

Consensus Statement

Alliance for Innovation on Maternal Health

Consensus Bundle on Sepsis in Obstetric Care

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Sepsis in obstetric care is one of the leading causes of maternal death in the United States, with Black, Asian/Pacific Islander, and American Indian/Alaska Native obstetric patients experiencing sepsis at disproportionately higher rates. State maternal mortality review committees have determined that deaths are preventable much of the time and are caused by delays in recognition, treatment, and escalation of care. The “Sepsis in Obstetric Care” patient safety bundle provides guidance for health care teams to develop coordinated,

multidisciplinary care for pregnant and postpartum people by preventing infection and recognizing and treating infection early to prevent progression to sepsis. This is one of several core patient safety bundles developed by AIM (the Alliance for Innovation on Maternal Health) to provide condition- or event-specific clinical practices that should be implemented in all appropriate care settings. As with other bundles developed by AIM, the “Sepsis in Obstetric Care” patient safety bundle is organized into five domains: Readiness, Recognition and Pre-

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vention, Response, Reporting and Systems Learning, and Respectful, Equitable, and Supportive Care. The Respectful, Equitable, and Supportive Care domain provides essential best practices to support respectful, equitable, and supportive care to all patients. Further health equity considerations are integrated into the elements of each domain.

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Sepsis is the second leading cause of maternal mortality in the United States and affects an estimated 5.7 per 10,000 pregnancies.^{1–3} Despite overall improvements in sepsis care over time for the general population, the proportion of maternal deaths due to sepsis has remained unchanged since 1987, when the Centers for Disease Control and Prevention (CDC) began monitoring the causes of pregnancy-related death.^{1,4} Deaths are reportedly preventable up to 73% of the time and are mostly due to delays in recognition, treatment, and escalation of care.^{5,6} Delays in recognition often occur because of the overlap between physiologic changes of pregnancy and pathophysiologic signs found in sepsis, making it difficult to recognize sepsis at an early stage. Delays in recognition may also occur because patients have not been properly educated about early warning signs for which to seek medical care.^{1,5,6} Delays in treatment include failure to start appropriate antimicrobials within 1 hour of presentation. Delays in escalation of care are the result of failure to recognize the signs and symptoms of critical illness and the severity of the disease.⁶

In response to the high proportion of deaths due to sepsis and the high preventability of deaths from sepsis, AIM (the Alliance for Innovation on Maternal Health) convened an interdisciplinary workgroup to develop a “Sepsis in Obstetric Care” patient safety bundle (Box 1). AIM is a quality-improvement program that is supported by a cooperative agreement with the Health Resources & Services Administration of the U.S. Department of Health and Human Services designed to support best practices that make birth safer, improve maternal health outcomes and save lives. Patient safety bundles are clinical condition-specific collections of evidence-based frameworks intended to be uniformly applied to the care of every patient, in every setting, in every episode of relevant care. *Maternal sepsis* is defined by the World Health Organization as a life-threatening condition with organ dysfunction resulting from infection during pregnancy, childbirth, postabortion, or postpartum period (up to 42 days).⁷ In this patient safety

bundle, we use the term “sepsis in obstetric care” in place of “maternal sepsis” to include all patients regardless of gender or pregnancy outcome. Safety bundles created by AIM are organized into five domains: Readiness, Recognition and Prevention, Response, Reporting and Systems Learning, and Respectful, Equitable, and Supportive Care. This bundle is part of a subset of core patient safety bundles in the AIM initiative that crosses the continuum of care, beyond the labor and delivery setting to the emergency department (ED), primary care, and other outpatient settings.

READINESS (EVERY UNIT)

1. Establish Inter- and Intradepartmental Protocols and Policies for the Care of Patients Experiencing Obstetric Sepsis or Suspected Sepsis

Sepsis in obstetric care is associated with mortality rates between 9% and 14%.^{2,3,8} Given the high mortality and rarity of obstetric sepsis cases, it is prudent to employ a rapid response team with experience stabilizing obstetric patients with sepsis as a complement to the obstetric care team. Protocols should contain broad spectrum and targeted antibiotic selection indications, fluid management, and vasopressor type and titration, when indicated. Unstable patients with sepsis can receive the same care as nonpregnant patients, including antimicrobials, fluid resuscitation, and vasopressors.⁹

Prompt antibiotic therapy is a mainstay for good outcomes. Delay in prompt antibiotic treatment has been shown to increase mortality in the general population by 7.6% for each hour delay.¹⁰ For sepsis in obstetric care, a retrospective case-control reported mortality was 8% in patients who received antibiotics within 1 hour and 20% in patients who received them after 1 hour.¹¹ There are multiple strategies to reduce time to the administration of antibiotics including the following: creation of antibiotic treatment order sets to predetermine antibiotic selection and dosing for common infections; process coordination with pharmacy to dose and deliver antibiotic therapy promptly; placing antibiotic therapy in automated medication dispensing systems (to reduce time to obtain antibiotics from the pharmacy), prioritizing orders with the nursing team, providing additional intravenous access to allow multiple antibiotics to be administered concurrently (many cannot be given in the same line), and immediate administration even while awaiting transfer to imaging services or to the intensive care unit (ICU).¹¹ Additionally, many hospitals use a “code sepsis” or “sepsis alert” system that mobilizes the

Box 1. Sepsis in Obstetric Care Patient Safety Bundle: Alliance for Innovation on Maternal Health*

READINESS (EVERY UNIT)

1. Establish inter- and intradepartmental protocols and policies for the care of patients experiencing obstetric sepsis or suspected sepsis.
2. Provide multidisciplinary education on obstetric sepsis to all clinicians and staff that provide care to pregnant and postpartum people, including in non-labor & delivery settings such as emergency departments, intensive care units, and outpatient clinics.
3. Use evidence-based criteria for sepsis assessment for all pregnant and postpartum patients, in all units, including obstetric-specific criteria, when appropriate.
4. Create a culture that utilizes nonhierarchical communication so that all team members, including the patient, feel empowered to speak up about a concern and know that their input is valued by the entire care team.

RECOGNITION AND PREVENTION (EVERY PATIENT)

5. Implement evidence-based measures to prevent infection.
6. Recognize and treat infection early to prevent progression to sepsis.
7. Consider sepsis on the differential diagnosis of a person with deteriorating status, even in the absence of fever.
8. In all care environments, assess and document whether a patient presenting is pregnant or has been pregnant within the past year.
9. Provide patient education focused on general life-threatening pregnancy and postpartum complications and early warning signs, including sepsis signs and symptoms other than fever, and instructions for who to notify with concerns.

RESPONSE (EVERY EVENT)

10. Initiate facility-wide standard protocols and policies for assessment, treatment, and escalation of care for people with suspected or confirmed obstetric sepsis.
11. Initiate facility-wide standard protocols and policies for post-stabilization management of people with sepsis.
12. Engage in team communication among units involved in the care coordination for patients with sepsis to understand diagnoses, treatment plans, and follow-up care.
13. Facilitate comprehensive post-sepsis care, including screening and proper referrals for post-sepsis syndrome.

REPORTING AND SYSTEMS LEARNING (EVERY UNIT)

14. Conduct multidisciplinary reviews for systems improvement of each sepsis case to assess the screening program, the quality of care provided to patients with sepsis, and whether instances of bias may have impacted care.

15. Establish a culture of multidisciplinary planning, huddles, and post-event debriefs.
16. Implement a system to ensure that communication occurs with the pregnant or postpartum person and their identified support network on an ongoing basis during treatment and through follow-up care.

RESPECTFUL, EQUITABLE, AND SUPPORTIVE CARE (EVERY UNIT, EVERY TEAM MEMBER)

17. Include each pregnant or postpartum person and their identified support network as respected members of and contributors to the multidisciplinary care team.
18. Engage in open, transparent, and empathetic communication with pregnant and postpartum people and their identified support network about sepsis diagnosis and recommended treatment plans that are aligned with their health literacy, culture, language, and accessibility needs.
19. Because maternal mortality and severe maternal morbidity related to sepsis disproportionately affect Black, Indigenous, and Hispanic people because of systemic racism, but not race itself, it is necessary to mitigate this bias by having a high index of suspicion for sepsis.

* Data from Alliance for Innovation on Maternal Health. Sepsis in obstetric care. Accessed December 6, 2022. <https://saferbirth.org/psbs/sepsis-in-obstetric-care/>

rapid response team to the bedside, notifies the pharmacy to prioritize antibiotics, laboratory to prioritize results, and the ICU to assess the patient for possible transfer to the ICU. This is operationalized by having a group page stating “sepsis alert” with the patient’s name and location that simultaneously pages the pharmacy, rapid response team, laboratory, and ICU team, rather than spending time to locate and page the individual team members.

Operationalizing alerts, patient evaluations, protocols, and prompt treatment requires staff education, accessible step-by-step instructions, and practical simulation. It is helpful to identify champions for each type of care team member (physicians, advanced practice professionals, nurses, rapid response team, pharmacy) to serve as a leader for dissemination of new processes.

2. Provide Multidisciplinary Education on Obstetric Sepsis to All Clinicians and Staff that Provide Care to Pregnant and Postpartum People, Including in Non-Labor And Delivery Settings Such as EDs, ICUs, & Outpatient Clinics

Pregnant patients are often cared for in settings that mostly serve nonpregnant patients. Between 5% and 10% of postpartum patients present to the hospital within 42 days of delivery, often to EDs rather than

Table 1. Examples of Pregnancy-Adjusted Screening Tools for Sepsis

Organization	Type of screening	Criteria
California Maternal Quality Care Collaborative*	Modified SIRS	<ul style="list-style-type: none"> •Oral temp lower than 36°C (96.8 °F) or higher than 38°C (100.4 °F) •Heart rate higher than 110 bpm •Respiratory rate higher than 24/min •WBC count higher than 15,000/mm³ or less than 4,000/mm³ or greater than 10% bands Positive if any 2 of 4 criteria are met (sustained for 15 min)
Safe Motherhood Initiative [†]	Modified Maternal Early Warning Criteria	<ul style="list-style-type: none"> •Systolic BP (mm Hg) lower than 90 or higher than 160 •Diastolic BP (mm Hg) higher than 100 •Heart rate lower than 50 bpm or higher than 120 bpm •Respiratory rate lower than 10/min or higher than 24/min •O₂ saturation on room air less than 95% •Oliguria less than 35 mL/h×2 h •Temperature lower than 36°C or higher than 38°C •WBC count higher than 15,000/mm³ or less than 4,000/mm³ •Maternal agitation, confusion, or unresponsiveness Positive if any 1 criterion is met (sustained for 20 min)
United Kingdom Obstetric Surveillance System [‡]	Modified SIRS	<ul style="list-style-type: none"> •Temperature lower than 36°C or higher than 38°C •Heart rate higher than 100 bpm •Respiratory rate higher than 20/min •WBC count greater than 17×10⁹/L or less than 4×10⁹/L or with 10% immature band forms Positive if any 2 of 4 criteria are met if measured on 2 occasions (at least 4 h apart for temperature, heart rate, and respiratory rate)

SIRS, systemic inflammatory response syndrome; bpm, beats per minute; WBC, white blood cell; BP, blood pressure.

* Data from Gibbs R, Bauer M, Olvera L, Sakowski C, Cape V, Main E. Improving diagnosis and treatment of maternal sepsis: a quality improvement toolkit. California Maternal Quality Care Collaborative. Accessed December 6, 2022. <https://www.cmqcc.org/resources-toolkits/toolkits/improving-diagnosis-and-treatment-maternal-sepsis-errata-712022>

[†] Data from American College of Obstetricians and Gynecologists District II. Safe Motherhood Initiative: maternal safety bundle for sepsis in pregnancy. Accessed December 6, 2022. <https://www.acog.org/-/media/project/acog/acogorg/files/forms/districts/smi-sepsis-bundle.pdf>

[‡] Data from National Perinatal Epidemiology Unit. UK Obstetric Surveillance System (UKOSS). Accessed December 6, 2022. <https://www.npeu.ox.ac.uk/ukoss>

labor and delivery units.^{12,13} Admission due to infection occurs in 15.5% of all postpartum readmissions.¹⁴ Additionally, the most recent national estimate in 2020 reports that 1.7 per 1,000 deliveries are complicated by ICU admission and sepsis is the primary indication for admission in 5% of ICU admissions.^{15,16} Education about sepsis in obstetric care and the importance of obstetric specific-screening, diagnosis, and treatment in all settings where pregnant and postpartum patients are provided care is key for early identification and improved outcomes.

In a national database study of delivery hospitalizations and postpartum readmissions, approximately half of sepsis cases occurred in the postdischarge postpartum period.³ Therefore, when a patient calls with symptoms related to infection, the health care team should use a preadmission risk assessment to determine the next steps for evaluation. A preadmission risk assessment includes setting criteria for urgent or emergent care, such as sending the patient to the ED or labor and delivery triage for assessment. An

example of a prerisk hospital assessment would be to ask whether the patient is experiencing any of the AIM “Urgent Maternal Warning Signs.”¹⁷ When patients are at home, they will report symptoms rather than vital signs and identification of warning signs can shorten time to urgent clinical evaluation.

3. Use Evidence-Based Criteria for Sepsis Assessment for All Pregnant and Postpartum Patients, in All Units, Including Obstetric-Specific Criteria, When Appropriate

It is not known which tools are optimal to identify sepsis during antepartum, delivery, and postpartum hospitalizations while balancing rates of false positive screening. There is significant overlap between pregnancy physiology and screening tools leading to possible high positive screening rates.^{18,19} The pregnancy-adjusted screening tools have been tested mostly during the delivery hospitalization, but there may be differences in performance criteria during antepartum, intrapartum, and postpartum admissions. During the delivery hospitalization, when screening

systems are modified for pregnancy, identification is more accurate.¹¹ It may be reasonable to use a nonpregnancy-adjusted tool in cases of less than 20 weeks of gestation or greater than 3 days postpartum to avoid missing patients with sepsis. Although physiologic changes of pregnancy occur earlier (by 12 weeks of gestation) and persist later (up to 6 weeks after delivery), there is a gradual increase during pregnancy and a steep decrease after delivery in some parameters, such as heart rate, that can result in false-negatives in early pregnancy and postpartum with pregnancy-adjusted tools.^{19–21} The SEP-1 (Severe Sepsis and Septic Shock Management) bundle from the Centers for Medicare & Medicaid Services also recommends the same timing for use of pregnancy-adjusted thresholds. There are single institution studies available evaluating the use of tools to identify sepsis and decompensation but they are limited by small numbers of the outcome of interest and do not discriminate between type of hospitalization.^{22,23} More studies should identify appropriate screening tools for sepsis identification that limit positive screening rates. Some examples of available sepsis screening tools currently in use for obstetric patients are presented in Table 1.

Incorporating alerts and order sets into the electronic medical record allows for prompt identification of aberrant vital signs, and outcomes are improved when alert systems are paired with treatment pathways or protocols.²⁴ Order sets can standardize complete evaluation for end organ injury. Once an alert has occurred due to aberrant vital signs, a bedside evaluation can be helpful to assess the patient for signs and symptoms of an infection. If present, providing prompt antibiotic therapy, fluid resuscitation, and vasopressor initiation (if needed) is critical. Evaluation for end organ injury includes laboratory testing, vital sign evaluation (for hemodynamic compromise), and bedside evaluation to evaluate for signs of end organ injury (such as decreased urine output, mental status changes, or decreased perfusion).

Vital sign thresholds alone do not constitute a diagnosis of sepsis in obstetric care. The World Health Organization definition requires evidence of end organ injury due to infection; however, end organ injury determinations must be evaluated in the context of pregnancy physiology. The diagnosis of sepsis in the general population is defined as life-threatening organ dysfunction caused by a dysregulated host response to infection.²⁵ End organ damage in nonpregnant adults is operationalized as an increase of 2 points on the SOFA (Sequential Organ

Failure Assessment) score. SOFA scoring is based on the patient's PaO₂/FiO₂ ratio, platelet count, bilirubin level, mean arterial blood pressure, vasopressor requirement, Glasgow coma scale score, creatinine level, and urine output. In previously healthy individuals, the baseline SOFA score is 0.²⁵ However, the SOFA score is not adjusted for physiologic changes of pregnancy such as lower platelet counts, lower serum creatinine, and lower blood pressure (especially in the second trimester).

Once a pregnant patient has been diagnosed with sepsis, monitoring for clinical deterioration is essential. A higher level of care is needed if the patient is deemed to be at high risk for clinical deterioration, is clinically unstable, or needs specialized ICU care, such as invasive hemodynamic monitoring or mechanical ventilation. Knowledge of the resources available in each hospital setting is critical when determining the need to transfer either within or outside of the hospital.

In caring for patients with sepsis, having a standardized set of pregnancy-validated parameters to escalate care may be beneficial. The Maternal Early Warning Criteria is a collection of vital sign abnormalities meant to prompt a bedside evaluation for a variety of obstetric emergencies, including sepsis.²⁶ The SOS (Sepsis in Obstetrics Score) is a validated, pregnancy-specific sepsis scoring system for patients with a known or suspected infection to assess for escalation of care. An SOS of 6 or higher predicted ICU admission in both retrospective and prospective validation and may help in identifying patients at risk for clinical deterioration and in need of escalation of care.^{27,28} Whether this escalation of care is to the ICU, to a high-acuity unit within labor and delivery, or elsewhere will depend on the available resources and the capabilities of each particular labor and delivery unit.

4. Create a Culture that Utilizes Nonhierarchical Communication So That All Team Members, Including the Patient, Feel Empowered to Speak Up About a Concern and Know That Their Input is Valued by the Entire Care Team

In view of the challenge of identifying sepsis in pregnant and postpartum patients, concerns of any team member about suspicion of sepsis should be valued. Many existing sepsis in obstetric care screening tools are nurse-led and require cooperative, collaborative teamwork for the best possible identification and outcome of sepsis.

In many cases, patients may feel intimidated about voicing their own concerns. Strive to create an environment where patients (and their support

network) feel comfortable bringing up concerns and create and maintain a pathway for patients to escalate their concerns if they do not feel heard.

RECOGNITION AND PREVENTION (EVERY PATIENT)

5. Implement Evidence-Based Measures to Prevent Infection

Examples of evidence-based measures to prevent obstetric infection during labor and delivery are summarized in Box 2. The contents of Box 2 include the use of prophylactic antibiotics during labor and delivery, along with infection prevention measures to adhere to for cesarean deliveries.

6. Recognize and Treat Infection Early to Prevent Progression To Sepsis

Maintain a high index of suspicion for infection during pregnancy and postpartum. In cases of intra-amniotic infection, intrapartum antibiotic treatment reduces neonatal infection and maternal length of stay. Because of these benefits, the American College of Obstetricians and Gynecologists recommends consideration of antibiotics in cases of isolated fever unless another source can be determined.²⁹

Challenges remain in the discrimination of infectious fever and other causes of noninfectious causes of temperature elevation (such as epidural-related maternal fever and misoprostol use).^{30,31} Due to the potential adverse outcomes with untreated infection, each incidence of fever should be thoroughly evaluated and treated when indicated.

7. Consider Sepsis on the Differential Diagnosis of a Person With Deteriorating Status, Even in the Absence of Fever

One of the major delays leading to deaths from obstetric sepsis is delayed recognition. This is due in part to the expectation that sepsis is accompanied by a fever or hypothermia. The presence or absence of temperature alterations is often transient. In a cohort of obstetric patients who died due to sepsis, only 25% of patients presented with a fever or hypothermia, and 25% never developed any alterations in temperature before death.⁶ Sepsis frequently presents in a nontraditional manner. For example, patients may report sensations of anxiety rather than “heart racing” with tachycardia; tachycardia of unknown etiology requires further evaluation. Consider sepsis as a potential cause of critical illness whether or not fever is present.

8. In All Care Environments, Assess and Document Whether a Patient Presenting is Pregnant or Has Been Pregnant Within the Past Year

Because early pregnancy or postdelivery status may not be recognized, appropriate assessment for current or recent pregnancy is paramount and should be done at first contact with the health care professional as part of patient triage in critically ill patients. Additionally, national peripartum estimates showed that about half of sepsis cases occurred after discharge.³ Pregnancy-related causes of sepsis may be present up to 6 weeks postpartum. Knowledge that a patient is currently or recently pregnant allows for identification and exploration of pregnancy-related infections (such as intrauterine infection due to early pregnancy loss or retained products of pregnancy), and prompt source control through consultation with an obstetrician-gynecologist.

9. Provide Patient Education Focused on General Life-Threatening Pregnancy and Postpartum Complications and Early Warning Signs, Including Sepsis Signs and Symptoms Other Than Fever, and Instructions for Who to Notify With Concerns

Education about possible subsequent warning signs and encouragement to seek prompt medical care can be lifesaving. State maternal mortality review committees reviewed sepsis in obstetric care deaths in California and Michigan and noted that many patients presented late to care or died at home without seeking care.^{5,6} This reflects inadequate patient awareness of when to seek care or barriers to care. Fever may not be present in many cases of sepsis, and patient education should emphasize additional warning signs. One example of education that is readily accessible and available in many languages is the AIM “Urgent Maternal Warning Signs.”¹⁷ This document is supported by the CDC as a part of the Hear Her Campaign.³² An online warning signs flyer that identifies multiple types of severe maternal morbidity (including sepsis in obstetric care) has been translated into 19 languages to date and is free to download.

RESPONSE (EVERY EVENT)

10. Initiate Facility-Wide Standard Protocols and Policies for Assessment, Treatment, and Escalation of Care for People With Suspected or Confirmed Obstetric Sepsis

Once sepsis is identified, adherence to the protocols, initiating the alerts, and bringing together the multidisciplinary rapid response team to the bedside is critical to providing optimal care. Having health care professionals use checklists may be helpful to make sure that treatment including antibiotic therapy, fluid resuscitation, and vasopressor initiation, as

Box 2. Examples of Obstetric Evidence-Based Measures for Infection Prevention During Labor and Delivery

PERIPARTUM INDICATIONS FOR ANTIBIOTICS*

- Preterm prelabor rupture of membranes at less than 34 wk
- Group B streptococcus prophylaxis
- Treatment of presumed or confirmed chorioamnionitis
- Repair of 3rd- or 4th-degree laceration
- Bacterial endocarditis prophylaxis for vaginal delivery only in the highest-risk patients (including cyanotic heart disease, prosthetic heart valves, or both)
- Other suspected or diagnosed bacterial infections

INFECTION PREVENTION DURING CESAREAN DELIVERY

- Use of electric clippers rather than a razor for hair removal[†]
- Avoid perioperative hyperglycemia[‡]
- Advise patients to shower with soap or an antiseptic agent the night before[‡]
- Preoperative surgical site skin preparation with an alcohol-based agent[‡]
- Vaginal cleansing with povidone-iodine or chlorhexidine for labor or ruptured membranes^{‡§||}
- Closure of subcutaneous tissue 2 cm or greater^{||¶}
- Use of subcuticular suture^{||¶}
- Cesarean delivery: cefazolin administered within 60 min before incision (weight-adjusted dosing to cefazolin 3 g can be considered for patients with weight more than 120 kg)[‡]
- Redose after 1,500 mL estimated blood loss or lengthy procedures[‡]
- For patients in labor or with ruptured membranes, add azithromycin to antibiotic prophylaxis for cesarean delivery^{*}
- Follow indwelling urinary catheter protocol postoperatively[#]

*Data from Use of prophylactic antibiotics in labor and delivery. ACOG Practice Bulletin No. 199 [published erratum appears in *Obstet Gynecol* 2019;134:883–4]. American College of Obstetricians and Gynecologists. *Obstet Gynecol* 2018;132:e103–19. doi: 10.1097/AOG.0000000000002833

†Data from Prevention of infection after gynecologic procedures. ACOG Practice Bulletin No. 195. American College of Obstetricians and Gynecologists. *Obstet Gynecol* 2018;131:e172–89. doi: 10.1097/AOG.0000000000002670

‡Data from Roeckner JT, Sanchez-Ramos L, Mitta M, Kovacs A, Kaunitz AM. Povidone-iodine 1% is the most effective vaginal antiseptic for preventing post-cesarean endometritis: a systematic review and network meta-analysis. *Am J Obstet Gynecol* 2019;221:261.e1–20. doi: 10.1016/j.ajog.2019.04.002

§Data from Lakhi NA, Tricorico G, Osipova Y, Moretti ML. Vaginal cleansing with chlorhexidine gluconate or povidone-iodine prior to cesarean delivery: a randomized comparator-controlled trial. *Am J Obstet Gynecol MFM* 2019;1:2–9. doi: 10.1016/j.ajogmf.2019.03.004

||Data from Dahlke JD, Mendez-Figueroa H, Maggio L, Sperling JD, Chauhan SP, Rouse DJ. The case for standardizing cesarean delivery technique: seeing the forest for the trees.

Obstet Gynecol 2020;136:972–80. doi: 10.1097/AOG.0000000000004120

¶Data from Dahlke JD, Mendez-Figueroa H, Rouse DJ, Berghella V, Baxter JK, Chauhan SP. Evidence-based surgery for cesarean delivery: an updated systematic review. *Am J Obstet Gynecol* 2013;209:294–306. doi: 10.1016/j.ajog.2013.02.043

#Data from Gould CV, Umscheid CA, Agarwal RK, Kuntz G, Pegues DA. Guideline for prevention Of catheter-associated urinary tract infections. Healthcare Infection Control Practices Advisory Committee 2009. Accessed May 17, 2023. <https://www.cdc.gov/infectioncontrol/pdf/guidelines/cauti-guidelines-H.pdf>

needed, is promptly administered. During pregnancy, antibiotic therapy is still recommended within the first hour of diagnosis. Fluid resuscitation of 30 mL/kg is suggested by the Surviving Sepsis Campaign Guidelines and is part of the SEP-1 bundle from the Centers for Medicare & Medicaid Services core measure.³³ Ideal body weight should be used to calculate fluid resuscitation rather than total body weight to avoid fluid overload. When vasopressors are indicated, norepinephrine is the first-line treatment in pregnancy for hypotension.³⁴

Closed loop communication during active stabilization can help prioritize and eliminate communication errors. Bedside assessment for escalation of care may also be included on the checklist as lack of escalation of care has been identified as a theme of deaths due to obstetric sepsis.^{5,6} Evaluation for source control may also be considered on the checklist, because in cases requiring source control by surgical or percutaneous approaches, timely communication with the operating room and interventional radiology is crucial.

11. Initiate Facility-Wide Standard Protocols and Policies for Post-stabilization Management of People With Sepsis

Each delivery area should have a protocol-based approach after the pregnant or postpartum patient with sepsis is initially stabilized. Critical components include determining the best location for ongoing care and delineating the goals of both maternal and fetal care. The American College of Obstetricians and Gynecologists has defined levels of maternal care as a standardized system to risk-stratify the ability of birth centers and facilities to care for pregnancies of varying complexity in the antepartum, intrapartum, and postpartum period.³⁵ Level 1 refers to the ability to provide basic care; level 2, specialty care; level 3, subspecialty care; and level 4, regional perinatal health care centers. For pregnant patients with sepsis, level 3 or 4 care is necessary. Level 3 centers always have the full complement of

subspecialists available for consultation—maternal–fetal medicine specialist with inpatient privileges available at all times, in-house availability of all blood components, specialized imaging available at all times, and onsite ICU services willing to accept a pregnant or postpartum patient. Some level 2 centers may have ICU services willing to accept pregnant and postpartum patients. To prepare, centers may determine their level of care and ICU capabilities for pregnant and postpartum patients. If ICU services are not available, the nearest transfer center should be identified and the process for transfer should be determined. Each level 1 and level 2 center should be aware of its closest level 3 or level 4 center to expedite transfer after initial stabilization of sepsis.

Fetal surveillance in pregnant patients with sepsis is based on gestational age. For previsible gestations, periodic checks of fetal heart rate during stabilization and ongoing management may be helpful, for example, to prompt improvement of maternal oxygenation or optimizing uterine blood flow by maternal lateral positioning. Among patients with viable gestations, periodic or continuous fetal surveillance are both reasonable strategies during the initial stabilization of sepsis, and the approach should be individualized. Interpretation of fetal surveillance is conditional on maternal status. Most abnormal fetal heart rate tracings may be expectantly managed during the initial stabilization phase, as they will improve with maternal hemodynamic optimization. After maternal stabilization, continuous monitoring of viable gestations may be appropriate depending on the goals of the patient or their identified support network, although there is a limited role for fetal monitoring during interfacility transport. Interpretation of fetal surveillance should follow American College of Obstetricians and Gynecologists guidelines once maternal acidemia is resolved.³⁶

Although nonobstetric infection in pregnancy (such as pneumonia or pyelonephritis) is associated with an increased risk of pregnancy loss or preterm birth, it is rarely an indication for delivery. Prompt maternal antibiotic treatment and source control as needed, combined with supportive and resuscitative measures, lead to stabilization of both patient and fetus in the majority of cases. Intrauterine infection does require delivery; however, it rarely needs to be immediate and is rarely an indication for cesarean delivery.^{29,37} With appropriate maternal treatment and reassuring fetal status, vaginal delivery is preferred in these patients when possible because of the increased risk of maternal morbidity associated with cesarean delivery.³⁸ Additionally, adverse neonatal

outcomes related to intrauterine infection do not appear to be related to duration of infection once antibiotic therapy is initiated.³⁹ Cesarean delivery should be performed for standard obstetric indications, such as a labor arrest disorder or concern for fetal compromise in a patient remote from delivery. If the patient is having significant maternal deterioration that may precipitate preterm delivery, antenatal corticosteroid administration for fetal benefit may be considered.

12. Engage in Team Communication Among Units Involved in the Care Coordination for Patients With Sepsis to Understand Diagnoses, Treatment Plans, and Follow-up Care

Regular multidisciplinary communication about patients with sepsis, especially when there is a change in clinical status, is crucial for coordination of care. For example, teams may coordinate availability of neonatal resuscitation equipment in the ICU, operating room availability for emergent cesarean delivery, and appointing a representative from each team to disseminate communication. These strategies ensure safety and efficiency in the event delivery is required in a patient with critical illness.

13. Facilitate Comprehensive Post-sepsis Care, Including Screening and Proper Referrals for Post-sepsis Syndrome

Post-sepsis syndrome is characterized by fatigue, cognitive decline, difficulty swallowing, pain, weakness, depression, anxiety, and posttraumatic stress disorder (PTSD). Although the incidence of post-sepsis syndrome in obstetric patients is unknown, it is estimated that, in the general population, 16.7% have post-sepsis impairments.⁴⁰ Evidence-based strategies to prevent post-sepsis syndrome include prompt antibiotic treatment, routine assessment and management of pain and delirium, targeted light sedation protocols, and early mobilization.⁴⁰

Psychological sequelae are common after sepsis and ICU admission.⁴¹ Comprehensive screening after sepsis should include evaluation for depression, anxiety, and PTSD. Use of screening tools, such as the EPDS (Edinburgh Postnatal Depression Scale), the PASS (Perinatal Anxiety Screening Scale), and the Primary Care PTSD Screen, satisfies the requirement for general screening.

post-sepsis admission follow-up may include assessment for physical, cognitive, and mental health impairment. Patients with new weakness after illness benefit from prompt referral to rehabilitation care, physical therapy, occupational therapy, and speech therapy.⁴⁰ Patients may also benefit from multidisciplinary referrals such as pulmonologist management of new chronic lung

disease, wound management, and nutritional therapy for wound healing. Referral to a multidisciplinary post-ICU clinic may be helpful, but such clinics are not available in many areas. The increased risk of rehospitalization with infection should prompt careful follow-up planning, including patient education at discharge. Patient information and educational materials may be found at <https://www.sepsis.org/sepsis-basics/post-sepsis-syndrome/>.⁴² In addition, although prompt patient referral to mental health services are preferred, given the high rates of mental health disorders after critical illness and pregnancy it may be prudent to include mental health services that patients can access through phone and text for support regardless of insurance status in discharge materials and education. For example, there is now the National Maternal Mental Health hotline funded by Health Resources & Services Administration that is staffed 24 hours each day, 7 days each week. It is available free of charge to all pregnant, postpartum, and postloss individuals and their partners and families. The hotline number is 1-833-943-5746.⁴³

REPORTING AND SYSTEMS LEARNING (EVERY UNIT)

14. Conduct Multidisciplinary Reviews for Systems Improvement of Each Sepsis Case to Assess the Screening Program, the Quality of Care Provided to Patients With Sepsis, and Whether Instances of Bias May Have Impacted Care

Reviews of sepsis cases are meant to help improve processes and protocols, reduce disparities, and make system improvements. Collaboration between Emergency Medicine and Critical Care Medicine is needed to identify sepsis cases during pregnancy and up to 6 weeks postpartum, particularly those postpartum cases that may have occurred without an obstetric cause. There should be a plan to review missed, near-miss, and failure-to-rescue cases with representatives from the respective specialties. *Failure to rescue* is defined as the inability to prevent death after the development of a complication. Once cases are identified, review whether screening criteria were used and adherence of sepsis response protocols were followed to identify opportunities for improvement. Multidisciplinary collaboration increases implementation of obstetric-specific screening and treatment in areas other than labor and delivery units, such as EDs and primary care offices, where pregnant and postpartum patients frequently receive care. Assessing obstetric-specific screening tools for false-positives and false-negatives aids in the refinement of these screening tests and addresses the balance between

alarm fatigue and identifying early signs and symptoms of sepsis. Reviews can also include updated review of evidence-based screening threshold-based tools or artificial intelligence screening to incorporate changes. Valuable information for system improvements can be obtained by monitoring health care professionals' response time after alert notification for evaluation, as well as antibiotic ordering to administration times. Identifying barriers, such as delays in the administration of antibiotic therapy, can lead to system-level improvements.

Importantly, review of each case to identify ways that discrimination based on race, ethnicity, socioeconomic status, or type of insurance affected care can be used to address barriers and incorporate changes to policies, protocols, and education to support equitable care delivery. Recently, the CDC created a working group to develop a tool to report racism in maternal health to the CDC Maternal Mortality Review Information Application.⁴⁴ This conceptual tool defined the types of racism, its manifestations in health care, and provided a framework to develop actionable recommendations to mitigate the effects of racism on maternal deaths. This tool may be helpful when reviewing cases for bias in care.

15. Establish a Culture of Multidisciplinary Planning, Huddles, and Post-event Debriefs

Team huddles for obstetric patients have been shown to improve health care professionals' perception of working conditions such as teamwork and safety climate.⁴⁵ Having a huddle at the time of sepsis identification to assure adherence to institutional policies and procedures, such as order sets for appropriate antibiotic therapy, mechanisms for obtaining prompt antibiotic treatment, rapid response team initiation, and escalation of care assessment can facilitate timely coordination of processes. Post-event debriefings can provide real-time action plans to remove barriers that occur.

16. Implement a System to Ensure That Communication Occurs With the Pregnant or Postpartum Person and Their Identified Support Network on an Ongoing Basis During Treatment and Through Follow-up Care

Identify a process for communicating with patients throughout their treatment process. When patients are hospitalized, there should be an identified health care professional who is responsible for managing the overall coordination. It may be challenging for the patient to receive timely communication, because they may be transferred to multiple units of

the hospital such as the ED, labor and delivery, ICU, and interventional radiology. In sepsis in obstetric care, the obstetric care professional may already be known to the patient and may be the appropriate person to communicate, coordinate care, and facilitate comprehensive follow-up care.

RESPECTFUL, EQUITABLE, AND SUPPORTIVE CARE (EVERY UNIT, EVERY TEAM MEMBER)

17. Include Each Pregnant or Postpartum Person and Their Identified Support Network as Respected Members of and Contributors to the Multidisciplinary Care Team

Inclusion of the patient and identified support network during teaching of warning signs, in medical decision making, and to gather feedback about the understanding of the patient's medical condition helps provide support for the patient and also supports patient autonomy. The elements for successful inclusion include active listening, respect, trust, and bidirectional shared decision making to honor the patient and their support network's values and goals of care.

18. Engage in Open, Transparent, and Empathetic Communication With Pregnant And Postpartum People and Their Identified Support Network About Sepsis Diagnosis and Recommended Treatment Plans That are Aligned With Their Health Literacy, Culture, Language, and Accessibility Needs

Quality communication and empathy have profound positive effects on patients' psychological sequelae. Patient perception of quality health care professional-patient communication during life-threatening events can reduce subsequent development of PTSD.⁴⁶ Further, obstetric patients' perception of quality communication may reduce PTSD.⁴⁷ Patient perception of empathy from their health care professional has also been shown to reduce the risk of developing PTSD during an ED visit for a life-threatening emergency.⁴⁸

Communication in the patient's preferred language presented at their level of health literacy is critical. Ask about religious practices or cultural norms that may be important to the patient's clinical situation. Additionally, ask how they like to be presented information whether verbal or written. Consider providing written materials with infographics to be accessible to all patients and support networks because about 20% of U.S. adults have low literacy levels.⁴⁹

19. Because Maternal Mortality and Severe Maternal Morbidity Related to Sepsis Disproportionately Affect Black, Indigenous, and Hispanic People Because of

Systemic Racism, but Not Race Itself, it is Necessary to Mitigate This Bias by Having a High Index of Suspicion for Sepsis

Disparities strongly contribute to maternal mortality. Pregnancy-related mortality ratios for Black patients are 3.3 times higher and American Indian/Alaska Native patients are 2.5 times higher than White patients.¹ Sepsis in obstetric care affects far more patients who are Black, Indigenous, and of color. National rates of sepsis during pregnancy for Black patients, Asian/Pacific Islander patients, Native American patients are 2.4, 1.5, and 1.8 times higher, respectively, than rates for White patients.² However, it is the exposure to systemic racism that creates these disparities. Belief that there is a biological basis for physiologic differences between racial groups has been shown to promote inequitable care. Calculation of glomerular filtration rate based on race results in delayed referral for renal transplantation.⁵⁰ Utilizing race-based thresholds to diagnose anemia likely reduces the diagnosis, complete workup, and treatment for anemia.⁵¹ These are only a few examples of how deeply engrained discriminatory care is in medicine.

There are also reports of patients and their identified support network not feeling heard. The CDC Hear Her Campaign presents multiple stories of birthing people of color describing their experiences.³² To mitigate bias in care, especially for birthing people of color, heightened awareness of patient concerns and having a high index of suspicion for sepsis in these populations are critical. Continued research should be conducted to eliminate disparities, and strategies to reduce disparities in care should be implemented to improve care.

DISCUSSION

This bundle provides strategies to address the delays that have been identified by state maternal mortality review committees in the recognition, treatment, and escalation of care that lead to maternal deaths from sepsis.^{5,6} The goal of the "Sepsis in Obstetric Care" patient safety bundle is to have systems in place to identify, treat, escalate care, and mitigate bias to improve outcomes and reduce disparities in the care of patients with obstetric sepsis. The implementation of this bundle requires a multidisciplinary approach for all health care professionals who may care for pregnant patients throughout all trimesters and postpartum patients outside labor and delivery units, such as emergency and urgent care professionals. The scope of this bundle addresses not only the acute care of patients with sepsis in obstetric care, but also

communication with the patient's support network and need to provide appropriate assessment and resources during the recovery period. This bundle and accompanying resources (<https://saferbirth.org/psbs/sepsis-in-obstetric-care/>) provide a comprehensive, structured approach to improve outcomes for obstetric patients with sepsis.⁵²

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