highly valued adult subpopulation
- Reflects coordination and care for complex unique clinical difficulties
  - Pre-eclampsia and its unique pathophysiology
  - Medical Diseases in Pregnancy such as Sepsis and how care differs from other adult populations considering both maternal and fetal concerns

KY Maternal Mortality Rate

- Sadly, one of the 5 states in the US with the highest rate when calculated within pregnancy or up to 1 year of post-pregnancy

- Between 2018-2022, 6th highest rate at 34.6 per 100,000 births: 91 deaths. (Within pregnancy or 42 days post-pregnancy)

- 75-85% of KY Maternal Mortalities are Related to the BIG 3
  - Substance Use – Accidents
  - Mental Health – Depression and other co-factors
  - Intimate Partner Violence
    - Ky MMM TF is supporting programming to identify and refer cases regarding IPV

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Successes to Lower Maternal Mortality
We are learning for other States

- What a focus on *Population Health* in Obstetrics can do!
- CCMQCC
  - Between 2006 and 2016, California reduced their maternal mortality rate by 65%
  - Keys to Success
    - Data-Driven Programming. Uses statewide hospital-level data to guide smart goals and metrics-driven programming
    - Evidence-based Education and Training
    - Assists in Quality Improvement Programming
    - Partnership and Collaboration

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Sepsis in Obstetric Committee

May 2025

Dr. Maureen Marra, MD Chair

Definition

- A life-threatening organ dysfunction caused by a dysregulated host response to infection. In pregnancy, we follow the same general definition, but with important distinctions due to the physiologic changes of pregnancy.

The pathophysiology involves:

- Initial infection (most commonly urinary, respiratory, or genital tract)
- Systemic inflammatory response
- Endothelial damage
- Microvascular dysfunction
- Tissue hypoperfusion
- Organ failure

Septic Shock

- Septic shock represents a subset of sepsis with circulatory and cellular/metabolic abnormalities profound enough to substantially increase mortality. It is characterized by persistent hypotension requiring vasopressors to maintain MAP ≥65 mmHg and serum lactate >2 mmol/L despite adequate fluid resuscitation.
- Maternal sepsis should be considered a medical emergency requiring rapid identification and treatment, much like hemorrhage or severe preeclampsia.

Maternal Sepsis as a Contributing Factor for Maternal Mortality

- Varies by state
- Considered the 3rd leading cause of Maternal Mortality in the US (CDC data)
- In KY, the MMRC has identified cases of Septic Shock and maternal death related to
  - Endocarditis and sequelae of substance use
  - Group A Strep sepsis
  - Others

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Maternal Sepsis Is Not Adult Sepsis

- Unique Physiology of Pregnancy Alters Screening Parameters
- Cardiac Rate changes
  - Increased Cardiac Output needed for fetal demands
    - Increased heart rate (10-15 bpm above baseline)
    - Decreased blood pressure (particularly in second trimester)
    - Expanded blood volume
  - Cardiac Output = SV x HR
  - Limited capacity to expand SV

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Respiratory Changes in Pregnancy

- Respiratory Rate changes
  - Minute ventilation increases due to increased oxygen demands
  - Limited increase to no change in Tidal Volume
- Respiratory Rate increases during pregnancy related to progesterone concentration increases

- Decreased functional residual capacity

Additional Physiologic Changes

- **Immunologic changes:**
  - Partial immunosuppression to accommodate the fetus
  - Altered leukocyte function
  - Changed inflammatory response
- **Renal changes:**
  - Increased glomerular filtration rate
  - Dilated urinary collecting system
  - Higher risk of pyelonephritis

Adult Screening Parameters

- These normal physiologic adaptations present challenges because:
  - Tachycardia and tachypnea may be attributed to normal pregnancy
  - Hypotension may appear later than in non-pregnant patients
  - Leukocytosis is normal in pregnancy
  - The immunologic adaptations may accelerate infection progression
  - Relying on traditional SIRS criteria alone for sepsis screening is inadequate in the pregnant population.

Risk Factors for Maternal Sepsis

- **Prenatal risk factors:**
  - Obesity
  - Diabetes (pre-existing or gestational)
  - Impaired immunity/immunosuppressive medications
  - Anemia
  - Prior Group B Streptococcus colonization
  - Recent antibiotic use
  - Lack of prenatal care

Risk Factors for Maternal Sepsis

- **Intrapartum risk factors:**
  - Prolonged rupture of membranes (>18 hours)
  - Multiple vaginal examinations
  - Intrauterine procedures
  - Retained products of conception
  - Cesarean delivery
  - Operative vaginal delivery
  - Prolonged labor

Risk Factors for Maternal Sepsis

- **Postpartum risk factors:**
  - Cesarean delivery
  - Wound complications
    - Particularly for labor complications such as
      - Failed active phase of labor
      - Failed descent in the second stage of labor
  - Urinary catheterization
  - Mastitis
  - Prolonged hospital stay

Maternal Screening for Sepsis

- SIRS criteria (two or more indicate possible sepsis):
  - Temperature >38°C (100.4°F) or <36°C (96.8°F)
  - Heart rate >110 beats per minute
  - Respiratory rate >24 breaths per minute
  - White blood cell count >15,000/mm^3 or <4,000/mm^3 or >10% bands

Assessment for Organ Dysfunction

- Decreased mental status
- Oxygen saturation <95%
- Lactate >2 mmol/L
- Creatinine >1.2 mg/dL
- Platelets <100,000/mm^3
- Total bilirubin >1.2 mg/dL
- International normalized ratio >1.5 or aPTT >60 seconds

- Systolic BP <90 mmHg or MAP <65 mmHg

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Surviving Sepsis Campaign's sepsis bundles for the obstetric population.

- The sepsis 3-hour bundle
- **Obtain blood cultures** before antibiotic administration (ideally within 45 minutes)
- **Administer broad-spectrum antibiotics** within 1 hour of recognition
  - Consider penicillin allergy status
  - Cover likely pathogens (group A streptococcus, E. coli, anaerobes)
  - Consult infectious disease if source unclear
- **Measure lactate level** within 1 hour
  - If initial lactate ≥2 mmol/L, repeat within 2-4 hours
- **Begin rapid fluid resuscitation** for hypotension or lactate ≥4 mmol/L
  - Administer 30 mL/kg crystalloid within 3 hours
  - Balanced solutions preferred over normal saline
  - Consider albumin for substantial fluid requirements

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Delay = Death

- Each hour of delay in antibiotic administration is associated with an approximately 8% increase in mortality.

Source Control: Identifying and Controlling the Source is Critical

- Comprehensive physical examination to identify possible sources:
  - Respiratory: pneumonia
  - Urinary: pyelonephritis, urinary tract infection
  - Genital: endometritis, wound infection, retained products
  - Skin/soft tissue: cellulitis, necrotizing fasciitis
  - Abdominal: appendicitis, cholecystitis
- Appropriate imaging studies (with fetal shielding if indicated)
  - Chest X-ray
  - Ultrasound
  - Limited CT when necessary
- Surgical consultation when indicated for:
  - Debridement of infected tissue
  - Drainage of abscesses
  - Removal of infected foreign bodies
  - Evacuation of retained products of conception
- Multidisciplinary management involving:
  - Obstetrics
  - Critical care
  - Infectious disease
  - Surgery as needed

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Special Considerations in Pregnancy

Fetal monitoring:

- Continuous fetal monitoring for viable gestations
- Recognition that fetal tachycardia may be an early sign of maternal sepsis

Delivery considerations:

- Delivery is not always indicated
- Decision based on gestational age and maternal status
- May be therapeutic in cases of intrauterine infection

Postpartum considerations

- Higher risk period for sepsis (particularly first week)
- Different source profile (endometritis, wound infections)
- Need for close monitoring after discharge

- Semmelweiss Story

Special Considerations

- **Medication adjustments:**
  - Physiologic changes affect pharmacokinetics
  - May need higher doses of some antibiotics
  - Some medications contraindicated or require careful consideration
- **Breastfeeding considerations:**
  - Most antibiotics compatible with breastfeeding
  - Support for milk expression if mother unable to breastfeed

Prevention Strategies and Quality Improvement

- **System-level interventions:**
  - Implementation of standardized screening protocols
  - Development of clear response algorithms
  - Regular simulation drills for sepsis management
  - Audit and feedback processes

Prevention Strategies and Quality Improvement

- **Provider-level Interventions**
  - Education on early recognition of sepsis
  - Training on appropriate antibiotic selection
  - Clear communication pathways between services

Subjective

Our goal is to improve recognition and timely treatment of sepsis by increasing the number of OB providers and nursing staff trained on **Obstetric Sepsis**.

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AIM Bundle Includes

- Readiness
- Recognition and prevention
- Response
- Reporting/systems learning

- Implementation of the AIM sepsis bundle has been associated with reduced mortality, shorter hospital stays, and lower costs.

Maternal Sepsis requires

- A high index of suspicion
- Recognition of the altered physiology of pregnancy
- Standardized screening tools
- Rapid implementation of treatment bundles
- Multidisciplinary management
- Ongoing quality improvement efforts

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KyMMM Strategic Plan

For

Sepsis in Obstetrics Committee

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Phase 1

- Strategic Plan Development
- Establish Baseline Data

Phase 2

- High Fidelity Simulation for Sepsis in Obstetrics
- OB and ED staff education of Sepsis in the Obstetric patient

Phase 3

- Protocols for Management of Suspected and Confirmed OB Sepsis
- Obstetric and Sepsis Screening and Diagnosis System

Phase 4

- Birthing Hospitals to report data to KyPQC Data Portal

Protocols Help with Readiness, Recognition and Response

- 25 Birthing Hospitals in KY did not have a protocol to specifically address Sepsis in Pregnancy in a survey

- Probable that hospitals with ERs that see pregnant patients but do not have an Obstetrical service are more likely not to have a Protocol

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KY MMM TF Planning for Sepsis

- Provide a Protocol for Maternal Sepsis
  - Looking at options but likely to utilize CMQCC upcoming version
- Expand consideration of Unique Diseases
  - Invasive Group A Strep in Pregnancy is a potentially fulminant infection that has led to maternal deaths in KY
    - KY MMM TF Sepsis Committee has considered programming to expand appreciation of the potential severity of this pathogen
- Provide Simulation Opportunities for Hospitals
  - Building capacity for simulation which is initially focusing at annual meetings
  - Ultimately, address the needs of our ER Community and OB Hospitals

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Subjective: Committee Indicators and Activity

Provide multidisciplinary education on **Obstetric Sepsis** to all clinicians and staff that provide care to pregnant and postpartum patients, including in non-labor & delivery settings such as emergency departments, intensive care units, and outpatient clinics

Lunch and Learns via KyPQC or KyMMM

- Can be recorded and watched throughout the year

Sepsis in the Obstetric Patient Simulations

- Make it part of annual competencies for obstetric and emergency department staff

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Objective: Sepsis Data Collection

Administrative Data from ED and Inpatient

ACOG defines sepsis:

- Infection with hypotension with multiple liters of IV fluid or pressors used (septic shock)
  - Fever >38.5°C with elevated lactate alone without hypotension
- Infection with pulmonary complications such as pulmonary edema or acute respiratory distress syndrome (ARDS)
  - Fever >38.5°C with presumed chorio/endometritis with elevated pulse but no other cardiovascular signs and normal lactate
- Positive blood cultures without other evidence of significant systemic illness

Year reported	Events reported in Kentucky	Percentage per 10,000 births
2018-2023	1500	0.52%
2024		
2025		
2026		
2027		
2028		

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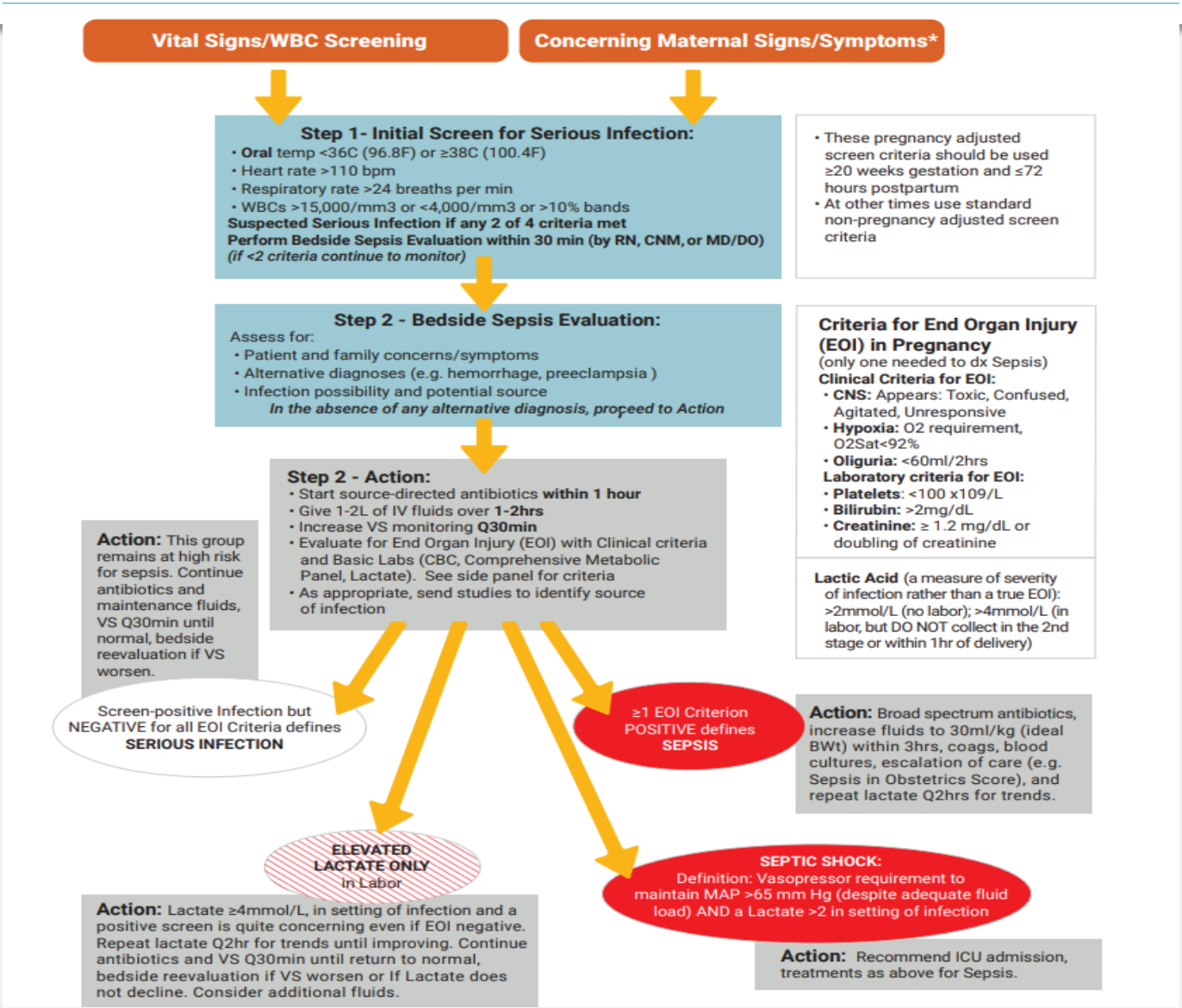
CMQCC's Obstetric Serious Infection/Sepsis Evaluation Flow Chart



THANK YOU

We thank you for sharing your time and talent!
Email kentucky_mmm@uky.edu with any questions or ideas.

Contact the KY MMM TF Director
Cynthia Cockerham, RN

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