CMQCC
California Maternal
Quality Care Collaborative

Improving Diagnosis and Treatment of Obstetric Sepsis, V2.0

A CMQCC Quality Improvement Toolkit
September 2025

Improving Diagnosis and Treatment of Obstetric Sepsis

A CMQCC Quality Improvement Toolkit | September 2025

Elliot K. Main, MD, Christa Sakowski, MSN, C-EFM, CLE, Ruhi Nath, MPH, Melissa E. Bauer, DO, Ronald S. Gibbs, MD, Editors

Suggested citation:

Main EK, Sakowski C, Nath R, Bauer ME, Gibbs RS. Improving Diagnosis and Treatment of Maternal Sepsis: A Quality Improvement Toolkit. 2025. Stanford, CA: California Maternal Quality Care Collaborative.

This toolkit is considered a resource, but does not define the standard of care in California. Readers are advised to adapt the guidelines and resources based on their local facility's level of care and patient populations served and are also advised to not rely solely on the guidelines presented here.

For correspondence:

California Maternal Quality Care Collaborative
Medical School Office Building, Stanford University
1701 Page Mill Road, Palo Alto, CA 94304
Phone: (650) 725-6108
Email: info@cmqcc.org
Website: www.cmqcc.org

This work was supported by the Eunice Kennedy Shriver National Institute of Child Health and Human Development of the NIH under award UH3HD108053: Large-scale Implementation of Community Co-led Maternal Sepsis Care Practices to Reduce Morbidity and Mortality from Maternal Infection (Dr. Bauer and Dr. Main). The content is solely the responsibility of the authors and does not necessarily represent the official views of the NIH. We also acknowledge the partnership and support of the Department of Obstetrics & Gynecology, Stanford University School of Medicine.

2025 Sepsis Taskforce

Bolded = Author
* = Reviewer

***Gillian Abir, MBChB, FRCA**
Stanford University School of Medicine

Lindsay Admon, MD, MSc
University of Michigan

***Kathleen Andonian, PharmD**
Sharp Mary Birch Hospital

Vernice Anthony, BSN MPH
Southeast Michigan Perinatal Quality Improvement Coalition

***Natali Aziz, MD, MS**
Stanford University School of Medicine

Leah Bahrencu, CPT, PN1
Certified Patient Family Partner, MoMMAs Voices

***Lori Barnes, BSN, RNC, CCE, C-EFM**
Munson Healthcare Cadillac Hospital

***Melissa E. Bauer, DO**
Duke University School of Medicine

Hayden Bosworth, PhD
Duke University Medical Center

Alethia Carr, RD, MBA
Carr Consulting LLC

Arianna G. Cassidy, MD
University of California, San Francisco

April Chavez, MA
Certified Patient Family Partner, MoMMAs Voices

***Holly Champagne, DNP, RN, CNS, RNC-OB, C-EFM**
Retired, formerly Clinical Nurse Specialist, Kaiser Permanente Northern California

Julianne DeMartino, MD
University Hospitals Cleveland Medical Center

Lindsay du Plessis, DrPH, MPH
CMQCC

*Douglas Fenton, MD
Scripps Memorial Hospital Encinitas

Shabnam Gaskari, PharmD, BCPPS
Stanford Children's Health

Marianne Gausche-Hill, MD, FACEP, FAAP, FAEMS
UCLA Medical Center

***Ronald S. Gibbs, MD**
Stanford University School of Medicine

*William Gilbert, MD
Sutter Medical Center, Sacramento

*Bernard Gonik, MD
Wayne State University School of Medicine

*Neeru Gupta, MD
Kaiser Permanente of Northern California

*Herman L Hedriana, MD
University of California, Davis Health

Brenna Hughes, MD, MSc
Duke University School of Medicine

*Jody Jones, MD, FACOG
IHA Medical Group, Canton

Jessica Kaslik, RN
Beaumont Health System

*Tyler Katz, MD
University Hospitals Cleveland Medical Center

Sarah Kuiper
Lactation Consultant

Maile LeBoeuf
Advocate, Sepsis Alliance

*Deirdre J. Lyell, MD
Chair and Principal Investigator, CMQCC

***Elliott K. Main, MD**
Stanford University School of Medicine

***Courtney Martin, DO, MHA, FACOG**
Hoag Health

Emily McCormick, MPH, BSN, RNC-MNN, C-ONQS
Kaiser Permanente, Oakland

Sara McMannus, RN, BSN, MBA
Sepsis Alliance

Kate Menard, MD, MPH
University of North Carolina School of Medicine

***Ruhi Nath, MPH**
Stanford University School of Medicine

Gwendolyn Norman, PhD
Wayne State University School of Medicine

***Lori Olvera, DNP, RNC-OB, EFM-C**
Sutter Medical Center, Sacramento

Janelle Palacios, PhD, CNM
Kaiser Permanente, Oakland

Danielle M. Panelli, MD
Stanford University School of Medicine

Christina Perez, BSN
Santa Clara County Public Health Department

D'Angela Pitts, MD
Wayne State University School of Medicine

***Lauren Puckett, PharmD**
Stanford Children's Health

*Rashmi Rao, MD
UCLA Medical Center

Melissa G. Rosenstein, MD
University of California, San Francisco

***Christa Sakowski, MSN, C-EFM, CLE**
CMQCC

***Laurence Shields, MD**
Dignity Health

*Neil S. Silverman, MD
University of California, Los Angeles

Maria Small, MD, MPH
Duke University Health System

***Casey Smiley, MD**
Vanderbilt University Medical Center

Devin Smith, MSN, RN
Inter-Tribal Council of Michigan

Kendra Smith, PhD, MPH
Smith Research and Consulting LLC

Robert Sokol, MD
Emeritus Dean of the Wayne State University School of Medicine

***Beth Stephens-Hennessy, MSN, RNC-OB, EFM, CNS**
Sutter Medical Center, Sacramento

Kayleigh Summers, LCSW
The Birth Trauma Mama Therapy & Support Services

Maricar A. Tabios, LCSW
University of California, San Francisco

*Jourdan Triebwasser, MD, MA
University of Michigan Health

Maya Vasquez, MS, RN, IBCLC
San Francisco Department of Public Health

Deborah (Debbie) Villa, MSN, RN, APRN-CNS, RNC-OB, C-EFM
CommonSpirit Health

Jamie Vincent, MSN, APRN-CNS, RNC-OB, C-EFM, C-ONQS
John Muir Health

Charity S. Watkins, PhD
North Carolina Central University

*Kurt Wharton, MD
Corewell Health William Beaumont University Hospital

Sarahn Wheeler, MD
Duke University School of Medicine

Lyn X. Yasumura, MD
Kaiser Permanente, Baldwin Park

Conflict of Interest Statement

None of the toolkit authors report any conflicts of interest. One reviewer, Dr. Neil Silverman, was a consultant and speaker for Pfizer and Cepheid in the past but is not currently associated with the development or marketing of any Pfizer or Cepheid products.

Table of Contents

TABLE OF CONTENTS

TABLE OF CONTENTS

Executive Summary

Background

Sepsis is a leading cause of maternal morbidity and mortality. The Centers for Disease Control and Prevention notes that the proportion of U.S. pregnancy related deaths (during pregnancy and up to 1 year post-delivery) from sepsis (12.0%) is higher than the proportion of deaths from obstetric hemorrhage (11.1%) and hypertensive disorders (7.4%).[1] In a recent California maternal mortality committee report it was estimated that 63% of maternal deaths from sepsis had a good or strong chance to have been preventable.[2-3] Furthermore, for each maternal death, there are 50 women who experience life-threatening morbidity from sepsis.[4] This is concerning, given that prompt recognition and rapid treatment of pregnant and postpartum women with sepsis usually results in good outcomes in this young and generally healthy population. Physiological changes of pregnancy can mimic signs of sepsis (e.g. elevated heart rate, lower blood pressure and higher white blood cell count). Labor can further impact these physiologic parameters and significantly raise lactic acid levels.[5] As a result, the national adult sepsis criteria are not satisfactory for the obstetric population.[6-7] Sepsis may be caused by many different infections (Table 1) which can make the clinical scenario more complex.[6,8]

Table 1. Leading Causes of Maternal Sepsis

Antepartum	Intrapartum/ Immediate Postpartum	Post-discharge
Septic abortion	Chorioamnionitis/ intraamniotic infection	Pneumonia/influenza
Chorioamnionitis/ intraamniotic infection	Endometritis	Pyelonephritis
Pneumonia/influenza	Pneumonia/influenza	Wound Infection/ necrotizing fasciitis
Pyelonephritis	Pyelonephritis	Mastistis
Appendicitis	Wound Infection/ necrotizing fasciitis	Cholecystitis

Previous CMQCC clinical quality improvement toolkits for hemorrhage and hypertension have been instrumental in driving reductions in maternal mortality and morbidity from these causes, and there are similar opportunities for improving outcomes for women who experience maternal sepsis.

Maternal Sepsis or Obstetric Sepsis?

Maternal sepsis and obstetric sepsis are widely used interchangeably in the medical literature, but may have different connotations. Maternal sepsis clearly indicates pregnancy, but some observers may not include sepsis in the postpartum period or sepsis from non-pregnancy direct causes such as pneumonia. Providers in the Emergency Department, for example, might misinterpret obstetric to refer only to obstetric etiologies. Obstetric sepsis is meant to include any sepsis for a patient during pregnancy, delivery, and postpartum periods. In this toolkit, we will use maternal sepsis and obstetric sepsis interchangeably to refer to sepsis of all causes during pregnancy and postpartum.

Sepsis Toolkit Revision

The publication of the first edition of the "Improving Diagnosis and Treatment of Maternal Sepsis - A CMQCC Quality Improvement Toolkit" (January 2020) was immediately followed by the COVID-19 pandemic, which led to an increased focus on infectious diseases during pregnancy. Since that edition, many clinical practices have changed. Large studies on screening strategies (involving over a half million patients) identified the strengths and limitations for screening,[9,10] new and improved antibiotics were introduced to obstetrics, Infectious Diseases Society of America's sepsis guidelines were updated,[11] and national obstetric organizations became focused on sepsis in pregnant and postpartum patients.[8,12] In 2021, Dr. Melissa Bauer (Duke University) and Dr. Elliott Main (Stanford University) received a National Institutes of Health (NIH) cooperative agreement to plan and develop a two-state (Michigan and California) community co-designed implementation Collaborative focused on maternal sepsis.[13] This supported the creation of tools for patient education, advocacy, support after delivery, and community engagement. These tools combined with the practical experiences of a large multi-hospital QI collaborative, as well as the changes occurring over the last 5 years mentioned above, became the key elements for the complete revision of this Toolkit. With NIH support we are able to create a resource that is openly available to everyone across the country and the world.

At the start of this process, we created a multi-disciplinary Taskforce from both Michigan and California that included clinicians, community members, and patients with lived experience. Members of the Taskforce have guided the development of resources, the Collaborative, and the revision of the Toolkit. The Taskforce guided a series of qualitative studies[14,15] involving both patients and clinicians that greatly influenced our work. We are pleased to be able to present the cumulative work of many in this Toolkit.

The goal of this Toolkit is to guide and support obstetrical care providers, hospitals, and supporting organizations in implementing methods for timely recognition of sepsis and for an organized, evidence-based response for this life-threatening condition. As we discovered, many of the resources developed for the collaborative and in the Toolkit are more widely applicable and will be useful for addressing many forms of severe maternal morbidities. These include broad implementation of Maternal Urgent Warning Signs, patient advocacy support, and clinician listening tips. In addition, we added important chapters on support after a severe maternal event, addressing support for birth trauma and connecting with community and patient advocates. Key steps to create linkages outside of the hospital are outlined. Implementation of this toolkit is intended to improve outcomes for all levels of birthing facilities.

References

1. Petersen EE, Davis NL, Goodman D, Cox S, Mayes N, Johnston E, Syverson C, Seed K, Shapiro-Mendoza CK, Callaghan WM, Barfield W. Vital Signs: Pregnancy-Related Deaths, United States, 2011-2015, and Strategies for Prevention, 13 States, 2013-2017. MMWR Morb Mortal Wkly Rep. 2019 May 10;68(18):423-429. doi: 10.15585/mmwr.mm6818e1. PMID: 31071074.
2. The California Pregnancy-Associated Mortality Review. Report from 2002-2007 Maternal Death Reviews. Sacramento: California Department of Public Health, Maternal, Child and Adolescent Health Division. 2017 available at: https://www.cdph.ca.gov/Programs/CFH/DMCAH/Pages/PAMR.aspx
3. Bauer ME, Lorenz RP, Bauer ST, et al. Maternal deaths due to sepsis in the state of Michigan, 1999-2006. Obstet Gynecol 2015 Oct;126(4):747-52.
4. Acosta CD, Kurinczuk J, Lucas DN, et al. Severe Maternal Sepsis in the UK, 2011-2012: A National Case-Control Study. PLoS Med. 2014 Jul 8; 11(7):e1001672.
5. Bauer ME, Balistreri M, MacEachern M, et al. Normal Range for Maternal Lactic Acid during Pregnancy and Labor: A Systematic Review and Meta-Analysis of Observational Studies. Am J Perinatol 2019 Jul;36(9):898-906.
6. Bauer ME, Housey M, Bauer ST, et al. Risk Factors, Etiologies, and Screening Tools for Sepsis in Pregnant Women: A Multicenter Case-Control Study. Anesth Analg 2018 Aug 29.
7. Singer M, Deutschman CS, Seymour CW. The Third International Consensus Definitions for Sepsis and Septic Shock (Sepsis-3). JAMA. 2016;315(8):801-810.
8. Shields AD, Plante LA, Pacheco LD, Louis JM. Society for Maternal-Fetal Medicine Consult Series #67: Maternal sepsis. Am J Obstet Gynecol. 2023 Sep;229(3):B2-B19. doi: 10.1016/j.ajog.2023.05.019.
9. Main EK, Fuller M, Kovacheva VP, Elkhateb R, Azar K, Caldwell M, Chiem V, Foster M, Gibbs R, Hughes BL, Johnson R, Kottukapally N, Cortes MS, Rosenstein MG, Shields LE, Sudat S, Sutton CD, Toledo P, Traylor A, Wharton K, Bauer ME. Performance Characteristics of Sepsis Screening Tools During Delivery Admissions. Obstet Gynecol. 2024 Mar 1;143(3):326-335. doi: 10.1097/AOG.0000000000005477
10. Bauer ME, Fuller M, Kovacheva V, Elkhateb R, Azar K, Caldwell M, Chiem V, Foster M, Gibbs R, Hughes BL, Johnson R, Kottukapally N, Rosenstein MG, Cortes MS, Shields LE, Sudat S, Sutton CD, Toledo P, Traylor A, Wharton K, Main E. Performance Characteristics of Sepsis Screening Tools During Antepartum and Postpartum Admissions. Obstet Gynecol. 2024 Mar 1;143(3):336-345. doi: 10.1097/AOG.0000000000005480.
11. Evans L, Rhodes A, Alhazzani W, et.al. Surviving Sepsis Campaign: International Guidelines for Management of Sepsis and Septic Shock 2021. Crit Care Med. 2021 Nov 1;49(11):e1063-e1143. doi: 10.1097/CCM.0000000000005337. PMID: 34605781.
12. Bauer ME, Albright C, Prabhu M, Heine RP, Lennox C, Allen C, Burke C, Chavez A, Hughes BL, Kendig S, Le Boeuf M, Main E, Messerall T, Pacheco LD, Riley L, Solnick R, Youmans A, Gibbs R. Alliance for Innovation on Maternal Health: Consensus Bundle on Sepsis in Obstetric Care. Obstet Gynecol. 2023 Sep 1;142(3):481-492. doi: 10.1097/AOG.0000000000005304.
13. NICHD: UG3 and UH3 HD108053 Large-scale Implementation of Community Co-led Maternal Sepsis Care Practices to Reduce Morbidity and Mortality from Maternal Infection
14. Smith KL, Main E, Bauer ME; Maternal Sepsis Community Leadership Board. Moving from Principle to Practice: A Researcher's Guide to Co-Leading Engaged Research with Community Partners and Patients with Lived Experience to Reduce Maternal Mortality and Morbidity for Maternal Sepsis. Matern Child Health J. 2024 Jun 18. doi: 10.1007/s10995-024-03954-y.
15. Bauer ME, Perez SL, Main EK, Norman GS, Fish LJ, Caldwell MA, Allen C, Hughes BL, Gibbs RS, Smith KL. Near-miss and maternal sepsis mortality: A qualitative study of survivors and support persons. Eur J Obstet Gynecol Reprod Biol. 2024 Aug;299:136-142.

Introduction

Clinical quality improvement toolkits for hemorrhage and hypertension have been instrumental in driving reductions in maternal mortality and morbidity, and there are similar opportunities for improving outcomes for those who experience maternal sepsis. We have created simple and practical approaches to care that make adoption of CMQCC Toolkits much more likely to succeed. Here we present a recently validated two-step approach for the diagnosis of maternal sepsis. In addition, we provide practical implementation aids for support bundles, antibiotic choices, and navigation through the Centers for Medicare and Medicaid Services (CMS) Sepsis-1 measure while still meeting the national Sepsis-3 definitions.

What is new is this edition?

We revised the structure of the Toolkit to follow the "5-R" framework established by the American College of Obstetricians and Gynecologists Alliance for Innovation on Maternal Heath (AIM).[1] The "5-Rs" refer to Readiness, Recognition, Response, Reporting and System Learning, and Respectful and Supportive Care. We have also applied this framework to other recent editions of CMQCC Toolkits and extended the focus of QI efforts to the periods before and after the actual event.

Readiness. We used the planning phase of National Institutes of Health (NIH) funding[2] to interview patients, community advocates, and clinicians (nurses, midwives, and physicians) about barriers to sepsis care.[3] This led to the creation of patient education strategies and tools to encourage self-advocacy and better listening by clinicians. These are included in the Readiness section together with a chapter on preparedness for small and low resource facilities.

Recognition. During the planning phase we analyzed data from approximately a half million inpatient electronic heath records from over 70 hospitals spread throughout the United States with a focus on cases diagnosed with sepsis.[4,5] These data provided a strong evidence base for a revised two-step screening algorithm that has been supported by the American College of Obstetrics and Gynecology (ACOG) and the Society of Maternal Fetal Medicine (SMFM).[6] Critical for the success of the two-step algorithm is a robust bedside evaluation and this is discussed in depth with important clinical pointers. The advantages of harnessing the electronic health record (EHR), including nurse-driven pathways, are also presented.

Response. Treatment of sepsis is greatly expanded with in-depth discussion of the antibiotics newly being used in obstetrics, approaches to beta-lactam (penicillin) allergies, and the use of prophylactic antibiotics in obstetrics. An expanded section on chorioamnionitis treatment is also presented. A chapter on care fundamentals now includes a discussion of the role of Rapid Response Teams and criteria for escalation of care.

Reporting and System Learning. The first chapter focuses on a reconciliation between Critical Care Society Consensus Sepsis-3 definition (requiring sepsis to have end-organ injury) and the CMS required hospital measure, SEP-1 (which defines sepsis as infection with SIRS vital sign abnormalities alone). This should be of immense value for hospital quality and safety departments. The next chapter expands a discussion of process, structure, and outcome measures to use while

implementing QI efforts for maternal sepsis. Detailed information on how to review individual cases during a quality improvement committee is also highlighted.

Respectful and Supportive Care. This section is entirely new and was driven by our combined patient-clinician leadership team recalling the lack of understanding and support in their post-sepsis care. The first chapter focuses on support for patients following a severe maternal event (SME) including "words not to say" with alternatives. Also included is a formal sit-down discussion with the patient and family as to what happened and what to expect next, including a discussion of follow-up needs. The importance of community engagement during care redesign and quality improvement projects is presented.

An additional advantage of this version of the Toolkit is that it has been field tested by a large-scale QI Collaborative involving hospitals in two states (Michigan and California). This has ensured that the tools have undergone use testing in a variety of hospital settings.

References

1. Alliance for Innovation on Maternal Heath (AIM), American College of Obstetricians and Gynecologists. https://saferbirth.org/
2. NICHD: UG3 and UH3 HD108053 Large-scale Implementation of Community Co-led Maternal Sepsis Care Practices to Reduce Morbidity and Mortality from Maternal Infection
3. Bauer ME, Perez SL, Main EK, Norman GS, Fish LJ, Caldwell MA, Allen C, Hughes BL, Gibbs RS, Smith KL. Near-miss and maternal sepsis mortality: A qualitative study of survivors and support persons. Eur J Obstet Gynecol Reprod Biol. 2024 Aug;299:136-142.
4. Main EK, Fuller M, Kovacheva VP, Elkhateb R, Azar K, Caldwell M, Chiem V, Foster M, Gibbs R, Hughes BL, Johnson R, Kottukapally N, Cortes MS, Rosenstein MG, Shields LE, Sudat S, Sutton CD, Toledo P, Traylor A, Wharton K, Bauer ME. Performance Characteristics of Sepsis Screening Tools During Delivery Admissions. Obstet Gynecol. 2024 Mar 1;143(3):326-335. doi: 10.1097/AOG.0000000000005477
5. Bauer ME, Fuller M, Kovacheva V, Elkhateb R, Azar K, Caldwell M, Chiem V, Foster M, Gibbs R, Hughes BL, Johnson R, Kottukapally N, Rosenstein MG, Cortes MS, Shields LE, Sudat S, Sutton CD, Toledo P, Traylor A, Wharton K, Main E. Performance Characteristics of Sepsis Screening Tools During Antepartum and Postpartum Admissions. Obstet Gynecol. 2024 Mar 1;143(3):336-345. doi: 10.1097/AOG.0000000000005480.
6. Shields AD, Plante LA, Pacheco LD, Louis JM. Society for Maternal-Fetal Medicine Consult Series #67: Maternal sepsis. Am J Obstet Gynecol. 2023 Sep;229(3):B2-B19. doi: 10.1016/j.ajog.2023.05.019.

Readiness

This section is designed to aid clinicians, nurse leaders, and quality leads in preparing for the implementation of the actions recommended in the following sections: Recognition, Response, Reporting and System Learning, and Respectful and Supportive Care. Only general issues are covered here as the reader is referred to those sections for details of care. Highlights covered include patient and clinician educational resources and special considerations for small and rural facilities.

In this section you will find the following chapters:

- Obstetric Sepsis Educational Resources
- Preparedness Considerations for Low-Resource Hospitals and Emergency Departments

Obstetric Sepsis Educational Resources

Elliott Main, MD, Stanford University School of Medicine
Melissa Bauer, DO, Duke University School of Medicine

Key Principles

1. Shared education documents create a shared mental model for communications between patients and clinicians.
2. Patient education is critical for early identification of sepsis.
3. Patient stories are invaluable for sensitizing clinicians of all disciplines to patient perspectives and critical importance of thorough and empathetic listening.

Introduction

Studies have shown that most maternal deaths occur due to delays in recognition, treatment, and escalation of care.[1,2,3] An important factor in these delays is the lack of patient understanding of key symptoms to watch for. Utilizing standardized warning signs education is helpful in teaching patients what warning signs to note and when to seek medical attention. Typically, education on these warning signs has been provided at the time of discharge following delivery, which is both too late for antenatal complications and at a time when the patient and family are overwhelmed with information. Additionally, standard discharge education handouts may be lost or accidentally discarded.

Specific Resources for Patients

Our Patient and Community Leadership Board identified two exceptional resources.

(1) The Alliance for Innovation in Maternal Healthcare (AIM) and the American College of Obstetricians and Gynecologists (ACOG) have developed Urgent Maternal Warning Signs (UMWS) graphic educational tools, now available in over 80 languages.[4] These tools can be provided to patients either physically in printed format or electronically during prenatal care, at the time of hospital discharge, and/or during the weeks postpartum. They can also be printed and posted on the walls of obstetric triage units, birthing suites, postpartum rooms, and doctor's offices. A novel approach to remedy the problem of lost paper resources has been the use of a QR code to quickly and easily add a tile with UMWS on the patient or partner's phone.

(2) The AWHONN POST-BIRTH Warning Signs[5] tool. This educational graphic focuses on nine key symptoms in the postpartum period that are either emergencies or need urgent attention. It is primarily used for predischarge education and is available in over 20 languages. It can be purchased as a poster or kitchen magnet on the AWHONN website for a modest cost.

Respectful and Supportive Care requires mechanisms for patients and families to advocate for themselves and to be listened to. Often patients know something is wrong and seek care early but have

difficulty obtaining a thorough evaluation. Patients who have experienced a Severe Maternal Event (SME) often report that their concerns were met with dismissal and their symptoms often described as "normal" for pregnancy or postpartum. This type of experience can result in significant delays in care, numbering in days and ultimately effecting patient outcomes. Studies show many patients report making at least two attempts to seek care (e.g., phone calls to the doctor's office or visit to the emergency department) before returning to the hospital and finally being admitted.[2,6] Regrettably, people of color and those who are not fluent in English report experiencing treatment bias during presentation with symptoms of a critical illness at substantially higher rates than Caucasian patients.[7] The promotion, full acceptance, and normalization of patient self-advocacy is an important step towards creating equitable care environments. Focus on improved listening to patients by clinicians should be included as part of this goal.

Providing Urgent Maternal Warning Signs (UMWS) educational tools assists in providing patients the language to self-advocate when they feel their symptoms during pregnancy or postpartum are being dismissed. Utilizing UMWS materials created by national organizations lends further credibility of patient's reported symptoms when interacting with hospital staff. UMWS documents can be an important support for patients when they feel they are not being heard or believed.

Advocacy Tips for Patients: Providers should promote patient advocacy by giving patients examples of advocacy language, resources and coaching on how to self-advocate in a health care environment. For example, The Sepsis Community Leadership Board co-developed an educational one-page document that provides example phrasing and advocacy tips for effective communication[6] (see chapter Educational Tools and Sample Resources).

Warning Signs Follow-up Guide: As a pairing to the Advocacy Tips for Patients and Urgent Maternal Warning Signs, guidance was developed for health professionals and, in particular, triage staff. This one-page tool was designed to prompt follow-up questions, identify action items, and remind staff of red flags that deserve special attention (see chapter Educational Tools and Sample Resources).

Introducing these tools prenatally and reinforcing them throughout the pregnancy care continuum fosters trust between providers and patients, encouraging birthing persons to use their voice in health care settings. It should be apparent that these patient education materials have a much broader application beyond sepsis. Indeed, they are designed to serve as education on warnings signs for all severe maternal morbidities. As such, they are very important for obstetric unit adoption.

Obstetric Sepsis Educational Resources for Clinicians

There have been several comprehensive reviews on obstetric sepsis published in the recent years that are highly recommended.[8,9] The ACOG/AIM Consensus Bundle "Sepsis in Obstetric Care" provides excellent background and quality improvement insights.[10] The AIM website has great resources for implementing the Sepsis Bundle.[11] Several of the lead authors of this toolkit participated in developing these resources and have been able to coordinate messaging as much as possible.

Recommendations (Level of Evidence)

1. Patient education materials that cover key symptoms related to severe maternal morbidities (such as Urgent Maternal Warning Signs) should be widely shared, ideally at multiple points during pregnancy/postpartum. (LEVEL B)

2. Videos featuring patient stories are very powerful tools for stressing the importance of listening and should be widely utilized. (LEVEL C)
3. "Advocacy Tips for Patients" and "Warning Signs Follow-up Guide for Health Care Professionals" have been useful tools for improved patient-healthcare team communication and are recommended for broad use. (LEVEL C)

Educational Tools and Sample Resources

1. ACOG/AIM Urgent Maternal Warning Signs
2. AWHONN POST-BIRTH Warning Signs
3. Appendix A: Warning Signs Follow-up Guide for Health Care Professionals
4. Appendix B: Advocacy Tips for Patients and Families (English)
5. Appendix C: Advocacy Tips for Patients and Families (Spanish)
6. MI AIM Sepsis Collaborative Patient Story
7. Sepsis Alliance: Pregnancy and Childbirth - Patient information and patient stories
8. Begin Again Foundation Patient Stories
9. American College of Obstetricians and Gynecologists/Alliance for Innovation in Maternity Care. AIM: Sepsis in Obstetric Care

References

1. Geller SE, Koch AR, Martin NJ, Rosenberg D, Bigger HR; Illinois Department of Public Health Maternal Mortality Review Committee Working Group. Assessing preventability of maternal mortality in Illinois: 2002-2012. Am J Obstet Gynecol. 2014 Dec;211(6):698.e1-11.
2. Seacrist MJ, Morton CH, VanOtterloo LR, Main EK. Quality Improvement Opportunities Identified Through Case Review of Pregnancy-Related Deaths from Sepsis. J Obstet Gynecol Neonatal Nurs. 2019 May;48(3):311-320. doi: 10.1016/j.jogn.2019.02.007.
3. Seacrist MJ, VanOtterloo LR, Morton CH, Main EK. Quality Improvement Opportunities Identified Through Case Review of Pregnancy-Related Deaths from Obstetric Hemorrhage. J Obstet Gynecol Neonatal Nurs. 2019 May;48(3):288-299. doi: 10.1016/j.jogn.2019.03.002.
4. Alliance for Innovation on Maternal Health (AIM)-Urgent Maternal Warning Signs (2024). https://saferbirth.org/aim-resources/aim-cornerstones/urgent-maternal-warning-signs-2/
5. Association of Women's Health, Obstetric, and Neonatal Nurses. Post Birth Warning Signs. https://www.awhonn.org/education/hospital-products/post-birth-warning-signs-education-program/
6. Bauer ME, Perez SL, Main EK, Norman GS, Fish LJ, Caldwell MA, Allen C, Hughes BL, Gibbs RS, Smith KL. Near-miss and maternal sepsis mortality: A qualitative study of survivors and support persons. Eur J Obstet Gynecol Reprod Biol. 2024 Aug;299:136-142. doi: 10.1016/j.ejogrb.2024.05.038.
7. Wang E, Glazer KB, Sofaer S, Balbierz A, Howell EA. Racial and Ethnic Disparities in Severe Maternal Morbidity: A Qualitative Study of Women's Experiences of Peripartum Care. Womens Health Issues. 2021 Jan-Feb;31(1):75-81. doi: 10.1016/j.whi.2020.09.002.
8. Shields AD, Plante LA, Pacheco LD, Louis JM; SMFM Publications Committee. Society for Maternal-Fetal Medicine Consult Series #67: Maternal sepsis. Am J Obstet Gynecol. 2023 Sep;229(3):B2-B19. doi: 10.1016/j.ajog.2023.05.019.
9. Pacheco LD, Bauer ME, Sepsis and Septic Shock during Pregnancy and Postpartum. Obstet Gyencol. 2025 in press
10. Bauer ME, Albright C, Prabhu M, Heine RP, Lennox C, Allen C, Burke C, Chavez A, Hughes BL, Kendig S, Le Boeuf M, Main E, Messerall T, Pacheco LD, Riley L, Solnick R, Youmans A, Gibbs R. Alliance for Innovation on Maternal Health: Consensus Bundle on Sepsis in Obstetric Care. Obstet Gynecol. 2023 Sep 1;142(3):481-492. doi: 10.1097/AOG.0000000000005304. PMID: 37590980;
11. American College of Obstetricians and Gynecologists/Alliance for Innovation in Maternity Care. AIM: Sepsis in Obstetric Care. https://saferbirth.org/psbs/sepsis-in-obstetric-care/

Preparedness Considerations for Low-Resource Hospitals and Emergency Departments

Emily McCormick, MPH, BSN, RNC-MNN, C-ONQS, Kaiser Permanente, Oakland
Lori Barnes, BSN, RNC, CCE, C-EFM, Munson Healthcare Cadillac Hospital
Holly Champagne DNP, RNC-OB, CNS
Melissa G. Rosenstein, MD, University of California, San Francisco
Christa Sakowski, MSN, C-EFM, CLE, CMQCC Clinical Lead, Stanford University School of Medicine

Key Principles

1. Communication and collaboration between departments and disciplines is essential to providing optimal care. All staff need a clear picture of response times, and teams should be mobilized early for high-risk situations.
2. The Emergency Department (ED) and rural locations require setting-specific organizational/regional structures to assess and care for obstetric sepsis patients.
3. Routine assessment for sepsis, including atypical presentation of sepsis, such as pain, must be included in telephone triage and ED triage standard work when speaking to pregnant or recently pregnant patients.

Background

Rural and low-resource obstetrics units and emergency department are settings that deserve special consideration when designing obstetric sepsis processes and building care teams. Emergency departments that operate in facilities that do not offer obstetric services may experience additional challenges that should be considered.

While data are conflicting on whether low-volume hospitals have higher incidences of maternal morbidity, it is clear that these facilities face special challenges and require additional planning to ensure high-quality care.[1]

Multidisciplinary and multi-departmental collaboration is critical to facilitating the care for patients. Availability of resources such as personnel, equipment, and advanced support may pose unique challenges for small hospitals. Additional factors may include distance from accepting facilities that provide advanced levels of care, availability of transfer resources, and weather conditions that can affect transport from the site. These hospitals should proactively identify potential challenges and

modify processes to optimize outcomes for their patients. Patient condition may warrant a higher level of maternal care where access to appropriate resources are readily available. The less resourced hospital should identify transfer resources and put mechanisms in place in preparation for any future needs, including a transfer agreement with a higher-level facility. The transfer agreement should include pregnant women being categorized as a high priority transfer. In California, consider utilizing a Regional Perinatal Programs of California (RPPC) coordinator to help facilitate these relationships.

Rural communities in California face significant income and transportation issues that can affect access to prenatal care and urgent medical services. Median income is 10% lower for rural households compared to urban households.[2] According to the Public Policy Institute of California, rural Californians are much more dependent on cars due to the lack of public transit.[2] This combined with significant geographic distance to healthcare providers can be an obstacle to accessing needed services.

Maternity Care Deserts in California

The March of Dimes classified at least 15 counties as "Maternity Deserts" or "Limited Access Areas" based on the availability of providers, availability of birthing hospitals, and health insurance coverage.[3] Reduced access – and the associated poor outcomes – disproportionately affect people of color, people in low-income communities, and people in rural areas. Limited access to care has an additive effect on outcomes when combined with the unequal social conditions that exist in these communities, such as food insecurity, dangerous environmental exposures, and housing deficiencies.[4] As Taylor et al. so aptly states in their policy blueprint, "ensuring access to comprehensive, affordable, high-quality health care is vital in the effort to eliminate racial disparities in maternal and infant mortality."[4]

Personnel

There may be limited nursing resources available in the labor and delivery unit, emergency department (ED), and general hospital operating room(s) (OR). Personnel may not always be in-house especially during nights, weekends, and holidays. Regardless of the size of the facility or personnel included, you must have a designated rapid response team (RRT) in place to respond to emergencies. This team is not generally made up of obstetric-specific clinicians, but those expected to respond need to be prepared to address the specific needs of this patient population, and simulation training to that effect should be implemented. Small units may find it appropriate to activate their RRT once any suspicion of serious infection is made to perform the bedside assessment and manage the initial steps of treatment. The focus should be on removing any delay in assessment and treatment. The strict use of the Sepsis in Obstetric Score and abnormal lab indicators should be used as a trigger for required consultation with an appropriate maternal level of care facility. See the Fundamentals in the Care of Sepsis During Pregnancy chapter for further discussion of this issue.

Contingency staffing is particularly important in small facilities where a limited number of staff are available. Consider all hospital personnel when creating this plan. A nursing supervisor or administrator may be able to assist with mobilizing personnel from other areas of the hospital, and may find space in the OR, post anesthesia care unit, or a bed in the intensive care unit (ICU) to best care for the patient.

READINESS

Medical-surgical nurses may be able to cross train to care for postpartum patients during an emergency while the obstetric nurses attend to the acute response of a severely ill patient. The recommendation is that a standard process for managing the unit and the patient requiring additional resources be developed. This process should be shared with all staff included and referred to consistently when challenges arise managing patients that require a higher level of care.

Anesthesia providers that also cover the main OR are not required to be in-house may not be able to attend to the labor and birth without a time delay. A clear and simple process to contact providers should be developed and practiced during drills. An organization chart with contact information that is correct and kept up to date is crucial and should be an assigned duty. It may be helpful to keep notification policies and call schedules readily accessible.

Established and streamlined access to a Maternal Fetal Medicine (MFM) specialists for consultation and acceptance of patient transfer is paramount in settings with limited resources. These relationships should be fostered between facilities and formal transfer agreements should be created. This creates a strong relationship in which patient care delays are minimized.

Communication

The entire care team should have a shared mental model of the emergency resources available within the hospital. This is especially relevant in facilities utilizing locums providers that spend a limited amount of time at a particular facility. Dialogue regarding time frames needed for mobilization of equipment and personnel should occur prior to an emergency. All hospital personnel should be aware of obstetric-specific codes paged overhead, and which resources need to be mobilized in response.

Offsite providers should be notified of evolving situations in order to actively participate in the development of a plan of care and the decision to be present at the bedside. Identification and management of serious infection and the communication that goes along with it provide the mobilization of effective action steps while awaiting confirmation of end organ injury (EOI). When consulting with MFM specialists who do not regularly or ever practice on their unit, they should be reminded of the resources and response capabilities of the facility when the considering appropriate interventions. All involved parties (including the patient and her support system) should have clear expectations regarding response.

Limited access to Outpatient Pharmacy and other barriers

Lack of access to an after-hours outpatient pharmacy is a reported challenge of some rural sites. It is recommended to continue the observation and treatment period until the patient can easily access antibiotics after discharge.

When discharge barriers are identified, consideration should be given to early consultation with the hospital social work or case management team during the ED visit. This may assist the ED with planning and patient access to community resources, such as medication expense coverage or transportation, and may allow the ED to discharge the patient when appropriate without the need for an extended stay due to lack of readily available outpatient treatment.

Emergency readiness and training

If a woman presents with signs of serious infection in the ED, early identification of sepsis is important, and personnel should provide timely treatment with antibiotics and fluids. The critical differences of diagnosing sepsis in obstetric patients, versus the general adult population, must be emphasized during training. Thorough education, including screening parameters and sources of infection in this population, should be provided and reviewed. Critical pieces of the Toolkit can be assembled for quick reference in a physical or virtual format. Prioritizing the care of obstetric patients, especially in emergency departments that do not operate in facilities that house obstetrics departments, is useful in reducing the time to identification and treatment of obstetric sepsis. It is important to remember that the standard Emergency Severity Index (ESI) tool employed by ED departments as a patient triage tool does not account for the alterations in maternal physiology associated with pregnancy and therefore should not be used as sole consideration when assigning prioritization of care. Inclusion of the maternal early warning systems (e.g CMQCC or MEWT) criteria should be utilized along with the standard triage process for all women presenting during pregnancy or within the first three days postpartum.[5] As noted in Screening and Diagnosis, in a large study published in 2023, using pregnancy adjusted criteria before 20 weeks and after 3 days postpartum led to reduced sensitivity and would miss patients. We recommend the ED use adult screening criteria before 20 weeks and 3 days postpartum (after delivery discharge) to screen patients.

It should be noted that providers should have a high suspicion of infection in postpartum patients presenting with pain – abdominal or other soft tissue – even in the absence of other symptoms. This has been found to be an area of delay in diagnosis and progression to obstetric sepsis. Utilizing signs that prompt patients to report that they are or have recently been pregnant in EDs, along with including this question in initial triage assessment may be helpful in identifying patients at increased risk for pregnancy-associated complications (see chapter Educational Tools and Sample Resources).

If the patient is to be transported out of the facility, drawing baseline labs to assess for end-organ injury would be a valuable timesaver for providing necessary advanced treatment upon arrival at the receiving facility. The CMQCC Obstetric Serious Infection/Sepsis Evaluation Flow Chart should be available physically or digitally in emergency departments to guide evaluation and assist in providing timely intervention (see chapter Educational Tools and Sample Resources).

All emergency department care providers should go through routine training to be prepared for the timely assessment and treatment of severe infection and obstetric sepsis (see chapter Educational Tools and Sample Resources). Participation in simulation exercises that identify the needs of their department when caring for obstetric patients, including communication with obstetric or intensivist providers as appropriate. High-fidelity simulators may not be available at small or low-resource facilities; however, they are not necessary. Conducting in situ drills and simulations is beneficial and valuable. Clearly defining roles and role-specific tasks during simulation may help save time and facilitate productive communication during an obstetric emergency. All events should end with a debrief to identify potential areas of improvement or to reinforce the effectiveness of current processes. Debriefing is a required piece of this training and cannot be omitted, as there will be a very low incidence of actual events to learn from and correct variations in standardized protocol.

READINESS

If non-OB providers and support staff are expected to respond to obstetric emergencies, ensure that they are included in obstetric simulations and drills, and can easily access and understand care management algorithms that are available and understandable to a provider outside of the obstetric specialty. Ensure that the care plan is followed even as the care team grows. Similarly, establish contingency plans if personnel are not available.

Telehealth

Telehealth has emerged as an important adjunct for the outpatient care of obstetric patients in rural areas. Its use was pioneered by the Maternal Fetal Medicine program at the University of Arkansas,[6] but Telehealth became widespread during the COVID-19 pandemic. A recent Society for Maternal Fetal Medicine review identified the advantages, barriers, and policy needs for Telehealth in obstetrics and is highly recommended.[7]

Telehealth Guidance

Rural providers should consider using video chats, phone calls, secure messaging, and remote patient monitoring. Providers should have the advantage of consulting physicians that may be remote from their rural locations to provide support in the care of complex patients.

The Medical University of South Carolina provides a maternal-fetal telehealth program that offers specialty care to women who have high-risk pregnancies. This program pairs maternal-fetal medicine specialists with local providers to manage the care of women with high-risk pregnancies via video consultation, allowing real-time conversations between the specialist and the local provider.[8]

Recommendations (Level of Evidence)

1. Convene a multidisciplinary, multi-departmental team to evaluate readiness for managing obstetric sepsis. (LEVEL C)
2. Consider all potential personnel resources within the facility and include departments such as the OR in planning response strategies. It is beneficial to include stakeholders from facilities you transfer to in an effort to streamline care. (LEVEL C)
3. Conducting routine inter-departmental obstetric drills may assist the team in developing a shared mental model of response times, identifying opportunities for system improvement, and ensuring there is adequate cross training in cases of emergency or unexpected decompensation. (LEVEL C)
4. Telehealth offers benefits for outpatient care of high-risk OB patients and is worth the efforts to overcome barriers. (LEVEL C)

Educational Tools and Sample Resources

1. Appendix D: Obstetric Serious Infection/Sepsis Evaluation Flow Chart
2. Appendix E: Teaching Points for Obstetric Serious Infection/Sepsis Evaluation Flow Chart
3. Appendix W: Sample: UC Davis Health Maternal Sepsis Drill Scenario
4. Appendix GG: Stop Sign Graphic
5. Health Resources and Services Administration (HRSA): Telehealth.HHS.gov - A Best Practice Guide
6. Association of Maternal and Child Health Programs: Quality Improvement in Maternity Care via Project ECHO

References

1. Mark P. Hehir, Cande V. Ananth, Jason D. Wright, Zainab Siddiq, Mary E. D'Alton, Alexander M. Friedman, Severe maternal morbidity and comorbid risk in hospitals performing <1000 deliveries per year, American Journal of Obstetrics and Gynecology, Volume 216, Issue 2, 2017, Pages 179.e1-179.e12, ISSN 0002-9378, https://doi.org/10.1016/j.ajog.2016.10.029.
2. Public Policy Institute of California. Rural California Fact Sheet. https://www.ppic.org/publication/rural-california/
3. March of Dimes. Nowhere to go: Maternity Care Deserts in California. 2018. https://drive.google.com/file/d/1aeuwCo87huSbC5gDS4OGW1Ivh5sgRGnA/view?usp=sharing
4. Taylor J, Novoa C, Hamm K, Phadke S. Eliminating racial disparities in maternal and infant mortality. A comprehensive policy blueprint. 2018. https://www.americanprogress.org/article/eliminating-racial-disparities-maternal-infant-mortality/
5. Bauer ME, Fuller M, Kovacheva V, Elkhateb R, Azar K, Caldwell M, Chiem V, Foster M, Gibbs R, Hughes BL, Johnson R, Kottukapally N, Rosenstein MG, Cortes MS, Shields LE, Sudat S, Sutton CD, Toledo P, Traylor A, Wharton K, Main E. Performance Characteristics of Sepsis Screening Tools During Antepartum and Postpartum Admissions. Obstet Gynecol. 2024 Mar 1;143(3):336-345. doi: 10.1097/AOG.0000000000005480.
6. Lowery C. Intro to Telemedicine and Connected Health in Obstetrics and Gynecology. Obstet Gynecol Clin North Am. 2020 Jun;47(2):xv-xvi. doi: 10.1016/j.ogc.2020.03.001. PMID: 32451025.
7. Society for Maternal-Fetal Medicine (SMFM); Kern-Goldberger AR, Malhotra T, Zera CA; SMFM Health Policy and Advocacy Committee. Electronic address: smfm@smfm.org. Society for Maternal-Fetal Medicine Special Statement: Utilizing telemedicine to address disparities in maternal-fetal medicine: a call to policy action. Am J Obstet Gynecol. 2024 May;230(5):B6-B11. doi: 10.1016/j.ajog.2023.11.001. Epub 2023 Nov 4. PMID: 37926134.
8. Medical University of South Carolina. Maternal Fetal Medicine. Retrieved from: https://muschealth.org/medical-services/womens/maternal-fetal-medicine

Recognition

This section is designed to aid clinicians, nurse leaders, quality and information technology (IT) leads in the value and design of medical and nursing care pathways for care of obstetric patients with serious infections and sepsis. Highlights include the revised "Obstetric Serious Infection/Sepsis Evaluation Flow Chart", a detailed look at the bedside evaluation within screening, and first-person advice on making the most of the electronic medical record (EMR) for rapid diagnosis and treatment.

In this section you will find the following chapters:

- Screening and Diagnosis of Sepsis
- Bedside Evaluation
- The Important Role of Nurse-Driven Care Pathways, Standing Orders, and Artificial Intelligence (AI) in the EMR for Obstetric Sepsis Management

Screening and Diagnosis of Sepsis

Elliott K. Main, MD, Stanford University School of Medicine
Melissa Bauer, DO, Duke University School of Medicine
Holly Champagne, DNP, RNC-OB, CNS, C-EFM, Kaiser Permanente Northern California
Julianne DeMartino, MD, FACOG, University Hospitals Cleveland Medical Center
Ronald Gibbs, MD, Stanford University School of Medicine
Courtney Martin, DO, MHA, Hoag Health
Lori Olvera, DNP, RNC-OB, EFM-C, Sutter Medical Center, Sacramento
Laurence Shields, MD, CommonSpirit Health
Beth Stephens-Hennessy, MSN, RNC-OB, EFM, CNS, Sutter Medical Center, Sacramento

Key Principles

1. Current multi-organization consensus (Sepsis-3) defines sepsis as life-threatening organ dysfunction caused by a dysregulated host response to infection.
2. All national and international organizations (ACOG, SMFM, WHO, FIGO, CDC) define maternal sepsis similarly, requiring end-organ injury related to an infection.
3. Current one-step sepsis screening tools, such as SIRS criteria, as used in the CMS measure SEP-1, perform poorly in pregnancy and should not be used for diagnosis.
4. Waiting for evidence of end-organ injury (Sepsis-3 definition) may delay critical treatments. This dilemma requires a new approach and new terminology for diagnosing obstetric sepsis.
5. This Taskforce recommends a two-step approach for the diagnosis of sepsis during pregnancy and postpartum to promote rapid treatment of serious infections and early evaluation for sepsis.

Defining Sepsis in Pregnancy

The definition of adult sepsis has evolved over the past thirty years. In 1992, a critical care consensus panel (Sepsis-1) developed the first standardized definition of sepsis as "infection plus evidence of systemic inflammatory response syndrome (SIRS)". Severe sepsis was defined as organ dysfunction.[1] This remained unchanged in 2002 following a second consensus panel. New data led to a third consensus panel in 2016 (Sepsis-3), which revised the definition of sepsis to"life-threatening organ dysfunction caused by a dysregulated host response to infection" and discarded SIRS as a criterion.[2]

In the setting of pregnancy, SIRS criteria have proven especially unsatisfactory. For example, > 90% of patients with chorioamnionitis meet standard adult SIRS criteria, while less than 5% actually have sepsis.[3] In 2017, a World Health Organization (WHO) formal statement declared that maternal sepsis should be defined as infection plus end-organ injury during pregnancy and up to 42 days postpartum. The WHO went on to specifically state that SIRS should not be used to define maternal sepsis.[4] (see Figure 1)

RECOGNITION

The American College of Obstetricians and Gynecologists (ACOG), the Society of Maternal Fetal Medicine (SMFM),[5] and the Centers for Disease Control and Prevention (CDC) have all recently defined maternal sepsis as infection with end-organ injury. The CDC also stated that obstetrics should be considered a special population akin to pediatrics for defining and reporting sepsis.[6] They recognize that obstetric and pediatric populations are not like adults in physiology, vital sign parameters, and response to infection, and as such screening tools and subsequent treatment should be tailored to these special populations. Centers for Medicare and Medicaid Services (CMS) remains the only major organization to continue using infection plus SIRS to define sepsis in their National Hospital Inpatient Quality Measures (SEP-1) and apply it to pregnancy.[7]

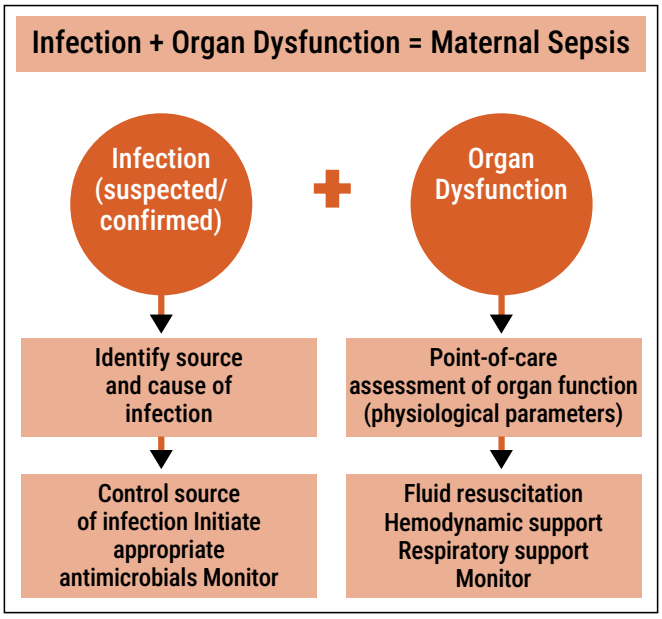


Figure 1. World Health organization (WHO) definition of Maternal Sepsis (2017)[4] endorsed by ACOG and SMFM

Table 1. Criteria for End-Organ Injury for Diagnosis of Maternal Sepsis

Organ System	Infection with SIRS/Abnormal Vital Signs
Cardiovascular	• SBP < 85 mmHg or MAP < 65mmHg or SBP decrease > 40 mmHg **OR** • Vasopressors required to stabilize BP
Respiratory	• New mechanical or non-invasive ventilation (e.g. CPAP, BiPAP) **OR** • O2 saturation < 92% OR O2 requirement
Coagulation	• Platelets < 100 x 109/L **OR** • INR > 1.5, or a PTT > 60 sec (PT and a PTT may not be routinely collected in OB)
Liver	• Bilirubin > 2 mg/dL
Renal	• Creatinine ≥ 1.2 mg/dL **OR** • Doubling of creatinine **OR** • Urine output < 60 cc over 2 hours (0.5 mL/kg/hour for 2 hours)
Mental status	• Appears toxic, confused, agitated, or unresponsive
Lactate	• Lactate is not a criterion of end organ injury in Sepsis-3 (except for septic shock, > 2mmol/L with persistent hypotension) but remains for SEP-1 measure > 2mmol/L when not in labor. (NOTE: Do not use lactate obtained during active labor through delivery and an hour postpartum). In Sepsis-3, lactate is a measure of severity rather than an indicator of end-organ injury

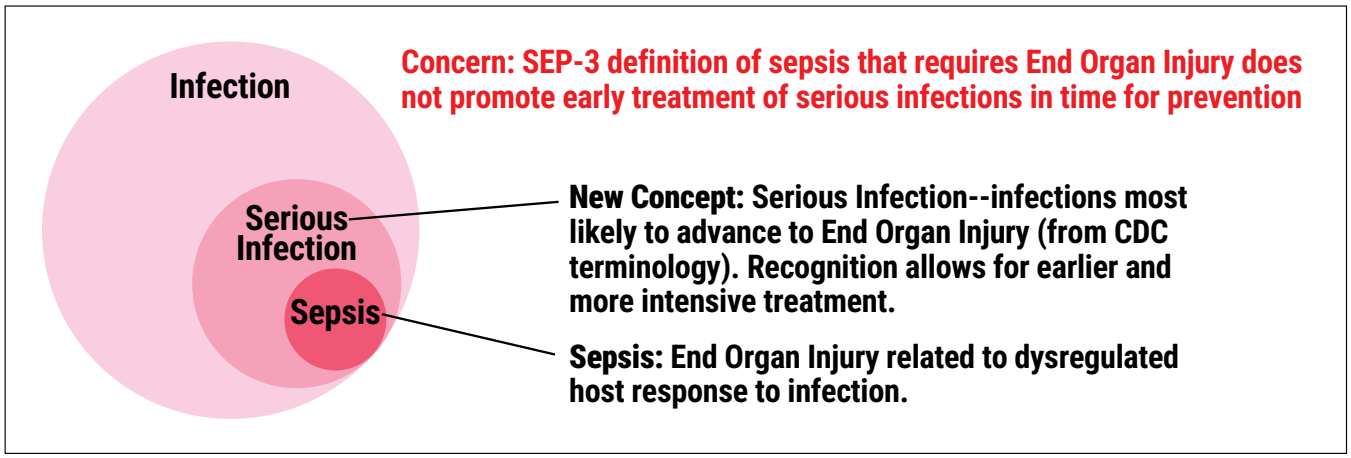
Another area that needs further alignment is the criteria for end organ injury, especially with regards to adjustments for pregnancy related physiologic changes. Criteria differ among Sepsis-3 SOFA score, CMS SEP-1 measure, WHO, and other organizations. Table 1 on the previous page draws from these organizations and represents a reasonable consensus of end-organ injury parameters, both clinical and laboratory, for use during pregnancy. However, it should be noted that few of these thresholds have been evaluated for pregnant persons and further research is needed to more precisely identify appropriate criteria for use during pregnancy and postpartum. Note that lactic acid, per Sepsis-3, is *not* used as a marker of end-organ injury but rather as an indicator of severity. In Sepsis-3, the definition of septic shock is persisting hypotension requiring vasopressors to maintain MAP > 65 mm Hg and having a serum lactate level > 2 mmol/L despite adequate volume resuscitation.[2] The exception is the use of lactic acid (> 4 mmol/L) in the diagnosis of septic shock. A more complete discussion of the interpretation of lactic acid results during labor will be provided later in this chapter.

Challenges of current sepsis definitions

Clinicians face a dilemma with defining sepsis for obstetric patients. A major downside of using SEP-1 criteria to define sepsis in obstetrics is the clear risk of overdiagnosis and overtreatment, especially in the setting of chorioamnionitis. An over-assignment of sepsis ICD-10 codes during pregnancy carries important ramifications. Sepsis codes are included in the definition of the new CMS Severe Obstetric Complications measure which is now required to be reported by all birthing hospitals. It is publicly reported as part of the Inpatient Quality Reporting system and in 2025 will become a key component of the Birthing Friendly designation. Hospitals that use SIRS (SEP-1) criteria to establish the diagnosis of maternal sepsis can double or triple their rate of Severe Obstetric Complications and may exclude themselves from achieving Birthing Friendly designation as well as overutilize system resources and increase costs. More detail on the SEP-1 measure is presented in Measuring Quality in the Care of Obstetric Sepsis/Sep-1 Measure. On the other hand, defining sepsis as infection plus end-organ injury has been criticized as it may delay aggressive sepsis treatment until end-organ injury is already present. Striking a balance – not over-diagnosing sepsis while simultaneously treating it early enough to minimize the risk of end organ injury – is the focus of the CMQCC two-step evaluation strategy.

In the 2025 revision of the CMQCC Obstetric Serious Infection/Sepsis Evaluation Flow Chart this concern is addressed by identifying those with infection and an abnormal vital sign screen (using the pregnancy adjusted criteria) as a “serious infection,” with recommendations for immediate initiation of antibiotics and a fluid challenge while performing a clinical bedside evaluation prior to sending laboratory tests for end-organ injury. This ensures rapid treatment, a balance of cost, and more accurate identification of those with end-organ injury (Figure 2). Language is important and in the screening flow chart the first step is carefully labeled as a screen for “serious infection.” The term “sepsis” is not used until end-organ injury is confirmed. This avoids language such as “sepsis screen positive” or “r/o sepsis” in the medical record which could be erroneously coded with the diagnosis of sepsis.

Figure 2. Terminology for Maternal Infections



It should be noted that fever is not required to diagnose obstetric infections or sepsis. Indeed, an important finding in a study of maternal deaths from sepsis was that 73% of patients presented with temperatures in the normal range and 25% never developed a fever.[8] Lack of fever may have led to delays in recognition and treatment.[9] ACOG has also released guidance stating that fever is not required for the diagnosis of intrauterine infection/chorioamnionitis in the setting of other signs and symptoms.[10] Attention to other vital signs and listening to patient's symptoms may prevent such cases from being overlooked.

"Wellness Bias" and "Normalization of Deviance" in Pregnancy Care:

Another challenge in identifying sepsis during pregnancy is a "wellness bias" among providers. "Wellness bias" is the unconscious tendency to assume "wellness" or health and disregard signs and symptoms that could suggest otherwise. In this instance, "wellness bias" results in a lower suspicion for infection or sepsis. This can lead to overlooking or minimizing concerns raised by patients, vital signs, or lab values. This is similar to the phenomenon called the "normalization of deviance," which is characterized by a gradual reduction of safety standards after a period of absence of any negative outcomes, reinforcing a suboptimal approach.[11] Classically this can include ignoring alarms, bypassing protocols or not using safety checklists.[12] Both of these phenomena are most commonly seen in pediatric and obstetric care, where the frequency of abnormal outcomes is low and patients are usually healthy. "Wellness bias" associated with pregnancy can be intertwined with unconscious biases toward marginalized groups and can add to disparities in diagnosis and treatment.

An Improved Approach to Screen for Obstetric Sepsis

In 2020, CMQCC's "Improving Diagnosis and Treatment of Maternal Sepsis" Toolkit introduced a screening approach using a pregnancy adjusted SIRS followed by testing for end-organ injury to complete the diagnosis.[13] This approach was based on earlier work by Shields and colleagues[14] in Dignity Health and unpublished data collected in Sutter Health. Recently, two large studies were published examining the optimal first step criteria, testing a range of published screening tools including SIRS, Maternal Early Warning Criteria (MEWC), Maternal Early Warning Trigger Tool (MEWT) and CMQCC and UKOSS pregnancy adjusted SIRS.[15,16] The criteria for each of the screening approaches is shown in Table 2. It should be noted that most of these criteria were developed to screen more broadly for severe maternal morbidities rather than specifically for obstetric sepsis.

Table 2. Vital Sign and WBC Criteria Used to Screen for Sepsis in Five Widely Used Tools [15]

	SIRS	Maternal serious infection screens		Maternal early warning screens (general maternal morbidity)		
Criteria	**SIRS any two**	**CMQCC any two**	**UKOSS any two**	**MEWC any one**	**MEWT (red) any one**	**MEWT (yellow) any two**
WBC (10^9 cell/L)	< 4 or > 12	< 4 or > 15	< 4 or > 17	< 4 or > 15		
Heart rate (beats/min)	> 90	> 110	> 100	< 50 or > 20	> 130	< 50 or > 10
Respiratory rate (breaths/min)	> 20	> 24	> 20	< 10 or > 24	> 30	> 24 or <10
Temperature (deg C)	< 36 or > 38	< 36 or > 38	< 36 or > 38	< 36 or > 38		< 36 or > 38
Pulse Oximetry (%)				< 95	< 90	< 93
Blood Pressure (mm Hg)				< 90 or > 160/100	> 160/110	< 85/45
Mean arterial pressure (mm Hg)					< 55	

SIRS - Systemic Inflammatory Response Syndrome
CMQCC - California Maternal Quality Care Collaborative
UKOSS - United Kingdom Obstetric Surveillance System
MEWC - Maternal Early Warning Criteria
MEWT - Maternal Early Warning Trigger Tool

To evaluate the sensitivity and specificity of these screening tools for the relatively uncommon diagnosis of obstetric sepsis, a very large sample size is needed. A consortium was recently developed to analyze this issue. Electronic Health Record (EHR) data for intrapartum,[15] antepartum and postpartum[16] patients from 71 hospitals (11 university and 60 small/medium community facilities from all parts of the U.S.), comprising a population of approximately 500,000 pregnant patients, were examined. All sepsis cases, all chorioamnionitis cases, and matched controls were identified. This population included approximately 2,949 patients with sepsis, creating by far the largest cohort of maternal sepsis patients with detailed vital signs ever examined. As obstetric sepsis has a low incidence, the goal of this analysis was to identify an approach with the lowest false positive rate while maintaining a high sensitivity. CMQCC and UKOSS criteria appeared superior with significantly lower false positive rates and similar sensitivities (see Table 3). Screening performance during the antepartum and postpartum admissions was similar to that during the delivery admission for the time periods beyond 20 weeks of gestation and up to 3 days postpartum, where CMQCC and UKOSS criteria

outperformed others. Before 20 weeks of gestation and after 3 days postpartum the SIRS criteria not adjusted for pregnancy performed slightly better than the pregnancy-adjusted criteria. **The Emergency Department should continue to use their standard approach for early pregnancy and most postpartum cases.**

Table 3: Performance of Screening Tools for Sepsis During Delivery Admissions

Delivery Cohort Excluding Chorioamnionitis and Endometritis						
	Sepsis By Diagnosis Codes (N=647)			Sepsis with End Organ Injury Codes (N=228)		
Screening System	False Positive Rate	Sensitivity	C statistic	False Positive Rate	Sensitivity	C statistic
SIRS	21.3%	96.9%	0.88	23.9%	98.7%	0.87
MEWC	38.3%	96.9%	0.79	43.9%	98.2%	0.77
MEWT	15.8%	79.9%	0.82	19.8%	90.8%	0.85
CMQCC	6.9%	90.6%	0.92	9.2%	96.9%	0.94
UKOSS	9.6%	92.0%	0.91	11.6%	96.1%	0.92

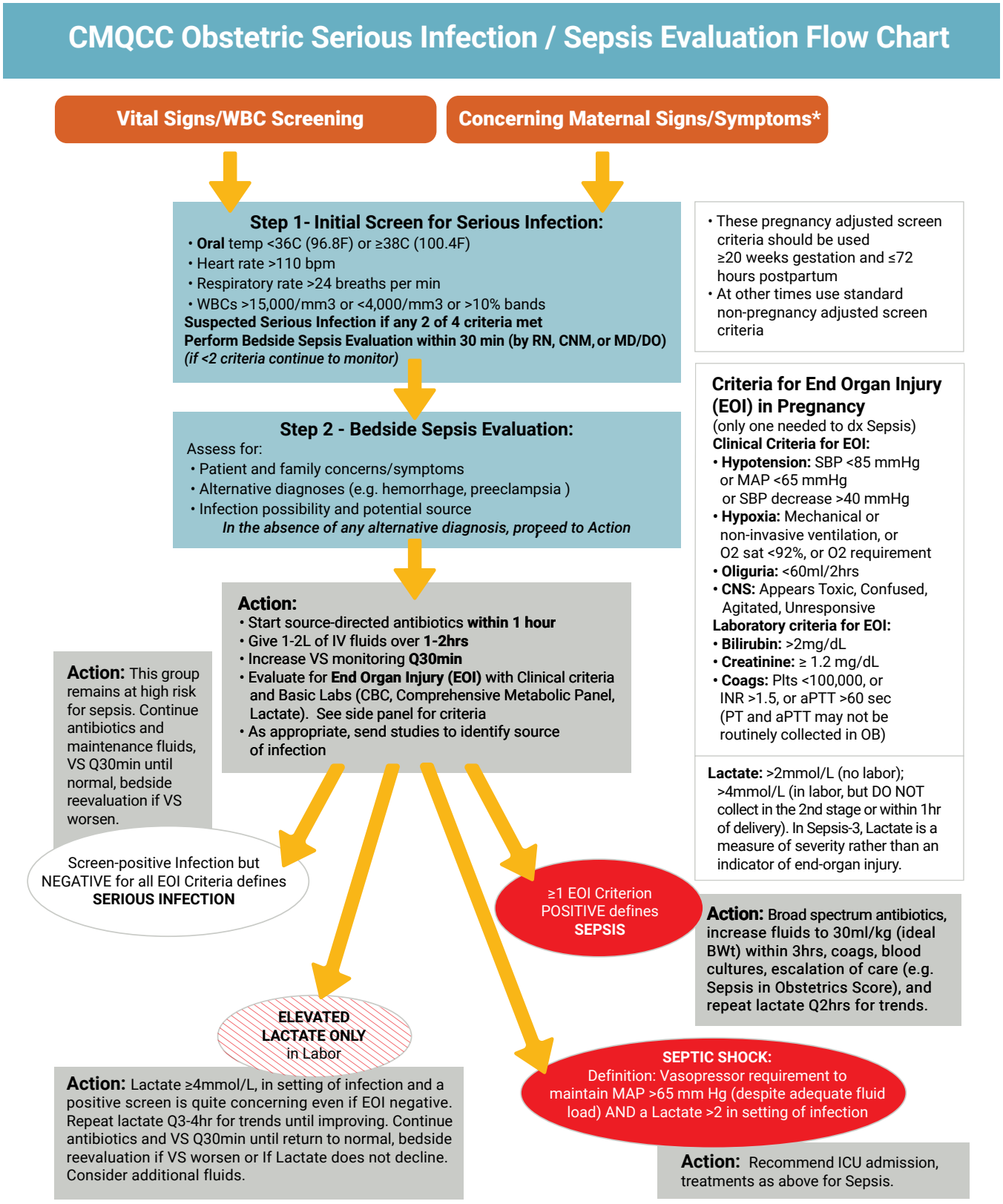
Chorioamnionitis and Endometritis Cases						
	Sepsis By Diagnosis Codes (N=1,049)			Sepsis with End Organ Injury Codes (N=238)		
Screening System	False Positive Rate	Sensitivity	C statistic	False Positive Rate	Sensitivity	C statistic
SIRS	86.6%	99.4%	0.56	86.6%	99.2%	0.56
MEWC	92.3%	97.7%	0.53	92.3%	97.9%	0.53
MEWT	45.7%	78.5%	0.66	45.7%	87.4%	0.71
CMQCC	60.2%	93.6%	0.67	60.2%	93.7%	0.67
UKOSS	67.5%	95.2%	0.64	67.5%	95.0%	0.64

As obstetric sepsis has a low incidence, despite the reasonable specificity and sensitivity of the CMQCC screen, the positive predictive value is still too low to serve as a definitive single diagnostic step. For example, in the setting of chorioamnionitis, 60% may still have a positive first screen based on this criterion. In addition, other conditions such as obstetric hemorrhage or preeclampsia can lead to serious vital sign abnormalities resulting in a positive screen. Thus, a second step of bedside evaluation is performed to assess for additional signs and symptoms that may inform differential diagnoses and the probability of infection. In the absence of alternate diagnoses, immediate treatment for serious infection and laboratory evaluation for end-organ injury is warranted.

Obstetric Serious Infection/Sepsis Evaluation Flow Chart

The original CMQCC Two-Step approach to diagnose and triage serious infections and sepsis has been modified based on the studies described above. The initial screen using vital signs and WBC count represents the first step. The Flow Chart is shown in Figure 3.

Figure 3. CMQCC Obstetric Serious Infection/Sepsis Evaluation Flow Chart



*This is often the pathway for outpatient care. Example tools: Urgent Maternal Warning Signs©; POST-BIRTH Warning Signs©

version 4.29.25

Bedside Evaluation: Step 2

A key element in the two-step approach for screening and diagnosis of obstetric sepsis is the bedside evaluation, following a positive first step initial screen for serious infection. This is a new process for many hospitals and will be discussed in detail in Bedside Evaluation. This evaluation includes a brief clinical evaluation that can be done by any level of clinician (MD/DO, CNM, or RN). There are two areas of assessment: (1) identify the likelihood of infection and potential sources, (2) and evaluate for alternate diagnoses, such as preeclampsia or hemorrhage. At this point, these patients are considered to have serious infection. Immediate actions include initiation of antibiotics and a moderate fluid load while evaluating for end organ injury (which would give a positive diagnosis of sepsis). A limited set of laboratory studies (CBC, comprehensive metabolic panel, and lactate) is collected. This approach supports rapid treatment of serious infection, early identification of sepsis, and conservation of resources. This approach also avoids generating falsely elevated publicly reported levels of Severe Obstetric Complications.

Potential Clinical Paths for Positive Screen

A positive Screen can lead to any one of several different clinical paths as described below:

Sepsis: One or more end-organ injury criteria is present that meets the diagnosis of sepsis. Action steps are discussed in detail in Treatment of Sepsis and Serious Infections During Pregnancy and Postpartum.

Septic Shock: Diagnosed if there is a vasopressor requirement to maintain MAP > 65 mm Hg despite adequate fluid resuscitation and a lactic acid level > 2 mmol/L in the setting of infection. This is a critical diagnosis and needs management led by a Critical Care specialist, usually in the Intensive Care Unit.

Serious Infections Without End-organ Injury and with an ELEVATED Lactate: The presence of a serious infection (infection plus abnormal vital sign screen) in the absence of end-organ injury findings BUT with an elevated lactic acid of > 4 mmol/L during 1st stage of labor, is an important variant that is concerning (see discussion of lactic acid below). This Taskforce recommends that the lactic acid be repeated Q3-4hours for trends until they improve. Antibiotics should be continued. These patients merit closer supervision with vital signs (VS) Q30 minutes until their VS return to normal, and bedside reevaluation if VS worsen or if lactate does not decline. Consider additional fluids.

Serious Infections Without End-organ Injury and with a NORMAL Lactate: All screen positive patients who are negative for end-organ injury criteria and have a normal lactic acid. This group also remains at higher risk for sepsis. This taskforce recommends continuing antibiotics and maintenance fluids, obtaining vital signs Q30 minutes until normal, and repeating the bedside evaluation if vital signs worsen. Significant clinical signs or symptoms but not end organ injuries deserve additional surveillance, and these are discussed in the accompanying CMQCC Obstetric Serious Infection/Sepsis Evaluation Flow Chart (see chapter Educational Tools and Sample Resources).

Please note that there are two entry points to the flow chart: (1) those identified by routine maternal vital sign screenings and (2) those identified by clinical signs and symptoms of potential infection. Significantly, the later entry point is how most antepartum and postpartum patients are recognized. This is important as more than half of obstetric sepsis cases occur in the antepartum and postpartum periods.

Lack of Patient Knowledge about Sepsis

Patient survivors of sepsis have provided feedback that they did not know sepsis signs and symptoms that would have allowed them to present earlier for medical care or did not feel heard in the healthcare environment.[9] This Taskforce encourages the use of patient education tools such as the AIM Maternal Urgent Warning Signs, which covers signs and symptoms for all major maternal complications beyond sepsis, for use in both antepartum and postpartum patient populations.

See the earlier chapter on Obstetric Sepsis Educational Resources.

Utility and Interpretation of Lactic Acid Levels

Even outside of pregnancy the correct role for lactic acid in the diagnosis of sepsis has been reevaluated. The Sepsis-3 consensus experts did not agree with prior panels regarding the use of lactic acid in establishing the diagnosis of sepsis and recommended against the use of lactic acid for screening.[2] Furthermore, pregnancy, and in particular labor, complicates the interpretation of lactic acid levels. Labor can be associated with high levels of lactic acid in the absence of serious infection, most likely due to anaerobic metabolism during prolonged physical exertion. When not in labor, lactic acid levels in pregnant women are similar to those in non-pregnant women. In the absence of active labor and one hour postpartum, the same lactic acid value thresholds can be used with expected values less than 2 mmol/L.[17] A meta-analysis of 22 studies of normal healthy pregnant women without infection demonstrated a rise in the average level of lactic acid during labor with an increasing portion of cases above 2 mmol/L.[17]

Conversely, for pregnant women with infection, high lactic acid levels are concerning. In a cohort of pregnant women with suspected infection, elevated levels of lactic acid were associated with higher morbidity (ICU admission, telemetry, length of stay, and positive blood cultures).[18] Also, in a study of 100 pregnant persons with infection, a lactic acid level ≥ 4 mmol/L had a sensitivity and specificity to identify sepsis of 38% and 88%, respectively.[19] Lactic acid can also be considered an important criterion to follow for adequate treatment of hypoperfusion in patients with sepsis, as suggested by the Surviving Sepsis Campaign.[20]

In summary, lactic acid serves as a measure of severity of infection rather than a true end-organ injury indicator. Abnormal levels are > 2 mmol/L (no labor) and > 4 mmol/L in first-stage labor. However, it is very difficult to interpret lactic acid levels during the second stage or in the first hour post-delivery as levels may be particularly high (even above 4 mmol/L) due to anaerobic metabolism.

Obtaining Cultures

The utility of cultures depends on the site of infection. For **urinary tract infections**, urine and blood cultures should be sent for suspected urinary infection in the setting of abnormal vital signs (serious infection). Similarly, in the setting of a **probable pneumonia or an infection without a suspected source** that presents with abnormal vital signs (serious infection), it is also recommended to draw blood cultures to evaluate for end-organ injury. **Chorioamnionitis and endometritis** represent up to

40% of obstetric sepsis cases[15] and the rarity of positive blood or cervical cultures in these cases resulting in any useful information indicates a different approach should be considered. Blood cultures in this setting are most often negative, or can return positive days after discharge of a now seemingly fully recovered patient, thereby not having utility for management. For these patients, this Taskforce recommends starting antibiotics, evaluating for end-organ injury at the time of diagnosis of serious infection (abnormal VS), and awaiting evidence of end-organ injury before sending blood cultures. Since the initial end-organ injury laboratory studies are rapid (CBC with differential and comprehensive metabolic panel or a creatinine and bilirubin), the results should be available at the time of or quite soon after administration of the initial antibiotic dose. Recent data suggests that drawing blood cultures up to 60-90 minutes after antibiotic administration does not appreciably decrease the rate of positive blood cultures.[21]

The role of rapid molecular diagnostics in microbiology for the identification of pathogens in blood culture collections is quickly emerging.[23-25,] There are a variety of technologies available that differ in terms of price, pathogen and resistance marker detection, complexity, and result turn-around-time. The price and complexity (e.g. assay and machine training and expertise) is unfortunately currently prohibitive in many hospital settings but may change in the near future. However, the use of rapid molecular diagnostic testing coupled with an antimicrobial stewardship team has been shown to reduce the time to identify appropriate antibiotic therapy and improve clinical outcomes for patients with sepsis and bloodstream infections. Rapid molecular tests that can detect multi-drug resistant organisms (MDRO) coupled with a stewardship team may be exponentially valuable in the setting of obstetric and neonatal sepsis associated with an MDRO. If an institution has access to rapid molecular testing for blood cultures and an antibiotic stewardship team, it is recommended to use these resources as a component with the CMQCC sepsis bundle as a means to improve maternal and neonatal sepsis outcomes.

Conclusion

The CMQCC two-step approach to recognize and treat obstetric sepsis has been endorsed by SMFM[8] and by an editorial in Obstetrics and Gynecology titled, “Finding the Needle in the Haystack: Challenges and Future Directions in Maternal Sepsis Recognition” that accompanied the above intrapartum, antepartum and postpartum screening research studies.[25] As obstetric providers, recall that a two-step approach is frequently used for other uncommon OB/GYN conditions. For example, to diagnose syphilis using the traditional algorithm, we generally start with a rapid plasma reagin (RPR) as a first step screen and follow with a treponemal specific antibody study, such as the Treponema pallidum particle agglutination (TP-PA), to confirm the diagnosis (or vice versa with reverse screening methods). Similarly, to screen for cervical cancer the first step includes HPV/Pap smear testing followed by a cervical biopsy to make the diagnosis. And of course, for every obstetric patient who is screened for gestational diabetes using two-step testing, the first step is a 1-hour 50gm screen followed up with a 3-hour 100 gm glucose tolerance test. The experience in California hospitals indicates that this two-step approach meets the goals of rapid treatment of serious infections, early identification of sepsis, and conservation of resources while not generating falsely elevated outcome measures that are publicly reported.

Recommendations (Level of Evidence)

1. Hospitals should reevaluate their approach to screening and diagnosing serious infections in pregnancy. (LEVEL A)
2. This taskforce recommends adoption of a two-step approach with bedside evaluation for early recognition of sepsis and avoidance of delays in treatment of both serious infections and sepsis. (LEVEL A)
3. Standardized order sets and nursing protocols should be adopted. (LEVEL B)
4. All clinicians should receive education on the screening and diagnosis of serious infections and sepsis in obstetric care. (LEVEL C)

Educational Tools and Sample Resources

1. Appendix D: Obstetric Serious Infection/Sepsis Evaluation Flow Chart
2. Appendix E: Teaching Points for Obstetric Serious Infection/Sepsis Evaluation Flow Chart
3. Appendix K: Sample: LLU Nursing Standard Order Set
4. Appendix P: Sample: Miller Sepsis/Chorio Order Sets

References

1. Bone RC, Balk RA, Cerra FB, et al. Definitions for sepsis and organ failure and guidelines for the use of innovative therapies in sepsis. The ACCP/SCCM Consensus Conference Committee. American College of Chest Physicians/ Society of Critical Care Medicine. Chest. 1992; Jun;101(6):1644-55.
2. Singer M, Deutschman CS, Seymour CW, Shankar-Hari M, Annane D, Bauer M, Bellomo R, Bernard GR, Chiche JD, Coopersmith CM, Hotchkiss RS, Levy MM, Marshall JC, Martin GS, Opal SM, Rubenfeld GD, van der Poll T, Vincent JL, Angus DC. The Third International Consensus Definitions for Sepsis and Septic Shock (Sepsis-3). JAMA. 2016 Feb 23;315(8):801-10. doi: 10.1001/jama.2016.0287.
3. Lappen JR, Keene M, Lore M, Grobman WA, Gossett DR. Existing models fail to predict sepsis in an obstetric population with intrauterine infection. Am J Obstet Gynecol. 2010 Dec;203(6):573.e1-5. doi: 10.1016/j.ajog.2010.07.040.
4. WHO Statement on Maternal Sepsis (2017). http://apps.who.int/iris/bitstream/10665/254608/1/WHORHR-17.02-eng.pdf (accessed August 24, 2024).
5. Shields AD, Plante LA, Pacheco LD, Louis JM. Society for Maternal-Fetal Medicine Consult Series #67: Maternal sepsis. Am J Obstet Gynecol. 2023 Sep;229(3):B2-B19. doi: 10.1016/j.ajog.2023.05.019.
6. CDC Hospital Sepsis Program-Core Elements (2023). https://www.cdc.gov/sepsis/hcp/core-elements/index.html (accessed August 24, 2024).
7. Centers for Medicare & Medicaid Services (CMS). Hospital Inpatient Quality Reporting Specifications Manual for National Hospital Inpatient Quality Measures Discharges 01-01-24 (1Q24) through 06-30-24 (2Q24) Version 5.15. SEP-1. Section 1b-AlphaDD, p1-135. https://qualitynet.cms.gov/files/648322c304f753001cd056f6?filename=HIQR_SpecsMan_v5.15.zip (Accessed August 1, 2024)
8. Bauer ME, Lorenz RP, Bauer ST, Rao K, Anderson FWJ. Maternal Deaths Due to Sepsis in the State of Michigan, 1999-2006. Obstet Gynecol. 2015 Oct;126(4):747-752. doi: 10.1097/AOG.0000000000001028. PMID: 26348189; PMCID: PMC4564866.
9. Bauer ME, Perez SL, Main EK, Norman GS, Fish LJ, Caldwell MA, Allen C, Hughes BL, Gibbs RS, Smith KL. Near-miss and maternal sepsis mortality: A qualitative study of survivors and support persons. Eur J Obstet Gynecol Reprod Biol. 2024 Aug;299:136-142.

10. ACOG Clinical Practice Update: Update on Criteria for Suspected Diagnosis of Intraamniotic Infection. Obstet Gynecol 144(1):p e17-e19, July 2024.
11. Ramsey K. Systems on the edge: developing organizational theory for the persistence of mistreatment in childbirth. Health Policy Plan. 2022 Mar 4;37(3):400-415. doi: 10.1093/heapol/czab135. PMID: 34755181.
12. Dekker S. Patient safety: A human factors approach. CRC Press, Boca Raton FL. 2011
13. Gibbs R, Bauer M, Olvera L, Sakowski C, Cape V, Main E. Improving Diagnosis and Treatment of Maternal Sepsis: A Quality Improvement Toolkit. Stanford, CA: California Maternal Quality Care Collaborative.
14. Shields LE, Wiesner S, Klein C, Pelletreau B, Hedriana HL. Use of Maternal Early Warning Trigger tool reduces maternal morbidity. Am J Obstet Gynecol. 2016 Apr;214(4):527.e1-527.e6. doi: 10.1016/j.ajog.2016.01.154.
15. Main EK, Fuller M, Kovacheva VP, Elkhateb R, Azar K, Caldwell M, Chiem V, Foster M, Gibbs R, Hughes BL, Johnson R, Kottukapally N, Cortes MS, Rosenstein MG, Shields LE, Sudat S, Sutton CD, Toledo P, Traylor A, Wharton K, Bauer ME. Performance Characteristics of Sepsis Screening Tools During Delivery Admissions. Obstet Gynecol. 2024 Mar 1;143(3):326-335. doi: 10.1097/AOG.0000000000005477.
16. Bauer ME, Fuller M, Kovacheva V, Elkhateb R, Azar K, Caldwell M, Chiem V, Foster M, Gibbs R, Hughes BL, Johnson R, Kottukapally N, Rosenstein MG, Cortes MS, Shields LE, Sudat S, Sutton CD, Toledo P, Traylor A, Wharton K, Main E. Performance Characteristics of Sepsis Screening Tools During Antepartum and Postpartum Admissions. Obstet Gynecol. 2024 Mar 1;143(3):336-345. doi: 10.1097/AOG.0000000000005480.
17. Bauer ME, Balistreri M, MacEachern M, Cassidy R, Schoenfeld R, Sankar K, Clauw DJ, Langen E. Normal Range for Maternal Lactic Acid during Pregnancy and Labor: A Systematic Review and Meta-Analysis of Observational Studies. Am J Perinatol. 2019 Jul;36(9):898-906. doi: 10.1055/s-0038-1675243. PMID: 30396223.
18. Albright CM, Ali TN, Lopes V, Rouse DJ, Anderson BL. Lactic acid measurement to identify risk of morbidity from sepsis in pregnancy. Am J Perinatol. 2015 Apr;32(5):481-6. doi: 10.1055/s-0034-1395477. PMID: 25486284.
19. Agarwal R, Yadav YK, Garg S, et al. Lactic acid as an adjuvant marker in pregnancy-associated sepsis. S Afr J Obstet Gynecol 2018;24(1):8-10.
20. Evans L, Rhodes A, Alhazzani W, et.al. Surviving sepsis campaign: international guidelines for management of sepsis and septic shock 2021. Intensive Care Med. 2021 Nov;47(11):1181-1247. doi: 10.1007/s00134-021-06506-y. Epub 2021 Oct 2. PMID: 34599691; PMCID: PMC8486643.
21. Zornitzki L, Anuk L, Frydman S, et.al. Rate and predictors of blood culture positivity after antibiotic administration: a prospective single-center study. Infection. 2024 Apr;52(2):483-490.
22. Wang Y, Lindsley K, Bleak TC, Jiudice S, Uyei J, Gu Y, Wang Y, Timbrook TT, Balada-Llasat JM. Performance of molecular tests for diagnosis of bloodstream infections in the clinical setting: a systematic literature review and meta-analysis. Clin Microbiol Infect. 2024 Dec 11:S1198-743X(24)00593-7. doi: 10.1016/j.cmi.2024.12.007.
23. Eubank T, Long S, Perez K. Role of Rapid Diagnostics in Diagnosis and Management of Patients with Sepsis. Journal of Infectious Diseases. 2020:222(Suppl 2):S103-9.
24. Fabre V, Carroll KC, Cosgrove SE. Blood Culture Utilization in the Hospital Setting: a Call for Diagnostic Stewardship. J Clin Microbiol. 2022 Mar 16;60(3):e0100521. doi: 10.1128/JCM.01005-21.
25. Shields AD, Tse BC. Finding the Needle in the Haystack: Challenges and Future Directions in Maternal Sepsis Recognition. Obstet Gynecol. 2024 Mar 1;143(3):323-325. doi: 10.1097/AOG.0000000000005513.

Bedside Evaluation

Christa Sakowski MSN, C-EFM, CLE, CMQCC
Elliott Main, MD, Stanford University School of Medicine

Key Principles

1. The bedside evaluation is the second critical step of the two-step process for evaluating potential serious infections, providing much improved specificity for the diagnosis of sepsis.
2. The intent of the bedside evaluation is to provide additional information to confirm probable infection and rule out other conditions.
3. A standard bedside evaluation serves to reduce "wellness bias" and prompt further laboratory testing to confirm or exclude end-organ injury (sepsis) and support immediate treatment of serious infection.
4. This assessment can be completed by a physician, midwife, or nurse.

Introduction

The bedside evaluation portion of the two-step serious infection screening process directs clinicians to perform a physical assessment of the patient prior to proceeding with laboratory testing and treatment. This provides a more comprehensive picture of the patient beyond vital signs and white blood cell (WBC) trigger values. At this point either a serious infection or an alternate diagnosis can be considered. The physical evaluation can be completed by a physician, midwife, or nurse. A positive bedside evaluation leads to key actions in the care of patients with serious infections; rapid administration of antibiotics, IV fluids, and assessment for end-organ injury.

Components of the Bedside Evaluation

The intent of the bedside assessment is to provide key additional information that may prompt providers to proceed with further laboratory testing to confirm or exclude the diagnosis of sepsis and begin immediate treatment of serious infection accordingly. In some cases, a more likely condition may be identified, resulting in alternate treatment pathways. Providers should pay close attention to key assessment indicators, such as quantitative blood loss, signs of preeclampsia, and possible sources of infection. In addition to a general physical assessment, health care professionals should elicit patient concerns and acknowledge reported symptoms. If the assessment is performed by the nursing team, communication with the provider, ideally utilizing SBAR format, is standard of care for nurse action steps, especially if a nurse-driven pathway is not the standard of care in the facility.

History/Exam Essential:

- Report general observations of the patient, including but not limited to:
- Shivering
- Confusion
- Clammy skin
- Difficulty breathing
- Grimacing/Guarding (e.g. signs of pain)
- Skin color associated with poor perfusion
- Signs of dehydration (e.g. low urine output, inability to produce milk or tears)
- Difficulty obtaining pulse oximetry reading (e.g. possible low perfusion)
- Difficulty obtaining temperature (e.g. possibly hypothermia)

Evaluate possible sources of infection:

- Uterus: tenderness, fetal tachycardia in labor
- Incision/laceration: tenderness, discharge, redness
- Breasts: tenderness, heat
- Urinary Tract: pain with urination, CVA tenderness, other signs of urinary/kidney infection
- Lungs: cough, abnormal lung sounds

Consider signs associated with an alternate diagnosis, most commonly:

- Heavy bleeding or other signs of hemorrhage
- Hypertension, edema, severe headache or other signs of preeclampsia

Vital Signs Essentials:

Emphasis on Accurate RESPIRATORY RATE

- One of the most important - frequently omitted, inaccurately measured, or not recorded vital signs.
- Semler et al. (2013)[1] found a significant difference between actual respiratory rate and the one recorded. Out of 368 recordings, 72% indicated 18 or 20 breaths per minute whereas only 13% were within that range.
- For patients with possible sepsis, accurate documentation of the respiratory rate is crucial, as the body will increase its respiratory rate in an attempt to maintain oxygen delivery to its tissues. An elevated respiratory rate is often due to increased acidosis (often lactic acidosis).
- A small change in the respiratory rate, of up to 3-5 breaths per minute, could be an early sign of patient deterioration. Any respiratory rate outside of normal range should be monitored closely.

Emphasis on Attention to PULSE RATE

- In maternal mortality and severe morbidity reviews, pulse rates as high as 120-130 were often ignored and dismissed as due to pain.
- In a recent evaluation of nearly 3,000 cases of obstetric sepsis, a pulse of 110 performed better (sensitivity and specificity) than 120 as part of the screening system.[2]

RECOGNITION

- In the screening data studies noted earlier, it was also noted that pulse rate was often not collected or recorded.
- Elevated pulse rate is a significant indicator of serious infection, sepsis or hemorrhage and requires close attention.

BLOOD PRESSURE Considerations

- Key indicator for sepsis shock (MAP < 65).
- Higher but borderline pressures (MAP 65 - 90) raise concern and need careful monitoring but are not in themselves evidence of sepsis and do not perform well as a screen for sepsis in pregnancy.

FEVER Cautions

- 25% of sepsis deaths had no pyrexia.[3]
- Do not dismiss serious infection or sepsis concern due to lack of fever.

Importance of Nursing Assessment and Communications

Nurses are the clinician most consistently with the patient and most likely to note small changes in patient condition and escalate patient complaints. These are important factors to be considered in the bedside evaluation. Nurses are also well placed to perform bedside assessments as they are immediately available at the bedside. This can significantly decrease time to treatment. A Rapid Response Team (RRT) call is typically not required to perform this assessment and should be reserved for cases when the patient shows signs of decompensation, such as hypotension. In facilities without nurse-driven pathways, the nurse evaluation including physical assessment is reported to the provider for diagnosis and treatment orders. The SBAR model of communications is well designed for this purpose.

Example of an SBAR for a patient with a positive serious infection screen

- Situation - Patient Jane Doe has met serious infection screening criteria.
- Background - Jane is G4P2 EGA 39.6 weeks admitted for SROM > 24hrs. Patient has been augmented with oxytocin and is making appropriate progress in her labor. GBS is negative and she has no other known risk factors.
- Assessment - Jane's vital signs are Temp 38.4°C, Pulse 115/min, BP 110/68 mm Hg, RR 22, pO2 96% on room air, Category 2 tracing with a baseline of 165, AO x4. Jane reports feeling very hot, but no additional symptoms. Upon physical assessment, no abnormalities are noted, thus there is no clear alternate diagnosis nor an obvious source of infection. She appears to meet the initial serious infection screening criteria based on abnormal VS.
- Recommendation - My recommendation is to start antibiotics, initiate labs to assess for end-organ injury (confirmation of sepsis), increase fluids, and increase VS monitoring. I will report back results for further orders.

Communication Pearls

All members of the clinical team should maintain a high index of suspicion and embrace a non-hierarchical communication structure to detect sepsis. All team members should feel empowered to speak up and know their input is valued by the care team.

Use CUS (concerned, uncomfortable, safety issue) words[4] if there is resistance to sepsis screening and you receive a response similar to the following examples:

- "We will continue to monitor her; sepsis screening is not necessary."
- "It is normal in pregnancy to have those vital sign changes; it is not sepsis."

Examples of CUS

- "I am uncomfortable with waiting to initiate the sepsis screening and I would like to activate the order set so that we can promote early recognition and treatment if indicated."
- "Although pulse can be elevated in pregnancy, her current vital signs meet sepsis screening criteria, meaning they are above the pregnancy normal ranges. This is now a safety issue we must address."

Documentation

The bedside evaluation should be clearly documented in the electronic health record (EHR) along with the basic vital sign triggers for severe infection screen. Communication to team members regarding screening results and the orders received should also be consistently noted.

For documentation, consider creating a standardized, concise method of charting screening criteria in the EHR such as:

- Unique fields
- Forms
- Dot phrases

Standardized Order Sets:

Sites may consider standardized order sets that operate under standard procedures to allow sepsis testing and initial treatment to begin simultaneously with provider notification. This is known as a nurse pathway. Nurse pathways are designed to decrease the time to treatment and can aid in standardization of care. These pathways may be especially useful in facilities where providers are not in the facility at all hours.

Summary

1. The bedside evaluation following a positive serious infection screen is a simple, structured assessment that can greatly expedite care for obstetric patients with infections.
2. Nurses are capable of performing this assessment and can report the findings to a covering provider. This is an important role, particularly in hospitals without a readily available physician on labor and delivery.
3. A nurse-driven pathway as the standard of care can further expedite care and may be appropriate and desired in some settings. The action steps are straightforward: rapid initiation of antibiotics, screening for end-organ injury and enhanced vital signs; making them ideal for the pathway method (see The Important Role of Nurse-Driven Care Pathways, Standing Orders, and Artificial Intelligence (AI) in the EMR).

Recommendations (Level of Evidence)

1. Bedside evaluation should become a routine part of care for patient with an abnormal serious infection screen. (LEVEL C)
2. Documentation tools for the bedside evaluation should be built into the EHR. Paper tools can be utilized until the EHR tools are completed. (LEVEL C)
3. Training in the elements of the bedside evaluation should be provided to nursing and medical staff. (LEVEL C)

Educational Tools and Sample Resources

1. Appendix G: The Importance of Taking a Respiratory Rate
2. Appendix H: How to Take an Oral Temperature Measurement
3. Appendix I: Collecting a Urine Specimen from a Foley Catheter
4. Appendix K: Sample: LLU Nursing Standard Order Set
5. Appendix P: Sample: Miller Sepsis/Chorio Order Sets

References

1. Semler MW, Stover DG, Copland AP, Hong G, Johnson MJ, Kriss MS, Otepka H, Wang L, Christman BW, Rice TW. Chest. 2013 Jun;143(6):1740-1744.
2. Main EK, Fuller M, Kovacheva VP, Elkhateb R, Azar K, Caldwell M, Chiem V, Foster M, Gibbs R, Hughes BL, Johnson R, Kottukapally N, Cortes MS, Rosenstein MG, Shields LE, Sudat S, Sutton CD, Toledo P, Traylor A, Wharton K, Bauer ME. Performance Characteristics of Sepsis Screening Tools During Delivery Admissions. Obstet Gynecol. 2024 Mar 1;143(3):326-335.
3. Bauer ME, Lorenz RP, Bauer ST, Rao K, Anderson FWJ. Maternal Deaths Due to Sepsis in the State of Michigan, 1999-2006. Obstet Gynecol. 2015 Oct;126(4):747-752. doi: 10.1097/AOG.0000000000001028. PMID: 26348189; PMCID: PMC4564866.
4. Agency for Healthcare Research and Quality (AHRQ) TeamSTEPPS. https://www.ahrq.gov/teamstepps-program/index.html (accessed January 20, 2025).

The Important Role of Nurse-Driven Care Pathways, Standing Orders, and Artificial Intelligence (AI) in the EMR

Courtney Martin, DO, MHA, Hoag Health

Key Principles

1. Implementation of well-designed best practice advisories (BPAs) and alerts are important in obstetric sepsis screening and treatment.
2. Nurse-driven care pathways and standing orders are practical for rapid recognition and treatment of intraamniotic infection/Chorioamnionitis, and in preventing, recognizing and treating sepsis.
3. Artificial Intelligence (AI) integration into the electronic medical record (EMR) has promise to further improve care for obstetric patients with uncommon conditions.

Introduction

Obstetric sepsis remains a leading cause of maternal morbidity and mortality worldwide.[1] Early recognition and timely intervention are critical in improving outcomes for affected patients.[2] Three related strategies have emerged as pivotal in enhancing maternal safety: nurse-driven care pathways, the implementation of standing orders, and the integration of artificial intelligence (AI) within electronic medical records (EMRs).[3] Together, these elements create a robust system that facilitates early detection, timely treatment, and streamlined communication among healthcare providers. Additionally, they work to address implicit and explicit biases in clinical decision-making for life-threatening conditions that are rarely seen in obstetrics. This trio of modalities help counteract the "wellness bias," an unconscious tendency among healthcare providers to assume normal pregnancy outcomes, sometimes dismissing signs and symptoms of serious illnesses.[4]

Nurse-Driven Care Pathways

Nurse-driven care pathways empower frontline nursing staff to initiate timely interventions based on standardized protocols, reducing delays in care delivery. In the context of obstetric sepsis, these pathways provide nurses with clearly defined steps to assess, escalate, and manage patients showing early signs of infection.[5]

1. **Early Recognition and Escalation:** Nurses play a crucial role in identifying early warning signs of sepsis, such as tachycardia, hypotension, fever, or altered mental status. Standardized screening tools embedded in the care pathway guide nurses in assessing sepsis risk factors and promptly escalating concerns to the provider team.

2. **Timely Intervention:** Once a patient meets criteria for concern, nurse-driven protocols enable immediate initiation of sepsis bundles, including obtaining lactate levels, blood cultures, and initiating fluid resuscitation before a physician evaluates the patient.[6]

3. **Reducing Bias Through Standardized Approaches:** By structuring care pathways around objective clinical criteria rather than subjective assessments, nurse-driven protocols and EMR use help mitigate biases that might lead to under-recognition of sepsis in marginalized patient populations.[7]

4. **Addressing Wellness Bias:** The standardized nature of nurse-driven pathways ensures that sepsis concerns are addressed regardless of the patient's overall appearance of wellness, reducing the risk of dismissing symptoms due to pregnancy-related optimism.

5. **Improved Coordination:** These pathways enhance multidisciplinary collaboration across the care team by ensuring clear communication between nurses, midwives, obstetricians, and intensivists, ultimately improving maternal outcomes.

Standing Orders: Reducing Delays in Care

Standing orders allow nurses to act autonomously within defined protocols, ensuring that critical interventions are not delayed while awaiting provider approval.[8] In obstetric sepsis management, standing orders provide a structured approach to implementing early goal-directed therapy.

1. **Empowering Nurses to Initiate Protocols:** Standing orders allow nurses to immediately initiate blood cultures, administer IV fluids, and request laboratory tests when criteria are met.[8]

2. **Guided Decision-Making:** Structured standing orders reduce variability in care, ensuring every patient receives evidence-based treatment aligned with national guidelines such as ACOG and AWHONN recommendations.

3. **Antibiotic Stewardship:** Standardized antibiotic administration protocols ensure that broad-spectrum antibiotics are given promptly while awaiting infectious workups, reducing the risk of progression to sepsis and septic shock.

4. **Mitigating Implicit Bias in Care Decisions:** By providing an evidence-based, standardized approach, standing orders ensure that all patients receive the same level of care in a timely manner regardless of race, ethnicity, or socioeconomic status, addressing disparities in sepsis recognition and treatment.

5. **Addressing Wellness Bias:** By focusing on physiological criteria rather than subjective provider assessments, standing orders help counteract the tendency to overlook infection in pregnant individuals perceived as otherwise healthy.

AI Integration in the EMR: Enhancing Early Detection and Decision Support

AI and machine learning algorithms embedded in EMRs provide real-time decision support to enhance early recognition and treatment of obstetric sepsis.[9]

1. **Predictive Analytics for Early Warning:** AI-driven sepsis prediction models analyze patient data, including vital signs, laboratory trends, and clinical history, to detect sepsis risk earlier than traditional methods.

2. **Automated Alerts and Risk Stratification:** AI-generated alerts notify providers and nursing staff when a patient's condition meets predefined sepsis criteria, prompting immediate intervention.

3. **Reducing Cognitive Biases in Clinical Judgment:** AI tools analyze large datasets to provide objective risk assessments, counteracting provider biases that may lead to underdiagnosis or delayed interventions in marginalized populations.

4. **Clinical Decision Support Systems (CDSS):** AI-enhanced CDSS assist clinicians in selecting the appropriate antibiotic regimen, guide fluid resuscitation strategies, and recommend escalation to higher levels of care when necessary.[10]

5. **Continuous Monitoring and Learning:** AI systems refine their predictive accuracy over time by continuously analyzing patient outcomes and adapting protocols to evolving clinical patterns.

6. **Addressing Wellness Bias with Objective Analysis:** AI-driven analytics ensure that all patient data is evaluated based on risk factors rather than assumptions of health, reducing the likelihood of overlooking early signs of sepsis in pregnant individuals.

Time Zero Trigger

It is also important to establish a time zero trigger to monitor time to treatment for every patient. This means starting a clock visible in the patient chart to encourage timely administration, as well as generating BPAs that alert providers and nursing teams. See the accompanying box for an *example* of how such a timer can work.

Time Zero Triggers

The serious infection timer can display within the patient's chart in storyboard.

- **Time provider documented YES to *'Do you suspect infection?'* in BPA/Navigator**

OR

- **Time or RN initial BPA firing/antibiotics ordered *(if provider has not yet documented infection)***

OR

- **Any time a laboring patient has a temp greater than 102.2°F (one time without any other criteria)**

OR

- **A pregnant patient has a temperature of 100.4°F - 102.1°F (sustained x2 values over 30 min) with fetal tachycardia (160 bpm or greater) AND leukocytes >15 or <4**

RECOGNITION

To build the safety infrastructure and utilize decision support, it is important to map out the sepsis two-step screen in a way that the computer can interpret. An example of how to map out and develop concrete decisions that the computer can learn and incorporate when building screening and treatment tools can be found in the chapter Educational Tools and Sample Resources.

Conclusion

Nurse-driven care pathways, standing orders, and integrating AI-powered decision support in EMRs represent a transformative approach to obstetric sepsis management. By enabling early recognition, streamlining interventions, and leveraging technology, these strategies improve maternal outcomes, reduce care delays, and enhance the efficiency of obstetric emergency care.[11] Furthermore, by standardizing protocols and incorporating AI-driven decision support, these approaches can reduce implicit and explicit biases, ensuring that every patient receives equitable, evidence-based care. Addressing wellness bias through objective, data-driven decision-making ensures that sepsis is identified and treated promptly, regardless of the patient's perceived overall health. Hospitals and healthcare systems should prioritize the inclusion of these strategies into their maternal safety frameworks to ensure timely and effective sepsis management for all obstetric patients.

Recommendations (Level of Evidence)

1. Hospitals should develop standard EMR protocols for evaluation and treatment of serious obstetric infections and sepsis. (LEVEL B)
2. Hospitals should explore nurse-driven pathways, especially in settings where there is not full patient coverage with in-house obstetricians. (LEVEL C)

Educational Tools and Sample Resources

1. Appendix F: HOAG: Sample: Obstetric Serious Infection Care Pathway
2. Appendix J: LLU Sepsis Decision Flowchart
3. Appendix K: Sample: LLU Nursing Standard Order Set

References

1. Society for Maternal-Fetal Medicine (SMFM); Shields AD, Plante LA, Pacheco LD, Louis JM; SMFM Publications Committee. Electronic address: pubs@smfm.org. Society for Maternal-Fetal Medicine Consult Series #67: Maternal sepsis. Am J Obstet Gynecol. 2023 Sep;229(3):B2-B19. doi: 10.1016/j.ajog.2023.05.019. Epub 2023 May 24. PMID: 37236495.
2. Olvera L, Dutra D. Early Recognition and Management of Maternal Sepsis. Nurse Womens Health. 2016 Apr-May;20(2):182-95; quiz 196. doi: 10.1016/j.nwh.2016.02.003. PMID: 27067934.
3. Martin C, Pappas J, Johns K, Figueroa H, Balli K, Yao R. Semiautonomous Treatment Algorithm for the Management of Severe Hypertension in Pregnancy. Obstet Gynecol. 2021 Feb 1;137(2):211-217. doi: 10.1097/AOG.0000000000004235. PMID: 33416295; PMCID: PMC7813439.
4. Ramsey K. Systems on the edge: developing organizational theory for the persistence of mistreatment in childbirth. Health Policy Plan. 2022 Mar 4;37(3):400-415. doi: 10.1093/heapol/czab135. PMID: 34755181.
5. Clark, Steven L., et al. "Maternal mortality in the United States: predictability and the impact of protocols on fatal postcesarean pulmonary embolism and hypertension-related intracranial hemorrhage." American Journal of Obstetrics and Gynecology. 211.1 (2014): 32-e1.

6. Gomez L, LeClair K, Jenkins D, David MA, Downing J, Graham J. ED Nurse-Led Code Sepsis to Reduce Time to Antibiotics. Adv Emerg Nurs J. 2025 Jan-Mar 01;47(1):64-74. doi: 10.1097/TME.0000000000000551. Epub 2024 Dec 20. PMID: 39705654.
7. Hauspurg A. Reducing Maternal Morbidity and Racial Disparities in Hypertension Care Using an Automated Care Pathway. Obstet Gynecol. 2021 Feb 1;137(2):209-210. doi: 10.1097/AOG.0000000000004265. PMID: 33416282; PMCID: PMC7856183.
8. Zemek, Roger, et al. "Triage nurse initiation of corticosteroids in pediatric asthma is associated with improved emergency department efficiency." Pediatrics 129.4 (2012): 671-680.
9. Wakamiya, Shunji, and Kazunobu Yamauchi. "What are the standard functions of electronic clinical pathways?." International Journal of Medical Informatics. 78.8 (2009): 543-550.
10. Alexiuk M, Elgubtan H, Tangri N. Clinical Decision Support Tools in the Electronic Medical Record. Kidney Int Rep. 2023 Oct 29;9(1):29-38. doi: 10.1016/j.ekir.2023.10.019. PMID: 38312784; PMCID: PMC10831391.
11. Seymour, Christopher W., et al. "Time to treatment and mortality during mandated emergency care for sepsis." New England Journal of Medicine. 376.23 (2017): 2235-2244.

Response

This section is designed to aid clinicians in the treatment of sepsis and severe infections during pregnancy and postpartum. The chapters cover multiple practical aspects of antibiotic treatment, sepsis bundles for supportive care, direction for escalation of care, as well as a detailed discussion of source control for serious infections during pregnancy.

In this section you will find the following chapters:

- Fundamentals in the Care of Sepsis during Pregnancy
- Source Control for Serious Infections during Pregnancy and Postpartum
- Antibiotics for Obstetric Sepsis and Serious Infections
- Chorioamnionitis/Intraamniotic Infections
- Prophylactic Antibiotics on Labor and Delivery
- Management of Patients with Beta-Lactam (Penicillins and Cephalosporins) Allergies

Fundamentals in the Care of Sepsis during Pregnancy

Lori Olvera, DNP, RNC-OB, EFM-C, Sutter Sacramento Medical Center
Gillian Abir, MBChB, FRCA , Stanford University School of Medicine
Melissa Bauer, DO, Duke University School of Medicine
Ronald Gibbs, MD, Stanford University School of Medicine
Elliott K. Main, MD, Stanford University School of Medicine
Beth Stephens-Hennessy, MSN, RNC-OB, EFM, CNS Sutter Sacramento Medical Center

Key Principles:

The Surviving Sepsis Campaign recommends the following:

1. Minimize time to treatment. Sepsis is a medical emergency.
2. Monitor closely for response or lack of response to interventions.
3. Extensive and open communication is critical to successful care.
4. Escalation of care should not be delayed.

Introduction

While most attention for the treatment of sepsis focuses on antibiotics and source control, successful treatment requires equal attention to the other parts of the bundle: monitoring, fluid management, cultures, communication and teamwork tools, engagement of a rapid response team and escalation of care. In this chapter, we will address key features of each of these components of care. This section focuses on the needs of obstetric providers as they care for patients with severe infections and early sepsis. A more complete discussion of medical care for patients with sepsis and septic shock during pregnancy and postpartum, including care in the Intensive Care Unit, is provided in the recent review article by Bauer and Pacheco.[1]

Monitoring

Continuous assessment of fetal status, pulse oximetry and mental status are a critical part of the care for all obstetric patients with serious infections or sepsis.[2] Likewise, vital signs monitoring should be increased to every 30 minutes once a positive Step 1 screen is noted. Urinary output is also a key vital sign in the setting of sepsis, and a foley catheter with urimeter should be placed as soon as the diagnosis of sepsis is confirmed. A urimeter can also be useful in the setting of serious infection if urine output is not easily monitored. Table 1 summarizes these recommendations.

TABLE 1. Assessment and Monitoring Recommendations Following a Positive Screen.
The ongoing assessment recommendations are based on 'Time Zero', starting with the initial positive screen.

Monitoring	Time Frame	Additional Considerations
Fetal monitoring	Continuous	Antepartum/intrapartum
Pulse oximetry	Continuous	Until vital signs are normalized
Blood pressure (MAP)	Q 30 minutes from 'Time Zero'	Until lactate less than 2.0 mmol/L, then Q 2 hour for non-laboring patients[1]
Temperature	Q 30 minutes from 'Time Zero'	Until lactate less than 2.0 mmol/L, then Q 2 hour for non-laboring patients[1]
Urine output	Q 1 hour from 'Time Zero'	Foley catheter with urimeter
Mental status	Continuous	Note agitation, confusion, or unresponsiveness

Cultures

Blood cultures are not required for women with uncomplicated infections, but all guidelines for sepsis recommend blood cultures and other site cultures as appropriate. Blood cultures should be collected prior to antibiotic administration when possible. Society of Critical Care Medicine recommends appropriate routine microbiologic cultures be obtained prior to starting antimicrobial therapy in patients with suspected sepsis and septic shock if it does not result in substantial delay in the start of antimicrobials.[3]

We recommend that blood cultures be drawn when sepsis is suspected or confirmed even if antibiotic therapy has been initiated.

Chorioamnionitis is an exception and blood cultures are recommended only if end-organ injury studies return positive.

For chorioamnionitis/intraamniotic infection (IAI) and endomyometritis, lower genital tract cultures are rarely performed because they may reflect primarily contaminating or normal flora organisms. Furthermore, patients initially diagnosed with chorioamnionitis/endomyometritis generally have negative blood cultures.[4] A positive culture may be reported after a recovered patient has been discharged, thereby not having management utility. It is recommended for institutions to have processes established for cultures that return positive for discharged patients. Should the patient show signs of end-organ injury or septic shock, however, blood cultures should be obtained immediately, if not already performed. In order to optimize identification of causative organisms, at least two sets of cultures for anaerobes and aerobes should be collected.[2] If the same organism is identified in both sets of blood cultures, the likelihood that the organism is causing sepsis increases.

Blood cultures should be drawn within three hours following a diagnosis of sepsis with organ dysfunction per CMS SEP-1 measure guidelines. According to CMS guidelines, it is acceptable to draw blood cultures after antibiotics were started if antibiotics were administered before sepsis

was diagnosed.[5] In addition, if there is concern for a patient's deteriorating condition due to rapidly advancing infection, antibiotics should be started immediately with documentation that blood cultures will be drawn as soon as possible. In this situation, the culture results should be interpreted with the understanding that cultures were obtained after the start of antibiotics. Depending on the duration of antibiotics administered prior to collection of blood cultures could impact organism positivity for those microbes covered by the empiric antibiotic regimen. Recent data suggests that the rate of positive blood cultures does not diminish for at least an hour after the initiation of broad-spectrum antibiotics.[6] In the case of peripartum blood culture positivity, it is crucial to inform the neonatal care team of the birth parent's culture and sensitivity results. In patients with bloodstream infections, studies have demonstrated that coupling rapid molecular diagnostic testing of blood cultures with antimicrobial stewardship programs positively impacts patient outcomes such as decreased time to effective antimicrobial therapy, hospital length of stay and mortality risk (particularly involving bacteremia with resistant organisms). Rapid molecular diagnostic testing cannot replace traditional blood cultures and cannot work effectively without antimicrobial stewardship programs. Additionally, in the case of peripartum blood culture positivity, it is crucial to inform the neonatal care team of the birth parent's culture and sensitivity results.

Fluid Management

Patients with sepsis or septic shock have low circulating intravascular volume. Adequate tissue perfusion is vital for both cellular and bodily function. Therefore, it is vital to optimize the patient's circulating volume and improve their cardiac output (blood pressure). Over the last two decades, the Surviving Sepsis Campaign (SSC) has evolved and modified its recommendations based on new evidence and expert consensus. The 2021 SSC guidelines suggest administering an initial fluid bolus of 30 mL/kg of crystalloid within the first three hours for patients with septic shock. Please note that this refers to Ideal Body Weight (IBW) not actual weight.[3] The choice of which weight estimate to use is discussed below.

For patients with a positive screen for serious infection but no end-organ injury, a more modest fluid load of 500-1,000 ml is recommended. This is further discussed in the chapter on Diagnosis and Screening. While the SSC does not recommend one crystalloid over another, recent research suggests that balanced crystalloids (such as Ringer's lactate or Plasma-Lyte) should be recommended over chloride-rich solutions (such as normal saline).[7,8]

Another key consideration for the calculation of fluid load volume for obstetric patients is which weight table to use. Sepsis-3 recommends using Ideal Body Weight (IBW).[3] The

TABLE 2. Ideal Body Weight Table to Calculate IV Fluid Load Volume in Sepsis

Height	Ideal Body Weight (Kg)	Fluid Load (ml) for 30mL/kg
5'0"	45.5	1,365
5'1"	47.8	1,434
5'2"	50.1	1,503
5'3"	52.4	1,572
5'4"	54.7	1,641
5'5"	57.0	1,710
5'6"	59.3	1,779
5'7"	61.6	1,848
5'8"	63.9	1,917
5'9"	66.2	1,986
5'10"	68.5	2,055
5'11"	70.8	2,124
6'0"	73.1	2,193

RESPONSE

ACOG-AIM Obstetric Sepsis Consensus also recommends using IBW for sepsis during pregnancy.[2] This results in a substantially lower infused volume than if the pregnant patient's current body weight were used. This is important as there can be concern for fluid overload in some obstetric clinical settings. Table 2 to the shows the IBW and the fluid load volumes (at 30 ml/kg) for women between 5 and 6 feet in height.

The SSC recommends that following initial fluid resuscitation, additional fluids administration should be guided by frequent reassessment of the patient's hemodynamic status.[3] The most common approach is to use a non-invasive cardiac output monitor that measures stroke volume and cardiac output in response to a fluid challenge, either from a 250 mL fluid bolus or from passive leg raising. It should be noted that passive leg raising is less accurate in the third trimester due to vena cava pressure. The use of non-invasive continuous cardiac output monitoring has been validated in the obstetric population.[9,10] A Rapid Response Team (RRT) nurse, ICU nurse, or emergency room nurse may perform a non-invasive cardiac monitor perfusion assessment. The nurse will record the stroke volume index (SVI) baseline, SVI challenge and SVI percentage change. If the SVI percentage change is greater than 10, the patient is fluid responsive. If SVI percentage change is less than 10, then additional fluids are not required. The use of non-invasive monitoring is also beneficial in patients with preeclampsia or an existing cardiac condition where there is concern for administrating large fluid boluses. It is important to determine if your facility has a non-invasive cardiac monitor and, if so, who performs the test. Usually this will be accomplished in conjunction with an intensivist who is co-managing the patient. When dynamic measurement systems are not available, tissue perfusion can be assessed after aggressive fluid resuscitation using blood pressure and heart rate response, urine output, transthoracic echocardiogram, central venous pressure (CVP) or central venous oxygen saturation (ScvO2) measurement, pulse pressure variation, and lactate clearance/ normalization.[2,11]

Communication and Teamwork Tools

A critical aspect of care for a patient with sepsis is clear and direct communication. Effective communication techniques will enhance perinatal patient outcomes. As with any new practice, providers may encounter resistance to establishing a treatment plan for early recognition of maternal sepsis. Clear, firm, and respectful communication can provide a culture of safety on the unit. All members of the clinical team should maintain a high index of suspicion and embrace non-hierarchical communication to detect impending sepsis. The use of SBAR communication, a structured communication tool, facilitates clear and concise information exchange, improving patient safety and teamwork. Clear communication can prevent delay of care and improve outcomes. All team members should feel empowered to speak up and know that their input is valued by the care team. Using phrases such as "I have a concern..." Or "Help me understand..." are examples of how to begin a difficult conversation to get everyone's attention. For pregnant patients, the timing and mode of delivery should be planned, clearly communicated to all team members, and continuously updated and reviewed in team meetings.

Rapid Response Team and Escalation of Care Coordination

Most hospitals have a rapid response team (RRT) that is important for supporting patients with sepsis and septic shock. Typically, the RRT is comprised of a critical care nurse and a respiratory therapist. The RRT supports the care team outside of the emergency and intensive care departments and is particularly useful in obstetric units where critically ill patients are uncommon. The RRT can assist with the assessment of a deteriorating patient, provide an early intervention, and make recommendations for necessary lab tests and treatment.

Clinically unstable obstetric patients (pregnant or postpartum) who are at risk for rapid deterioration are usually transferred to a higher level of care. Because obstetric patients with sepsis are younger, usually with fewer co-morbidities, and are generally healthier as compared to the overall population, these patients tend to withstand the challenges of sepsis for a longer time period but then can rapidly deteriorate.[2] Maternal physiologic changes such as an elevated heart rate and low blood pressure can mask some of the signs of clinical deterioration. In these circumstances, assessment and communication among essential personnel should include specialists in critical care, obstetrics and/or maternal-fetal medicine, anesthesiology, as well as nursing coverage for peripartum and ICU care. Preparation for birth, either vaginal or cesarean, should be taken into consideration inclusive of need for equipment for delivery, neonatal resuscitation and/or postpartum needs (e.g. breast pump set up). Additional clinical care recommendations that are specific to pregnancy and that can easily be overlooked in the ICU setting are presented in Table 3.[2]

TABLE 3. Additional Clinical Considerations for Pregnant Women with Sepsis

Consideration	Comment
Vasopressors	Norepinephrine is recommended in pregnancy for MAP < 65 mm Hg if unresponsive to intravenous fluids.
Inotrope	Dobutamine is recommended for myocardial dysfunction or hypoperfusion despite intravenous fluids and vasopressors, as it increases cardiac output.
Glucose control	Avoid hyperglycemia > 180 mg/dl.
Maternal temperature control	Treat fever aggressively to reduce fetal oxygen consumption and fetal tachycardia using acetaminophen and cooling blankets.
Fetal lung maturity	Consider steroids for fetal lung maturity if 22-36 weeks of gestation. Steroids are not contraindicated in this setting.
DVT prophylaxis	Lower leg sequential compression devices while on bed rest.

The decision to transfer an obstetric patient to a higher level of care should be made by a multidisciplinary team, including the obstetrician, anesthesiologist, nurse, the ICU critical care physician and, if appropriate, the neonatologist/pediatrician. Because facilities may have different resources available in their obstetric units to support a patient with sepsis, decisions such as a transfer to ICU should be based on the capabilities of each facility. The Sepsis in Obstetrics Score (SOS) is a validated pregnancy-specific scoring system to assess obstetric sepsis patients for need of escalation of care.[13,14] A score of 6 or more predicted clinical deterioration and ICU admission in both prospective and retrospective studies. The Sepsis in Obstetrics Score is presented in Table 4 and available online at Perinatology.com https://perinatology.com/calculators/Sepsis%20Calculator.htm for ease of real time calculation.

Table 4. The Sepsis in Obstetrics Score - A score of 6 suggests need for ICU care

	High Abnormal Range				Normal	Low Abnormal Range			
Variable	**+4**	**+3**	**+2**	**+1**	**0**	**+1**	**+2**	**+3**	**+4**
Temp (°C)	>40.9	39-40.9		38.5-38.9	36-38.4	34-35.9	32-33.9	30-31.9	<30
SBP (mm Hg)					>90		70-90		<70
HR (beats per minute)	>179	150-179	130-149	120-129	<119				
RR (breaths per minute)	>49	35-49		25-34	12-24	10-11	6-9		<6
SpO2					≥92%	90-91%		85-89%	<85%
WBC (white blood cell count 10^9/L)	>39.9		25-39.9	17-24.9	5.7-16.9	3-5.6	1-2.9		<1
% Bands			≥10		<10				
Lactic Acid (Mmol/L)			≥4		<4				

SBP, systolic blood pressure; HR, heart rate; RR, respiratory rate; SpO2, peripheral oxygen saturation; WBC, white blood count; Bands, immature neutrophils.

Clinical Criteria for Consideration of Transfer to a Higher Level of Care

- Hypotension (MAP < 65mm Hg) despite fluid resuscitation or need for administration of vasopressors
- Persistent hypoxia (SpO2 < 92% on room air)
- Altered mental status (combativeness, confusion, disorientation)

Other criteria for transfer to a higher level of care are presented in Table 5.

If the transfer to a higher level of care necessitates transfer to a different hospital, the patient must be stabilized prior to transport. If delivery is imminent, it may be safer to 'shelter in place' and transfer after delivery. Safe transport of a critically ill pregnant or postpartum patient to a different hospital requires continuous cardiac monitoring, pulse oximetry, venous access, and assessment of vital signs. The recommendation is not to delay transport of a critically ill pregnant patient because of inability to monitor the fetus; stabilizing the mother will stabilize the fetus.

If the transfer of a pregnant or postpartum patient occurs within the hospital, it is important that the patient is accompanied by the appropriate team members, which may include the obstetrician, anesthesiologist, and nurse, as well as the equipment necessary for monitoring the mother and fetus. Decisions for fetal monitoring can be individualized. Further considerations for team management are discussed in Table 5.

Table 5. Patient Location and Team Management

Location	ICU for Antepartum Patient	Labor and Delivery	ICU for Postpartum Patient
Team	•Critical Care physician (with MFM/OB consult) •Anesthesiologist •L&D/antepartum RN to assess for labor signs and perform fetal monitoring •NICU staff on stand-by	•MFM/OB (with Critical Care consult) •Anesthesiologist •ICU RN for invasive monitoring • NICU staff on stand-by	•Critical Care physician (with OB/MFM consult) •Postpartum RN to perform postpartum assessments
Preparations	•Vaginal delivery and emergent cesarean section equipment in the ICU •Neonatal resuscitation equipment in the ICU	•Monitoring equipment needed by ICU team for adequate assessments and support during labor and birth	•Breast pump set up •Newborn bonding, pictures, visits to ICU, skin-to- skin •Psycho-social support for the patient and her family

Indications for Delivery

The Society for Maternal-Fetal Medicine (SMFM) concludes sepsis by itself "is not an immediate indication for delivery (except in cases of chorioamnionitis/intraamniotic infection)."[15] Rather, the timing of delivery in a pregnant woman who is septic should be individualized, taking into consideration gestational age and maternal-fetal status. Because improving maternal hemodynamics often improves fetal status, cesarean delivery is usually reserved for supervening obstetric indications after the woman is stabilized by instituting appropriate supportive and antibiotic therapy. When chorioamnionitis/intraamniotic infection is the source of infection in sepsis, delivery is indicated with the mode of delivery (vaginal vs. cesarean) and exact timing determined by maternal and fetal condition.[4]

Anesthetic Considerations

In patients with bacteremia, there is thought to be a theoretical increased risk of meningitis or spinal epidural abscess with neuraxial procedures due to seeding of the meninges, subarachnoid, or epidural space. Given the low rate at which this occurs, no study to date has been powered to exclude this possibility. We provide this information to help clinicians decide whether to provide neuraxial anesthesia. It is ultimately the decision of the anesthesiologist whether or not to perform neuraxial procedures.

Screen Positive Patients

In a patient with confirmed or suspected bacteremia, a thorough assessment should be performed, including a history, physical exam, and review of laboratory values. As previously covered, it is not

uncommon for pregnant women to have elevated WBC counts or lactic acid as a result of the labor process itself.[16,17] In patients diagnosed with chorioamnionitis, there is a reported incidence of bacteremia in 5-12% of patients.[4] Two studies with a total of 810 patients diagnosed with chorioamnionitis receiving neuraxial procedures assess outcomes. Many patients were febrile at the time of neuraxial procedure placement without prior antibiotic therapy; both studies did not report any cases of spinal epidural abscess or meningitis.[18,19] Because it is rare a neuraxial infection occurs after a neuraxial procedure in patients with suspected bacteremia, consideration should be given to the higher risk of failed intubation in pregnant women (1 in 390).[20] We recommend an anesthesiologist perform neuraxial procedures in patients at risk for bacteremia. Prior to neuraxial procedures, appropriate preprocedural antibiotic therapy should be administered and infusion(s) completed, as research has shown that antibiotic therapy administered prior to neuraxial procedures mitigates this risk.[21]

Sepsis/Septic shock

In a patient with clinical signs and/or symptoms consistent with a diagnosis of sepsis or septic shock, avoidance of neuraxial procedures should be strongly considered in the risk assessment. The physiologic status of the patient with sepsis or septic shock is compromised and the cardiovascular effects of a neuraxial block technique may cause further detriment in an already critical clinical situation, with high potential for maternal (and fetal) morbidity and mortality.

Recommendations (Level of Evidence)

1. Hospitals should develop a standard protocol and order set for obstetric patients with the diagnosis of sepsis. (LEVEL C)
2. The hospital Rapid Response Team (RRT) or “Team Sepsis” is a very valuable support for the obstetric staff in the setting of sepsis or an unstable serious infection. (LEVEL C)
3. The obstetric service should have protocols for support of pregnant or postpartum patients in the Intensive Care Unit. (LEVEL C)
4. Most pregnant patients with serious infections or sepsis under appropriate antibiotic treatment can receive can receive neuraxial anesthesia for delivery. (LEVEL C)
5. Blood cultures should be drawn in sepsis even if antibiotics have been started. (LEVEL B)
6. The neonatal team should be notified immediately if maternal blood or placental cultures return positive. (LEVEL B)

Educational Tools and Sample Resources

1. Appendix P: Sample: Miller Sepsis/Chorio Order Sets
2. Appendix V: Sample: Maternal Sepsis Debriefing Form
3. Appendix W: Sample: UC Davis Health Maternal Sepsis Drill Scenario

References:

1. Bauer, ME and Pacheco LD. Sepsis and Septic Shock During Pregnancy and Postpartum. Obstet Gynecol. 2025 in press
2. Bauer ME, Albright C, Prabhu M, Heine RP, Lennox C, Allen C, Burke C, Chavez A, Hughes BL, Kendig S, Le Boeuf M, Main E, Messerall T, Pacheco LD, Riley L, Solnick R, Youmans A, Gibbs R. Alliance for Innovation on Maternal Health: Consensus Bundle on Sepsis in Obstetric Care. Obstet Gynecol. 2023 Sep 1;142(3):481-492.
3. Evans L, Rhodes A, Alhazzani W, et al. Surviving sepsis campaign: international guidelines for management of sepsis and septic shock. 2021. Intensive Care Med. 2021;47:1181–1247.
4. ACOG Committee on Obstetric Practice Opinion 712: Intrapartum Management of Intraamniotic Infection. Obstet Gynecol 2017 Aug;130(2):e95-E101
5. CMS. Severe Obstetric Complications Electronic Clinical Quality Measure (eCQM) Methodology Report, Version 1.0 October 2021. https://www.cms.gov/files/document/measure-methodology-report.pdf (accessed January 20, 2025).
6. Zornitzki L, Anuk L, Frydman S, et.al. Rate and predictors of blood culture positivity after antibiotic administration: a prospective single-center study. Infection. 2024 Apr;52(2):483-490.
7. Rochwerg B, Alhazzani W, Sindi A, et al. Fluid resuscitation in sepsis: a systematic review and network meta-analysis. Ann Intern Med. 2014;161:347–355.
8. Brown RM, Wang L, Coston TD, et al. Balanced crystalloids versus saline in sepsis. A secondary analysis of the SMART clinical trial. Am J Respir Crit Care Med. 2019;200:1487–1495.
9. Doherty A, El-Khuffash A, Monteith C, et al. Comparison of bioreactance and echocardiographic non-invasive cardiac output monitoring and myocardium function assessment in primagravida women. Br J Anaesth. 2017 Apr;1;118(4):527-32.
10. Beaudry S, Pick J, Heerdt PM. Non-invasive cardiac output monitoring for cesarean delivery under epidural anesthesia in a patient with Marfan syndrome and cardiomyopathy. Int J Obstet Anesth 2016 Feb;25:82-5.
11. Jones, AE. Lactate Clearance for Assessing Response to Resuscitation in Severe Sepsis. Acad Emerg Med 2013 Aug;20(8):844-847.
12. Gymafi-Bannerman C, Thom EA, Blackwell SC et al. Antenatal Betamethasone For Women at Risk for Late Preterm Delivery. N Eng J Med 2016 Apr;374:1311-1320
13. Albright CM, Ali TN, Lopes V, Rouse DJ, Anderson BL. The sepsis in obstetrics score:a model to identify risk of morbidity from sepsis in pregnancy. Am J Obstet Gynecol. 2014;211:39. e1–8.
14. Albright CM, Has P, Rouse DJ, Hughes BL. Internal validation of the sepsis in obstetrics score to identify risk of morbidity from sepsis in pregnancy. Obstet Gynecol 2017;130:747–55.
15. Shields AD, Plante LA, Pacheco LD, Louis JM; SMFM Publications Committee. Electronic address: pubs@smfm.org. Society for Maternal-Fetal Medicine Consult Series #67: Maternal sepsis. Am J Obstet Gynecol. 2023 Sep;229(3):B2-B19. doi: 10.1016/j.ajog.2023.05.019.
16. Bauer ME, Bauer ST, Rajala B, et al. Maternal physiologic parameters in relationship to system inflammatory response syndrome criteria: a systematic review and meta-analysis. Obstet Gynecol 2014;124:535-41.
17. Bauer ME, Housey M, Bauer ST, et al. Risk Factors, Etiologies, and Screening Tools for Sepsis in Pregnant Women: A Multicenter Case-Control Study. Anesth Analg 2019 Dec;129(6):1613-1620. doi: 10.1213/ANE.0000000000003709.
18. Goodman EJ, DeHorta E, Taguiam JM. Safety of spinal and epidural anesthesia in parturients with chorioamnionitis. Reg Anesth 1995-6 Sep-Oct;21:436-41.
19. Bader AM, Gilbertson L, Kirz L, et al. Regional anesthesia in women with chorioamnionitis. Reg Anesth 1992 Mar-Apr;17(2):84-6.
20. Reale SC, Bauer ME, Klumpner TT, Aziz MF, Fields KG, Hurwitz R, Saad M, Kheterpal S, Bateman BT; Multicenter Perioperative Outcomes Group Collaborators. Frequency and Risk Factors for Difficult Intubation in Women Undergoing General Anesthesia for Cesarean Delivery: A Multicenter Retrospective Cohort Analysis. Anesthesiology. 2022 May 1;136(5):697-708. doi: 10.1097/ALN.0000000000004173.
21. Practice Advisory for the Prevention, Diagnosis, and Management of Infectious Complications Associated with Neuraxial Techniques: An Updated Report by the American Society of Anesthesiologists Task Force on Infectious Complications Associated with Neuraxial Techniques and the American Society of Regional Anesthesia and Pain Medicine. Anesthesiology. 2017 Apr;126(4):585-601. doi: 10.1097/ALN.0000000000001521.

Source Control for Serious Infections during Pregnancy and Postpartum

Natali Aziz, MD, MS, Stanford University School of Medicine
Elliott K. Main, MD, Stanford University School of Medicine

Key Principles:

1. Source control is central to the treatment of many infections, especially those that involve infected tissue within the uterus or an abscess.
2. Delivery and dilation and curettage are important tools for infection source control in obstetrics.
3. If a patient has no improvement with initial antibiotics, imaging should be considered to assess the need for other interventions for source control management.

Background

Any locus of infection within the body can be difficult to treat with antibiotics alone. This is especially the case if the infection has progressed to an abscess, a soft tissue infection, or is within a body cavity, such as the uterus. In such a situation, drainage of the site can be critical to successful treatment. Source control can take the form of open debridement, percutaneous drainage (with or without indwelling drain), delivery (in the case of chorioamnionitis), dilation and curettage to remove any residual uterine contents, and more extensive surgical treatment as appropriate.[1] In the case of retained products of conception or chorioamnionitis, evacuation of the uterine cavity can lead to rapid recovery, along with the concomitant use of antibiotics.[2]

RESPONSE

If patients have no improvement with initial antibiotics and fluid resuscitation, the following management should be undertaken:[3]

1. **Patients with identified sources of infection that are amenable to percutaneous drainage:**
    a. Interventional radiology consultation and assessment for possible drainage (with or without indwelling drains).
    b. Consider consultation with infectious diseases specialist if appropriate.
2. **Patients with identified sources of infection requiring surgery:**
    a. Gynecologic surgery consultation for procedures such as dilatation and curettage for retained products, hysterectomy for necrotizing Group A streptococcal uterine infection, or drainage of pelvic or perineal abscess not amenable to percutaneous drainage by interventional radiology.
    b. General surgery consultation for procedures such as drainage of abdominal abscess, appendectomy, cholecystectomy, or debridement for necrotizing fasciitis. **Early surgical consultation is strongly recommended for any concerns regarding necrotizing skin and soft tissue infections.**
3. **Patients with identified sources of infection that are too small or are not amenable to percutaneous drainage, patients with undetected sources, or patients with refractory fevers despite antibiotics and supportive measures:**
    a. Consider consultation with Infectious Diseases and/or Maternal-Fetal Medicine specialists.
    b. Consider imaging studies to detect occult abscess or other infections.

While many infections can be clinically diagnosed with physical examination and laboratory tests, some do require imaging, especially when the presumed infection is not responding quickly and there is concern for a sequestered locus that may need direct attention. Table 1 discusses imaging strategies for multiple infection scenarios for both the antepartum and postpartum periods.

Table 1. Imaging: Recommendations for Identifying Specific Sources of Infection

Suspected Infection source	Antepartum Imaging	Postpartum Imaging
Appendicitis[4,5,6]	**Graded compression ultrasonography** is first line. Sensitivity is 67-100%, specificity is 83-96%. **MRI of the pelvis** should be performed if ultrasound is inconclusive. Sensitivity is 94-97%, specificity is 97-99%. If MRI is not available, then CT scan can be performed if ultrasound is inconclusive.	**CT scan**
Cesarean delivery wound infection/ surgical site infection (SSI)[7]	N/A	**Superficial Incisional SSI:** No imaging needed because it is generally diagnosed on exam with culture and opening of the incision. **Consider ultrasound.**
		Deep Incisional SSI: CT scan and ultrasound.
		Organ/Space SSI: CT scan and ultrasound— unless endomyometritis, which is usually diagnosed and treated clinically.
Cholecystitis[8]	**Right upper quadrant (RUQ) ultrasound** is the most reliable modality for cholecystitis and cholelithiasis. **Magnetic resonance cholangiopancreatography (MRCP)** may be helpful in cases of choledocholithiasis when ultrasound is not diagnostic. Hepatobiliary iminodiacetic acid (HIDA) scan, while safe, can help to determine obstruction in cholecystitis but is rarely needed.	**RUQ ultrasound, MRCP, and HIDA scan** (involves a radioactive tracer).
Chorioamnionitis/ intraamniotic infection Endomyometritis[2]	Primarily diagnosed clinically.	Primarily diagnosed clinically.

Bacteremia/ endocarditis	Diagnose using blood cultures paired with risk factors and symptoms (i.e., Duke's criteria) with imaging diagnosis **by transthoracic echocardiogram (TTE)** with sensitivity 75%. If patient can tolerate sedation, **transesophageal echocardiogram (TEE)** has better valve visualization with sensitivity 95%.	**TTE and TEE.**
Mastitis/breast abscess	**Ultrasound with guided drainage** for abscess.	**Ultrasound with guided drainage** for abscess.
Necrotizing skin and soft tissue infection[9]	Primarily diagnosed clinically.	Primarily diagnosed clinically.
Pelvic abscess[10]	**Ultrasound.**	**Ultrasound** is usually the first line for diagnosis due to cost and no radiation exposure. It has similar sensitivity to CT scan (see below) for tubo-ovarian abscess (TOA) 75-82%, though there are no head-to-head comparisons. CT scan with IV and oral contrast with sensitivity for TOA 78-100%. Drainage recommended for abscess size ≥ 7 cm.
Pneumonia[11]	**Chest x-ray** remains the gold standard when diagnosis suspected (i.e., shortness of breath, cough, fever, tachypnea, hypoxia). **CT-chest** (low dose CT comparable with standard dose CT) is generally reserved for suspected pulmonary embolism with adjustments made from craniocaudal sections to avoid exposure to gravid uterus.	**Chest x-ray and CT-chest.**
Renal abscess/ urogenital tract[12]	**Ultrasound, MRI, and CT scan** with contrast only if necessary.	**CT scan** with contrast.
Retained products of conception/ septic abortion[13]	**Ultrasound** to show retained products. **CT scan** with contrast to evaluate parametrium but often non-specific.	**Ultrasound** to show retained products. **CT scan** with contrast to evaluate parametrium but often non-specific.

Septic pelvic thrombophlebitis[14]	N/A	Optimal imaging method is uncertain. **CT scan** with contrast OR **magnetic resonance venography** with gadolinium are reasonable alternatives. **Ultrasound is not as useful.** Interpret imaging findings with caution and in combination with clinical signs and symptoms, since pelvic vein thrombosis is also highly prevalent in asymptomatic postpartum individuals (after spontaneous vaginal delivery in one study using magnetic resonance venography).[14]

Recommendations (Level of Evidence)

1. Source control should be part of educational programs for serious infections during pregnancy and postpartum. (LEVEL C)
2. Obstetric units should include a multi-disciplinary approach with general surgery, infectious diseases, and interventional radiology specialty resources in protocols for emergency care of obstetric patients with serious infections. (LEVEL C)

References:

1. Plante LA, Pacheco LD, Louis JM. Society for Maternal-Fetal Medicine (SMFM) Consult Series #47: Sepsis during pregnancy and the puerperium. Am J Obstet Gynecol. 2019 Apr;220(4):B2-B10.
2. ACOG Committee Opinion Intrapartum Management of Intraamniotic Infection. Obstet and Gynecol 2017 Aug;130(2):e95-e101.
3. Huston JM, Barie PS, Dellinger EP, Forrester JD, Duane TM, Tessier JM, Sawyer RG, Cainzos MA, Rasa K, Chipman JG, Kao LS, Pieracci FM, Colling KP, Heffernan DS, Lester J; Therapeutics and Guidelines Committee. The Surgical Infection Society Guidelines on the Management of Intra-Abdominal Infection: 2024 Update. Surg Infect (Larchmt). 2024 Aug;25(6):419-435. doi: 10.1089/sur.2024.137.
4. Williams R, Shaw J. Ultrasound scanning in the diagnosis of acute appendicitis in pregnancy. Emerg Med J 2007 May;24(5):359-60.
5. Duke E, Kalb B, Arif-Tiwari H, et al. A Systematic Review and Meta-Analysis of Diagnostic Performance of MRI for Evaluation of Acute Appendicitis. ARJ Am J Roentgenol 2016 Mar;206(3):508-17
6. Burke LM, Bashir MR, Miller FH, et al. Magnetic resonance imaging of acute appendicitis in pregnancy: a 5-year multi- institutional study. Am J Obstet Gynecol 2015 Nov;213(5):693.e1-6.
7. Centers for Disease Control and Prevention. Procedure-associated Module: Surgical Site Infection (SSI) Event, January 2018. Available at: https://www.cdc.gov/nhsn/PDFs/pscManual/9pscSSIcurrent.pdf
8. Weinstein MS, Feuerwerker S, Baxter JK. Appendicitis and Cholecystitis in Pregnancy. Clin Obstet Gynecol. 2020 Jun;63(2):405-415. doi: 10.1097/GRF.0000000000000529.
9. Stevens DL, Bisno AL, Chambers HF, et al. Infectious Diseases Society of America. Practice Guidelines for the diagnosis and management of skin and soft tissue infections: 2014 Update by the Infectious Diseases Society of America. Clin Infect Dis. 2014 Jul 15;59(2). Erratum in Clin Infect Dis. 2015 May 1;60(9):1448.
10. Fouks Y, Cohen A, Shapira U, et al. Surgical Intervention in Patients with Tubo-Ovarian Abscess: Clinical Predictors and a Simple Risk Score. J Minim Invasive Gynecol 2019;26(3):535

11. Jackson CD, Burroughs-Ray DC, Summers NA. Clinical Guideline Highlights for the Hospitalist: 2019 American Thoracic Society/Infectious Diseases Society of America Update on Community-Acquired Pneumonia. J Hosp Med. 2020 Dec;15(12):743-745. doi: 10.12788/jhm.3444.
12. Meyrier A. Renal and perinephric abscess. Access: UpToDate.com. Current through April 2025. Last updated Sep 27, 2024.
13. Prager S, Micks E, Dalton V. Septic abortion: Clinical presentation and management. Access: UpToDate.com Current through April 2025. Last updated May 29, 2024.
14. Chen KT. Septic pelvic thrombophlebitis. Access: UpToDate.com. Current through April 2025. Last updated April 18, 2025

RESPONSE

Antibiotics for Obstetric Sepsis and Serious Infections

Kathleen Andonian, PharmD, Sharp Mary Birch Hospital for Women and Newborns
Natali Aziz, MD, MS, Stanford University School of Medicine
Lauren Puckett, PharmD, Stanford Medicine Children's Health
Casey L. Smiley, MD, Vanderbilt University Medical Center
Elliott K. Main, MD, Stanford University School of Medicine

Key Principles:

1. Early administration of antibiotics, ideally within one hour of symptom onset, improves outcomes in obstetric sepsis and serious infections.
2. Critically ill patients should be treated initially with empiric broad spectrum antibiotics to cover most or all likely pathogens associated with the suspected source or site of infection.
3. Assessment for source control (such as surgical/percutaneous drainage or debridement or even delivery) should be initiated in a timely fashion and using the least invasive approach possible.

Introduction

Antibiotics should be administered within one hour of diagnosis of serious infection.

Ideally, serious infections in obstetric patients should be treated within one hour of diagnosis to limit development of sepsis.[1] Initial antibiotic coverage for patients with sepsis should be empiric with the use of a broad-spectrum antibiotic regimen. In the 48-72 hours following initial antibiotic administration, it is often recommended that the antibiotic regimen be narrowed as culture information becomes available and the patient stabilizes. In contrast to pyelonephritis or pneumonia, which are usually caused by a single organism, it is important to recognize that many pelvic infections are polymicrobial, involving aerobes (which are usually identified in the laboratory within 24-72 hours) and anaerobes (which may be difficult to culture and take several more days to identify in most clinical microbiology laboratories). In addition, an organism isolated from blood, such as Group A Streptococcus or *E. coli*, may reflect only part of the polymicrobial flora causing many pelvic infections. Limitations in microbiologic testing in most facilities include the inability for in-house testing of exotoxin (most often from streptococcal species or staphylococcal species) and in-house identification of atypical bacteria (*Mycoplasmas* and *Ureaplasma*). Furthermore, cultures from the genital site may not have been collected or tested for anaerobic or atypical organisms. Decisions about narrowing the antibiotic regimen should therefore evaluate these special considerations coupled with the patient's clinical response, and suspected source/site of infection regarding the antimicrobial management of

pelvic infections. If there is concern for a polymicrobial infection, it is reasonable to continue empiric anaerobic coverage as these organisms can be difficult to isolate and are frequently found in genital and gastrointestinal flora.

Empiric antibiotic choices should be guided by the local antibiogram.

The antibiogram is a document produced by microbiology laboratories that lists the percentages of specific bacterial isolates tested at that lab that are sensitive to an array of antibiotics. In general, patients who have recently been hospitalized or who have been recently exposed to antibiotics are at risk of being infected with multi-drug-resistant organisms (MDRO), such as methicillin-resistant *Staphylococcus aureus* (MRSA) or extended spectrum beta-lactamase producing (ESBL) organisms. In patients at risk for these types of infections, it is important to choose broad spectrum agents that are active against these pathogens, (e.g. respectively vancomycin or a carbapenem). Of note, the carbapenem ertapenem does not provide coverage for *Pseudomonas aeruginosa*, *enterococci*, or Acinetobacter species. Additionally, carbapenems are known to increase the risk of seizures, with imipenem thought to be the most epileptogenic; its effect on lowering the seizure threshold in preeclampsia is unknown. Therefore, if ESBL is a risk factor in severe obstetric sepsis, the carbapenem meropenem offers the widest spectrum coverage with better safety profile for seizures and thus may be the best empiric option. Carbapenems also are not effective against atypical bacteria. Although well documented to be proinflammatory, the pathogenesis and virulence of genital Mycoplasmas and other atypical organisms in obstetric and gynecologic infections (as well as neonatal disease) is not completely established in the literature. Therefore, the decision to include atypical antimicrobial coverage will depend largely on suspected source of infection and institutional guidelines particularly when treating septic abortion or sepsis with retained products of conception.

Order sets are important.

In order to initiate antibiotics for pregnant women with sepsis as quickly as possible, we recommend having a sepsis order set available to clinicians in the obstetric units (see chapter Educational Tools and Sample Resources). The sepsis order set has helped to guide clinicians in giving the appropriate effective antibiotics based on source of infection that are considered safe for use in pregnancy. A pharmacist with antibiotic stewardship and infectious disease specialty training can play a key role in establishing the order sets and setting up systems which make antibiotics immediately available on the unit to facilitate antimicrobial therapy in sepsis and other obstetric infections.

Pain medications such as ibuprofen and acetaminophen can mask a fever. While it is considered best practice to give acetaminophen to pregnant patients to protect the fetus from the deleterious effects of high fever, one may need to evaluate for the presence of subclinical masked fever if giving acetaminophen (or other antipyretics such as ibuprofen) to postpartum patients. Additionally, fever can be the result of multiple non-infectious causes (for example, venous thromboembolic disease, atelectasis, transfusion, or administration of synthetic prostaglandins like misoprostol). On the other hand, as discussed in other sections, obstetric patients with sepsis may not present with fever. Therefore, fever should not be used as a sole criterion for deciding to administer antibiotics. The Obstetric Severe Infection/Sepsis Evaluation Screen Flow Chart, as discussed in Screening and Diagnosis of Sepsis in Pregnancy, helps the clinician navigate this assessment.

Group A Streptococcus (GAS) Infections

The importance of Group A *Streptococcus* (GAS) (*Streptococcus pyogenes*) cannot be overemphasized. It is perhaps **the organism most commonly responsible for fatal maternal sepsis.**[2] GAS can cause a range of infections, including endomyometritis, fulminant endomyonecrosis, necrotizing fasciitis, and streptococcal toxic shock syndrome (STSS).[3,4] It is also **a common organism associated with missed abortions/fetal demise cases and vaginal deliveries with retained products of conception (POC)**, underscoring the critical need to evacuate the uterus for source control. While not all pregnant or postpartum patients with severe invasive GAS infection will develop toxic shock syndrome, it is important to be aware of this syndrome because the recommended antimicrobial regimen is different from that for sepsis due to other sources. Furthermore, as stated above, most hospital microbiology laboratories are unable to test for the Streptococcal toxins responsible for STSS. Blood culture collection prior to antibiotic administration is strongly recommended when possible. Blood cultures will result positive in only about half of all cases of STSS; cultures collected after antibiotic administration have a reduced likelihood of identifying the organism, leading to a risk of misdiagnosis. Table 1 lists the clinical criteria for Streptococcal toxic shock syndrome.

Table 1. CDC Case Definition for Streptococcal Toxic Shock Syndrome in Adults

Hypotension--Systolic blood pressure <90mmHg
Multiorgan involvement characterized by two or more of the following: ▸ Renal impairment – creatinine ≥ 2mg/dL or ≥ 2 xelevation above baseline in patients with pre-existing renal disease ▸ Coagulopathy – Platelets ≤ 100,000/mm^3 or disseminated intravascular coagulation, defined by prolonged clotting times, low fibrinogen level, and the presence of fibrin degradation products ▸ Liver dysfunction– Alanine aminotransferase, aspartate aminotransferase, or total bilirubin levels ≥ 2x the upper limit of normal or ≥ 2x elevation over baseline in patients with pre-existing liver disease ▸ Acute respiratory distress syndrome ▸ Erythematous macular rash (may desquamate) ▸ Soft tissue necrosis (e.g., necrotizing fasciitis, myositis, or gangrene)

A patient who meets the clinical criteria with isolation of GAS from a normally sterile site (e.g., blood or surgical site) has a **confirmed diagnosis** of STSS. **A probable diagnosis** of STSS may be made for patients who meet the clinical criteria (in the absence of another explanation for the illness) with isolation of GAS from a nonsterile site (e.g. throat or vagina) in the presence of the physiologic STSS presentation as described in Table 1.

The differential diagnosis of pregnancy-related GAS infection includes infection due to *Clostridium perfringens* and *Clostridium sordellii*, which are also associated with high morbidity and mortality. **Antibiotic therapy for severe GAS infections and STSS includes combination therapy with high dose penicillin and clindamycin**. Clindamycin is used to ensure optimal anti-streptococcal activity and most importantly decrease the production of exotoxin and other virulence factors. Empiric use of clindamycin monotherapy is not recommended due to increasing resistance. When clindamycin is

used for toxin inhibition, the duration of treatment is usually 48-72 hours or until patient is clinically and hemodynamically stable for 24 hours (whichever is later). Linezolid is another option, in place of clindamycin, to limit toxin production, and has excellent activity against *streptococcal species* and *Clostridium* spp. In patients with reported allergies to penicillin, including Type 1 hypersensitivity reactions (i.e., anaphylaxis), high-dose cefazolin could be considered under close surveillance and based on clinician evaluation of risks/benefits per institutional guidelines. If a patient is allergic to penicillin and cephalosporins, or if MRSA is also a pathogenic concern, the patient should receive vancomycin (or daptomycin) and clindamycin. Linezolid could also be used as a single agent as it has excellent MRSA coverage. Of note, it is critically important for facilities to follow their institution's resistance trends for streptococcal species as current literature demonstrates significantly increasing trends of clindamycin resistance not only for streptococcal species but also pelvic anaerobes.

Diagnose necrotizing fasciitis clinically in the presence of fever, pain out of proportion to exam, crepitus, bullae, erythema, and rapid progression of findings. Prompt surgical management (with tissue pathology) confirms the diagnosis. Early debridement is critical.

Early surgical intervention (wound debridement, vulvar debridement, evacuating the uterus, or hysterectomy or a combination of these interventions) for source control is critically important for necrotizing fasciitis. It is important to note that cultures should be obtained at the time of surgical intervention or debridement. Alternatively, if the local antibiogram indicates a high resistance rate of GAS to clindamycin, some experts consider replacing clindamycin with linezolid for toxin inhibition.

Antibiotic Considerations for Sepsis and Serious Infections in Obstetrics

The following two tables summarize antibiotic considerations in routine infection settings, as well as for Type I through IV penicillin and cephalosporin allergies. Additional information for Bacterial Resistance & Virulence Factors is also provided. As always, these recommendations should be reviewed with the hospital antibiotic stewardship committee and compared against the local antibiogram. The associated notes are quite informative. The tables were developed by pharmacists who lead their hospital antibiotic stewardship committees and Infectious Diseases specialists. We are indebted to them for their attention to detail. These are general recommendations; institutional recommendations may vary based on local antibiograms. Appendix L summarizes use of these antibiotics and their safety information during breastfeeding (see chapter Educational Tools and Sample Resources). Antibiotic considerations for **Chorioamnionitis/Intraamniotic Infection** are discussed in-depth in the Chorioamnionitis/Intraamniotic Infection chapter.

Table 2. Antibiotic Considerations for **Sepsis of Unknown Source** or **Septic Shock.**
See footnotes for further explanation

Antibiotic Choices[a] *Empiric coverage for sepsis of unknown source or for septic shock should include coverage for gram-negative bacteria, gram-positive bacteria (including MRSA), and anaerobic bacteria.*	**Duration**
Piperacillin/tazobactam 4.5 g IV q8h[b] **AND** Vancomycin – per institutional protocol (target AUC_{24} 400-600)[c,d]	7-10 days is adequate for most infections[k] 14 days may be indicated in patients who were critically ill (see also source control section)
For Type I Penicillin Allergy (immediate hypersensitivity-hives, wheezing, anaphylaxis)[e]: Cefepime 2 g IV q8h[f] **AND** Metronidazole 500 mg IV/PO q8h **AND** Vancomycin – per institutional protocol (target AUC_{24} 400-600)[c,d]	
For Type I Cephalosporin Allergy[e] : Meropenem 1 g IV q8h (extended infusion) **OR** 500 mg IV q6h[g] **AND** Vancomycin – per institutional protocol (target AUC_{24} 400-600)[c,d]	
For Severe Type II-IV allergy to penicillins or cephalosporins (example: hemolytic anemia, toxic epidermal necrolysis (TEN), Steven's Johnson Syndrome (SJS), interstitial nephritis)[e]: Aztreonam 2 g IV q6h-q8h[h] **AND** Metronidazole 500 mg IV/PO q8h **AND** Vancomycin - per institutional protocol (target AUC_{24} 400-600) [c,d] **OR** Meropenem 1g IV q8h (extended infusion) OR 500 mg IV q6h[g] **AND** Vancomycin – per institutional protocol (target AUC_{24} 400-600) [c,d]	
FOR ALL OF THE ABOVE SCENARIOS: **ADD clindamycin for suspected or known STSS:** Clindamycin 900 mg IV q8h[i] **Risk of Fungemia:** Empiric Antifungal & Consult Infectious Diseases[j]	

Notes:

a. *Doses recommended in this table are based on normal renal and hepatic function. The above recommendations are based on available literature and national guidelines. They are not intended to replace obstetric provider clinical judgment based on patient-specific factors and hospital-specific guidelines.*

RESPONSE

b. ***Piperacillin-tazobactam**, when used for sepsis, should be started with a 4.5 g IVPB loading (bolus) dose infused over 30 minutes with maintenance dose of 4.5 g IV q8h, which is started 4-6 hours following the maintenance dose and administered as an extended infusion over 4 hours.[5,6,7] If patient does not have access to allow for extended infusion, the recommended administration of piperacillin-tazobactam is 4.5 g IV q6h given as a 30-minute intermittent infusion.*

c. ***Vancomycin**, when used for sepsis or critically ill patients, is typically started with a loading dose of 25-30 mg/kg. Loading doses greater than 2 g must be divided. Usual maintenance dosing range is 15-20 mg/kg IVPB q8h-q12h and adjusted for renal dysfunction. Monitor serum creatinine and vancomycin serum concentrations closely in patients with sepsis and end-organ injury. Typical target vancomycin 24-hour area under the curve (AUC_{24}) is 400-600 for most indications or ≥ 500 and/or a goal trough of greater than 10 mcg/mL in MRSA bacteremia or critically ill patients. Literature suggests that the risk of AKI increases with AUC > 650 and trough > 15 mcg/m. Pharmacists trained in pharmacokinetic dosing of vancomycin are recommended to assist with dosing and monitoring of vancomycin. Consider discontinuing vancomycin if no MRSA risk factors are present or when MRSA has not been identified. Testing for MRSA colonization in nares swab, when negative, can provide a strong negative predictive value for MRSA pneumonia. However, a negative predictive value for other sources in sepsis is not clearly identified in the literature. Some experts may recommend swabbing 2-3 locations such as nares, throat, and perineum, to help with early de-escalation and discontinuation of vancomycin in a clinically improving patient in the absence of an MRSA culture result from the suspected source.*

d. *For patients with vancomycin infusion reaction (formerly "red man syndrome"), characterized as maculopapular rash appearing on the face, neck, trunk, and/or upper extremities during vancomycin infusion, decrease the infusion rate to 1.5 - 2 hours per gram of vancomycin and consider premedication with an antihistamine (e.g. diphenhydramine). For patients with true allergic reactions (excluding aforementioned infusion rate-induced reaction) to vancomycin or a history of vancomycin resistant enterococcus (VRE), substitute vancomycin with daptomycin 8-10 mg/kg IV q24h. Note daptomycin is inactivated by pulmonary surfactant and is not acceptable for treatment of pneumonia. For infections involving the respiratory tract, substitute vancomycin with linezolid 600 mg IV/PO q12h.*

e. *Refer the following antibiotic allergy section for further discussion on antibiotic allergy definitions and management strategies.*

f. *Administer cefepime as an extended infusion when available; administer cefepime 2 g IV infused over 30 minutes with maintenance dose of 2 g IV over 4 hours starting 8 hours after the bolus.*

g. *Administer meropenem as an extended infusion when available; administer meropenem 1 g IV infused over 30 minutes (loading/bolus dose) with maintenance dose of 1 g IV infused over 3 hours to start 8 hours after bolus dose. If extended infusion is not available, consider meropenem 500 mg IV q6h infused over 30 minutes.[8]*

h. *Aztreonam is not a suitable alternative for patients with a history of Type 1 hypersensitivity (IgE-mediated immediate reaction) to ceftazidime due to similar side-chains and concern for cross-reactivity. For patients weighing > 100kg or who are critically ill, clinicians may consider dosing aztreonam 2 g IV q6h.*

i. *In confirmed or suspected Streptococcal Toxic Shock Syndrome, or Necrotizing Skin and Soft Tissue including fasciitis, or gas gangrene, add clindamycin or linezolid for anti-toxin effect for at least 48-72 hours or until patient is clinically and hemodynamically stable, whichever is later.*

j. *For patients at high risk of Candidemia infection (e.g. on total parenteral nutrition, with central venous catheter, or history of recent broad-spectrum antibiotics), start empiric echinocandin therapy such as caspofungin 70 mg IV x1 dose followed by 50 mg IV daily or micafungin 100 mg IV daily.*

k. *An antibiotic duration of 7-10 days for sepsis is usually adequate. However, antibiotic durations up to 14 days may be indicated in patients who were critically ill. Longer durations may rarely be indicated depending on the causative pathogen or lack of complete source control. Antibiotic duration begins at the start of the appropriate antibiotic therapy based on the causative pathogen, infection origin/source, and source control.*

Table 3. Antibiotic Considerations for **Serious Infections by Source in Obstetric Patients.**
See footnotes for further explanation

Source of Infection	Preferred Regimen[a]	Type I Penicillin Allergy[b]	Type I Allergy to cephalosporins or Type II-IV Allergy to Penicillin[b]	Bacterial Resistance & Virulence Factors[c]	Duration
Septic Abortion or Retained Products of Conception[d]	Piperacillin-tazobactam 4.5 g IV q8h, 4-h infusion[e] **May add** Doxycycline 100 mg IV/PO q12h	Cefepime 2 g IV q8h[f] **AND** Metronidazole 500 mg IV/PO q8h **May add** Doxycycline 100 mg IV/PO q12h	Meropenem 1 g IV q8h[g,h] **May add** Doxycycline 100 mg IV/PO q12h **OR** Levofloxacin 750 mg IV/PO q24h **AND** Metronidazole 500 mg IV/PO q8h **May add** Doxycycline 100 mg IV/PO q12h	**ESBL:** Meropenem 1 g IV q8h[g,h] **MRSA:** **ADD** Vancomycin[i,j] **STSS:** **ADD** Clindamycin 900 mg IV q8h	48h IV and afebrile with clinical improvement and source control; followed by an oral agent to complete 10-14 days
Urosepsis[k]	Ceftriaxone 2 g IV q24h **May add** Aminoglycoside[l]		Meropenem 1 g q8h [g,h] **OR** Levofloxacin 750 mg IV/PO q24h		IV antibiotics should be given until significant clinical improvement, then followed by an appropriate oral agent to complete 7-14 days total antibiotic therapy. There may be no oral option in patients with multi-drug resistant organism (MDRO) infections.

Hospital-Associated Intra-abdominal Infection[l]	Piperacillin-tazobactam 4.5 g IV q8h, 4-hour infusion[e]	Cefepime 2 g IV q8h[6] **AND** Metronidazole 500 mg IV/PO q8h	Meropenem 1 g q8h [g,h] **OR** Aztreonam 2 g IV q8h **AND** Metronidazole 500 mg IV/PO q8h	**ESBL:** Meropenem [g,h] **MRSA:** **ADD** Vancomycin [i,j] **VRE:** Daptomycin 8-10 mg/kg IV q24h OR Linezolid 600 mg IV/PO q12h	4-7 days following complete source control (See section on Source Control)
Pelvic Abscess[m]	Intra-abdominal Source: see Hospital-Associated Intra-abdominal Infection Genitourinary Source: see Septic Abortion/ Retained Products of Conception/ Tubo-Ovarian Abscess				48h IV and afebrile with clinical improvement and source control; followed- an oral agent to complete 10-14 days. See Source Control section.
Necrotizing Skin and Soft Tissue Infection or Necrotizing Fasciitis or Gas Gangrene[n]	Piperacillin-tazobactam 4.5 g IV q8h, 4-h infusion[e] **AND** Vancomycin[i,j] **AND** Clindamycin 900 mg IV q8h	Cefepime 2 g IV q8h[f] **AND** Vancomycin [i,j] **AND** Clindamycin 900 mg IV q8h **AND** Metronidazole 500 mg IV q8h	Meropenem 1 g q8h[g,h] **AND** Vancomycin[i,j] **AND** Clindamycin 900 mg IV q8h		7-14 days following source control
Monomicrobial Necrotizing Skin and Soft Tissue Infection due to: *S. pyogenes* (GAS) OR Clostridium spp. *(C. perfringens or C. sordellii)*	Penicillin G (aqueous) 4 million units IV q4h **AND** Clindamycin 900 mg IV q8h	Cefazolin 2 g IV q8h[o] **AND** Clindamycin 900 mg IV q8h	Vancomycin[i,j] **AND** Clindamycin 900 mg IV q8h	N/A	

RESPONSE

Community-acquired Pneumonia[p]	**Non-Pregnant:** Ceftriaxone 2 g IV q24h **AND** Doxycycline 100 mg IV/PO q12h **Pregnant:** Ceftriaxone 2 g IV q24h **AND** Azithromycin 500 mg IV/PO q24h	**Non-Pregnant:** Levofloxacin 750 mg IV/PO q24h **Pregnant:** Meropenem 1 g q8h[g,h] **AND** Azithromycin 500 mg IV/PO q24h	**MRSA:** **AND** Vancomycin[i,j] **Pseudomonas Risk:** Cefepime 2 g IV q8h[f] **AND** Doxycycline 100 mg IV/PO q12h **May add** Aminoglycoside if septic shock	5 days Patient should be afebrile x 48-72 hrs without supplemental oxygen dependence prior to stopping antibiotics.

Abbreviations: ESBL: extended spectrum beta-lactamase producing organism; MDRO: multi-drug-resistant organism; MRSA: methicillin resistant Staphylococcus aureus; STSS: Streptococcal Toxic Shock Syndrome; VRE: Vancomycin Resistant Enterococcus, GAS: Group A Streptococcus.

Notes:

a. ***Empiric antibiotic recommendations*** *are based on known or strongly suspected source of infection. Recommendations should be tailored to local antibiotic resistance patterns and local microbiological epidemiologic patterns. Antibiotic selection and duration should be adjusted when the pathogens and source(s) are known and controlled and based on patient's clinical response. Antibiotic dosing recommendations are based upon normal renal and hepatic function.*

b. Refer to the following antibiotic allergy section *for further discussion on antibiotic allergy definitions and management strategies.*

c. ***MDRO: Multi-drug-resistant organisms (MDRO)*** *may include ESBL producing Enterobacterales, MRSA, and VRE. Risk factors for MDRO organisms include prior history or present colonization/infection with these organisms.*

d. ***Septic Abortion or Retained Product of Conception:*** *Doxycycline should be considered when there is a need for coverage of atypical pathogens (i.e. Mycoplasma genitalium, Ureaplasma urealyticum). Consider atypical organism coverage for patients with (1) early (< 22 weeks gestational age) spontaneous abortion who undergo surgical uterine aspiration, (2) induced surgical abortion at any gestational age, or (3) lack of clinical improvement. Refer to* CDC guidelines (link) *for treatment recommendations for patients testing positive for M. genitalium. Clindamycin for STSS is usually provided for 48-72 hours or 24 hours of clinical and hemodynamic stability (whichever is longer). Clindamycin for STSS can replace metronidazole in metronidazole containing regimens based upon local anaerobic resistance trends. The option to use levofloxacin containing regimen should only be in institutions with low gram-negative resistance trends.*

e. ***Piperacillin-tazobactam*** *should be started with a 4.5 g IVPB loading (bolus) dose infused over 30 minutes with maintenance dose of 4.5 g IV q8h started 4 hours following the maintenance dose and administered as an extended infusion over 4 hours.*[5,6,7] *If patient does not have access to allow for extended infusion, administration of piperacillin-tazobactam 4.5 g IV q6h given as a 30-minute intermittent infusion is recommended.*

f. *Administer* ***cefepime*** *as an extended infusion when available; administer cefepime 2 g IV infused over 30 minutes (loading/bolus) with maintenance dose of 2 g IV over 4 hours starting 8 hours after the bolus.*

g. *Administer* ***meropenem*** *as an extended infusion when available, either 1 g IV infused over 30 minutes (loading/bolus dose) with maintenance dose of 1 g IV infused over 3 hours to start 8 hours after bolus dose or 500 mg IV q6h with a 30-minute infusion based upon institution practice.*[8]

h. ***Imipenem-cilastatin,*** *dosed at 500 mg imipenem component IV Q6h, may be considered as an alternative to meropenem. Ertapenem 1 g IV q24h may also be considered as an alternative to meropenem if Enterococcus spp., Pseudomonas aeruginosa, and Acinetobacter spp. are not frequent pathogens based on local epidemiology.*

i. ***Vancomycin****, when used for sepsis or critically ill patients, is typically started with a loading dose of 25-30 mg/kg. Loading doses greater than 2 g must be divided. Usual maintenance dosing range is 15-20 mg/kg IVPBq8h-q12h and should be adjusted based on TDM and renal function. Monitor serum creatinine and vancomycin serum concentrations closely in patients with sepsis and end-organ injury. Typical target vancomycin 24-hour area under the curve (AUC24) is 400-600 for most indications or ≥ 500 and/or a goal trough of greater than 10 mcg/mL in MRSA bacteremia or critically ill patients. Literature suggests that the risk of AKI increases with AUC > 650 and trough > 15 mcg/mL. Pharmacists trained in pharmacokinetic dosing of vancomycin are recommended to assist with dosing and monitoring of vancomycin.*

Consider discontinuing vancomycin if no MRSA risk factors are present or when MRSA has not been identified. Testing for MRSA colonization in nares swab, when negative, can provide a strong negative predictive value for MRSA pneumonia. However, a negative predictive value for other sources in sepsis is not clearly identified in the literature. Some experts may recommend swabbing 2-3 locations such as nares, throat, and perineum, to help with early de-escalation and discontinuation of vancomycin in a clinically improving patient in the absence of an MRSA culture result from the suspected source.

j. *For patients with **vancomycin infusion reaction** (formerly "red man syndrome"), characterized as maculopapular rash appearing on the face, neck, trunk, and/or upper extremities during vancomycin infusion, decrease the infusion rate to 1.5 - 2 hours per gram and consider premedication with an antihistamine (e.g. **cetirizine, diphenhydramine**). For patients with true allergic reactions (excluding aforementioned infusion rate-induced reaction) to vancomycin or a history of vancomycin resistant enterococcus (VRE), substitute vancomycin with daptomycin 8-10 mg/kg IV q24h. Note daptomycin is inactivated by pulmonary surfactant and is not acceptable for treatment of pneumonia. For infections involving the respiratory tract substitute vancomycin with linezolid 600 mg IV/PO q12h.*

k. ***Urosepsis**[9]: Levofloxacin can be considered in pregnancy and lactation with careful evaluation of the risks to the fetus or breastfed newborn. Aminoglycosides: Gentamicin or tobramycin may be administered as high-dose extended interval or conventional dosing strategy. Dosing and monitoring provided here is for high-dose extended interval regimens: gentamicin or tobramycin 5-7 mg/kg IV q24h. Therapeutic drug monitoring (TDM) should be performed for all patients. TDM target: Cmax: 15 – 30 mcg/mL, trough: < 0.3 mcg/mL. Pharmacists trained in pharmacokinetic dosing of aminoglycosides are recommended to assist with dosing and monitoring of these drugs. Preference and use of gentamicin or tobramycin should be guided by institutional policy and local antibiogram.*

l. ***Intra-abdominal Infection (IAB):** a complicated IAB signifies an infection that extends beyond the hollow viscus of origin into the peritoneal space and is associated with either abscess formation or peritonitis. A hospital-associated complicated IAB typically occurs after a surgical procedure or bowel perforation in a currently or recently hospitalized patient. Drainage (percutaneous or surgical) is key to management of IAB; early consultation of interventional radiology is mandatory. See section on Source Control. Empiric MRSA coverage is not routinely recommended; MRSA coverage should be considered in patients with MRSA colonization or with MRSA risk factors risk factor which include, but are not limited to prior treatment failure and significant antibiotic exposure. MRSA coverage should be discontinued at 48h if MRSA is not identified in cultures associated with the source of infection. Piperacillin-tazobactam may provide adequate empiric coverage of Enterococcus faecalis but should be confirmed with local antibiogram and susceptibility results if organism is identified in cultures. Consider VRE coverage in septic or severely ill patients with known prior colonization. Initial empiric management of Candida is not recommended in most circumstances.*

m. *Pelvic Abscess: Can be an infectious complication of surgery (i.e. hysterectomy, cesarean, induced abortion) or the result of infectious processes (i.e., pelvic inflammatory disease +/- tubo-ovarian abscess, inflammatory bowel disease, diverticulitis). Early imaging and surgical or interventional radiology consultation for source control is essential for managing pelvic abscesses with the goal to reduce risk on future fertility.*

n. ***Necrotizing Skin and Soft Tissue Infection, Necrotizing Fasciitis, or Gas Gangrene:** Source control along with early surgical consultation is mandatory in any patient with concern for necrotizing skin and soft tissue infection. Add clindamycin or linezolid for anti-toxin effect for at least 48-72 hours or until patient is clinically and hemodynamically stable (whichever is later).*

o. ***Cefazolin:** If measured bodyweight is >120 kg, consider dosing 2 g IV q6h*

p. ***Community-acquired Pneumonia:** CDC respiratory virus guidance is updated annually and are available through the CDC website (link). In California, the influenza season typically occurs October through March (but seasonality may differ by year). Obstetric patients infected with influenza should be treated with oseltamivir 75 mg PO BID x 5 days. There are several treatment options available for COVID-19 positive hospitalized patients. Recommendations for preferred treatment options vary by disease severity and patient comorbidities. Refer to IDSA guidelines for treatment options (link). If vancomycin is started for MRSA coverage, obtain cultures/nasal PCR to allow de-escalation or confirmation of need for continued therapy. In patients with prior respiratory isolation of Pseudomonas aeruginosa or recent hospitalization and parenteral antibiotic receipt, add coverage for Pseudomonas and obtain cultures to allow de-escalation or confirmation of need for continued therapy.[10]*

Antibiotic Compatibility for Intravenous Administration

Rapid administration of broad-spectrum antibiotics is a key step for treatment of sepsis and serious infections. In the setting of multiple antibiotics, delays can occur while investigating compatibility for sharing the same intravenous line with a Y-adaptor. Table 4 addresses this concern for the major antibiotic combinations for obstetric sepsis and serious infections. Institutions should use this below table as

an example, but verify IV Y-site compatibility based on hospital formulary medication formulations concentrations and diluent choice (e.g., NS, D5W). An important principle is to start with the most broad-spectrum antibiotic first and then add other antibiotics either thru a Y-adaptor or if not compatible as an immediately subsequent infusion.

Sepsis Antibiotic Administration Goals:

IMPORTANT: Delays in antibiotic administration increase mortality in the treatment of sepsis.

- Begin as soon as possible after cultures drawn (i.e. Blood x 2 and Urine).
- Start broad spectrum antibiotics FIRST unless directed otherwise or if dispensing delay.
- Concurrent Y-site administration is recommended if compatible.

TABLE 4. Antibiotic IV Compatibility Chart for Use in Co-Administration of Antibiotics in Initial Management of Severe Infections and Sepsis

Broad Spectrum Antibiotic (Start antibiotic in this column FIRST!)	Additional Antibiotics	Y-site Compatibility
Ampicillin-sulbactam	Gentamicin or Tobramycin	NO
Cefepime	Doxycycline	NO
	Metronidazole	YES
	Vancomycin	YES
Ceftriaxone (Compatible with NS, not compatible with LR)	Azithromycin	NO
	Doxycycline	YES
	Gentamicin	YES
	Metronidazole	YES
	Tobramycin	NO
	Vancomycin	NO
Levofloxacin	Clindamycin	YES
	Metronidazole	YES
	Vancomycin	YES
Meropenem or Ertapenem	Vancomycin	YES
Piperacillin-tazobactam (Compatible with NS, most products not compatible with LR)	Clindamycin	YES
	Doxycycline	NO
	Vancomycin	YES* (concentration dependent)

**Note: piperacillin-tazobactam and vancomycin are compatible via Y-adaptor depending on drug concentrations. Y-site compatibility for co-infusion of piperacillin-tazobactam and vancomycin is considered acceptable due to published compatibility data when piperacillin-tazobactam concentration range is 18-112.5 mg/mL and vancomycin concentration range is 2-5 mg/ml.*

Recommendations (Level Of Evidence)

1. Obstetric unit leadership should collaborate with the antibiotic stewardship team to review their local antibiogram and update standard severe infection treatment regimens as needed. (LEVEL B)
2. Invasive Group A Streptococcus (GAS) infections have reemerged as obstetric infections with high mortality rates and deserve additional clinician education (LEVEL B)

Educational Tools and Sample Resources

1. Appendix L: Antibiotic Considerations for Sepsis of Unknown Source or Septic Shock
2. Appendix M: Antibiotic Considerations for Serious Infections by Source in Obstetric Patients
3. Appendix N: Lactation Safety of Antimicrobials Used for Treatment of Sepsis
4. Appendix O: Antibiotic IV Compatibility Chart for Use in Co-administration of Antibiotics in Initial Management of Severe Infections and Sepsis

References:

1. Bauer ME, Housey M, Bauer ST, et.al. Risk Factors, Etiologies, and Screening Tools for Sepsis in Pregnant Women: A Multicenter Case-Control Study. Anesth Analg. 2019 Dec;129(6):1613-1620. doi: 10.1213/ANE.0000000000003709.
2. Harris K, Proctor LK, Shinar S, Philippopoulos E, Yudin MH, Murphy KE. Outcomes and management of pregnancy and puerperal group A streptococcal infections: A systematic review. Acta Obstet Gynecol Scand. 2023 Feb;102(2):138-157. doi: 10.1111/aogs.14500.
3. Donders G, Greenhouse P, Donders F, Engel U, Paavonen J, Mendling W. Genital Tract GAS Infection ISIDOG Guidelines. J Clin Med. 2021 May 10;10(9):2043. doi: 10.3390/jcm10092043.
4. Orieux A, Prevel R, Dumery M, et. al.. Invasive group A streptococcal infections requiring admission to ICU: a nationwide, multicenter, retrospective study (ISTRE study). Crit Care. 2024 Jan 2;28(1):4. doi: 10.1186/s13054-023-04774-2.
5. Thabit AK, Grupper M, et al. Simplifying Piperactillin/Tazobactam Dosing: Pharmacodynamics of Utilizing only 4.5 of 3.375 g Doses for Patients with Normal and Impaired Renal Function. Journal of Pharmacy Practice 2017, 30(6): 593-9.
6. Fawaz S, Barton S, and Nabhani-Gebara S. Comparing clinical outcomes of piperacillin-tazobactam administration and dosage strategies in critically ill adult patients: a systematic review and meta-analysis. BMC Infectious Diseaes 2020, 430
7. Yang H, Zhang C, et al. Clinical Outcomes with Alternative Dosing Strategies for Piperacillin/Tazobactam: A Systematic Review and Meta-Analysis. PLoS One 2014; 10(1)
8. Wilby KJ, Nasr ZG, et al. A Review of Clinical Outcomes Associated with Two Meropenem Dosing Strategies. Drugs RD, 2017;17(1):73-8 https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5318341/pdf/40268_2017_Article_173.pdf
9. Yefet E, Schwartz N, Chazan B, Salim R, Romano S, Nachum Z. The safety of quinolones and fluoroquinolones in pregnancy: a meta-analysis. BJOG. 2018;125(9):1069-1076. doi:10.1111/1471-0528.15119.
10. Metlay JP, Waterer GW, Long AC, Anzueto A, Brozek J, Crothers K, Cooley LA, Dean NC, Fine MJ, Flanders SA, Griffin MR, Metersky ML, Musher DM, Restrepo MI, Whitney CG. Diagnosis and Treatment of Adults with Community-acquired Pneumonia. An Official Clinical Practice Guideline of the American Thoracic Society and Infectious Diseases Society of America. Am J Respir Crit Care Med. 2019 Oct 1;200(7):e45-e67. doi: 10.1164/rccm.201908-1581ST.

Chorioamnionitis/ Intraamniotic Infection

Elliott K. Main, MD, Stanford University School of Medicine
Kathleen Andonian, PharmD, Sharp Mary Birch Hospital for Women and Newborns
Lauren Puckett, PharmD, Stanford Medicine Children's Health
Natali Aziz, MD, MS, Stanford University School of Medicine
Casey L. Smiley, MD, Vanderbilt University Medical Center
Courtney Martin, DO, MAS, Hoag Medical Center
Ronald Gibbs, MD, Stanford University School of Medicine

Key Principles:

1. The clinical criteria for chorioamnionitis/intra-amniotic infection (IAI) are widely debated. However, the variations in definitions minimally affect maternal and neonatal outcomes.
2. Newer antibiotic combinations may offer advantages, particularly for cesarean birth but choices need to be based on the local antibiogram.
3. Source control, particularly vaginal delivery, remain a key component of care.

Introduction

This chapter is not intended to be a comprehensive overview of chorioamnionitis/IAI. Several recently published, excellent reviews are listed at the end of this chapter for the reader's convenience.[1,2,3]

Instead, this chapter will focus primarily on the diagnosis of chorioamnionitis and the relationship to sepsis, followed by a detailed update on antibiotic recommendations. Prevention and neonatal considerations will also briefly be discussed.

Chorioamnionitis/IAI is a common obstetric condition, developing in approximately 4-5% of laboring patients.[1] Among these, as many as 6-8% will be diagnosed with sepsis.[4] However, the proportion with documented end-organ injury is lower, approximately 2-3%.[4] This makes chorioamnionitis the leading cause of obstetric sepsis during birth hospitalization, accounting for 20-25% of cases.

Diagnostic Categories

Similar to obstetric sepsis, the definition of chorioamnionitis/IAI has been debated for many years and the overlap of IAI and sepsis can present special considerations. In 2017, The American College of Obstetricians and Gynecologists (ACOG) recommended the following categorization: isolated maternal fever, suspected intraamniotic infection, and confirmed intraamniotic infection.[1] While this has been widely cited, subsequent studies have shown that there are little to no differences in clinical outcomes among these three clinical categories.[5,6] As a result, antibiotics and antipyretics are widely used for the management of all three. The ACOG criteria for IAI spectrum categories are presented in Table 1.[1]

Table 1. ACOG Criteria for Intraamniotic Infection (IAI) Spectrum

Isolated Maternal Fever	Suspected Intraamniotic Infection	Confirmed Intraamniotic Infection
A single oral temperature of ≥ 39.0°C (102.2°F) or greater **OR** Oral temperature of 38.0-38.9°C (100.4-102.02°F) that persists for 30 minutes	Maternal fever of ≥ 39.0°C (102.2°F) OR 38-38.9°C (100.4-102.02°F), **plus one additional clinical risk factor:** • Maternal leukocytosis • Purulent cervical drainage • Fetal tachycardia	Positive amniotic fluid test result (gram stain, glucose level, or culture results consistent with infection) **OR** Placental pathology with histologic evidence of infection or inflammation

ACOG recently updated the definition of IAI to recognize that fever is not a requirement if other symptoms are present.[7] Thus, the diagnosis of IAI largely remains a clinical judgement. This ambiguity also compounds the challenge of how to identify sepsis among patients with IAI. Previous studies have shown that standard Systemic Inflammatory Response Syndrome (SIRS) criteria will be positive in very high proportion of patient with IAI.[8] In a recent study that included electronic health record (EHR) data (including all vital signs and laboratory values) from 59 hospitals and nearly 15,000 patients with chorioamnionitis/IAI, 90% of these patients were positive for SIRS.[4] Different formulations of the Maternal Early Warning Score (MEWS) also had very high false positive rates. The California Maternal Quality Care Collaborative (CMQCC) modified SIRS screening criteria performed the best with a 97% sensitivity but still had a false positive rate of 60%. This underscores that the CMQCC screen (and other screens) serves only to identify serious infections that require a second step of a bedside evaluation and a limited set of laboratory tests to identify end-organ injury (and therefore sepsis). This expert taskforce recommends that all patients with chorioamnionitis/IAI should be screened for serious infection with CMQCC criteria and if positive, be further evaluated for sepsis beginning with a bedside evaluation. This creates three levels of treatment and intervention for chorioamnionitis/IAI: Routine IAI, IAI with serious features, and IAI with Sepsis (Table 2).

Table 2. Division of Intraamniotic Infection (IAI) into Three Categories for Treatment

Uncomplicated Intraamniotic Infection	Intraamniotic Infection with Serious Features	Intraamniotic Infection with Sepsis
Intraamniotic infection progressing to a vaginal delivery and not qualifying for serious features	Maternal fever of ≥ 39.0°C (Any one of the following): • Intraamniotic infection with a positive screen for serious infection (e.g. CMQCC screen) but without criteria for sepsis or septic shock • Intraamniotic infection with a persistent temperature ≥ 39°C • Intraamniotic Infection with a cesarean delivery	Intraamniotic infection with end-organ injury signs or symptoms consistent with sepsis
Treatment: routine antibiotics (see table 4) that generally do not need to be continued following vaginal delivery; cooling measures, acetaminophen for treatment of fever	**Treatment:** antibiotic regimen that includes anaerobic coverage (see Table 4), consider a minimum of 24-48 hours following a cesarean; supplemental IV fluids; cooling measures, acetaminophen for treatment of fever	**Treatment:** Change antibiotics to Sepsis regimen (see Table 4); additional fluids; enhanced clinical care

Higher temperatures (e.g. ≥39C) and longer duration of fever have been associated with increased maternal complications such as reduced uterine contractility (resulting in labor dysfunction and postpartum hemorrhage) and neonatal complications (respiratory and neurologic morbidities).[2,9] In the analysis of the capability of vital signs to predict sepsis among patients with chorioamnionitis, researchers were unable to determine that patients with a temperature ≥39C had a higher specificity than ≥38C.

Differential Diagnosis for Fever in Labor and Postpartum

Aside from chorioamnionitis/IAI, consider other sources for fever in labor. While less common, urinary tract infections or pneumonia can present in labor. The most common non-infectious cause of elevated temperature is labor epidural with neuraxial analgesia. In well controlled studies, the excess rates of fever with epidural ranges from 2% to 25%.[10] Typically, after approximately 6 hours of epidural administration, maternal temperature will begin to rise on average by 0.1˚C per hour.[11] The two leading hypotheses for this rise include a sterile (non-infectious) inflammatory process and a thermoregulatory mechanism secondary to neuraxial blockade. No preventative approach has been effective. Clinically it is not possible to distinguish between non-infectious epidural-related fever and chorioamnionitis/IAI, so most patients in this setting receive antibiotics.

During delivery and post-partum periods, the interpretation of abnormal vital signs in the setting of uterine bleeding poses additional challenges. Chorioamnionitis/IAI and endomyometritis are often associated with poor uterine contractility and hence postpartum hemorrhage requiring antibiotic treatment simultaneously with uterotonic. Additionally, fever is a known side effect of misoprostol when used as a uterotonics and can reach as high as 40^{C} with higher doses.[12]

Antibiotics for Chorioamnionitis/IAI

Similar for all infections, source control is a key element of treatment of chorioamnionitis/IAI. For routine IAI, emptying the uterus (by vaginal delivery when clinically indicated) is such an effective treatment that it can be difficult to identify meaningful differences among different antibiotic regimens. This does not mean that chorioamnionitis/IAI in a stable parturient is an indication for immediate cesarean delivery, but rather an expedited approach to delivery, preferably by the vaginal route, should be the focus of initial management strategies. Indeed, cesarean delivery in the setting of chorioamnionitis carries additional risk for the parturient.

IAI with serious features is more concerning as this clinical setting is where most complications occur. Multiple antibiotic regimens have been proposed for IAI and few have been evaluated through randomized trials. The long-standing ACOG recommended regimen of ampicillin and gentamicin with the addition of clindamycin for serious infections has been in use since the 1980's. With current concerns for rising resistance among common bacterial strains to ampicillin, gentamicin, and clindamycin, reappraisal of chorioamnionitis/IAI treatments is necessary. ACOG has recommended that chorioamnionitis/IAI antibiotic options require careful reevaluation by institutions, with guidance by local antibiograms and pharmacists specializing in antibiotic stewardship.[1] In addition, it is highly recommended that each hospital develop a standardized order set to facilitate appropriate and timely care. Antibiotic considerations and choices are discussed in Table 3 and 4.

What bacteria do we need to cover in Chorioamnionitis/IAI?

Primary pathogens: Group A and B Streptococci (GAS and GBS), *Escherichia coli* and other enteric gram negatives.

Anaerobic coverage is necessary for cesarean delivery or more serious infections.

***Enterococcus* spp.** is a less common pathogen in routine chorioamnionitis; however, empiric coverage should be added if the patient fails to respond adequately to the initial antibiotic regimen and should be considered for endomyometritis readmissions.

Choice of optimal hospital antibiotic regimen is driven by the local antibiogram and in consultation with Infectious Diseases and Maternal-Fetal Medicine specialists, and pharmacists specializing in antibiotic stewardship.

Table 3. Antibiotic Considerations for Chorioamnionitis/Intraamniotic Infection

Antibiotic	Discussion
Aminoglycosides (gentamicin, tobramycin)	Difficult pharmacokinetics in pregnancy (i.e. hard to achieve adequate blood levels); weight-based dosing requires pharmacy preparation with potential delays; rising resistance of gram-negative bacteria; risks for nephrotoxicity and ototoxicity; needs to be part of a triple drug regimen to be most effective for chorioamnionitis followed by cesarean. Not ideal in sepsis and septic shock and may impart no added survival benefit.
Ampicillin	Narrow in spectrum, covers *Streptococcus* spp. well, but little else; must be part of a triple drug regimen to be most effective for chorioamnionitis followed by cesarean.
Ampicillin-Sulbactam	Covers gram-positive bacteria and anaerobes (due to addition of sulbactam); typically needs the addition of an aminoglycoside based on local antibiogram gram-negative bacteria susceptibility patterns.
Cefoxitin	Growing resistance among gram-negative bacteria; facilities should check local antibiogram to guide use. Not ideal for Group B *Streptococcus* and no enterococcal coverage. May include coverage of pelvic anaerobes (not first line).
Ceftriaxone	Similar coverage for gram-negative bacteria as aminoglycosides without the safety and monitoring concerns; good gram-positive coverage, needs second drug for anaerobes (often metronidazole); does not cover *Enterococcus* nor *Pseudomonas aeruginosa*. Daily dosing (2g) is advantageous.[13]
Clindamycin	Substantial resistance is developing among pelvic anaerobes (especially *Bacteroides* spp.). May have beneficial anti-inflammatory and anti-endotoxin effects when used for an infection due to *Streptococcus* spp. and *Staphylococcus* spp. (i.e. necrotizing fasciitis or STSS).
Metronidazole	Broad anaerobic coverage; inexpensive; oral is equivalent to IV. Historical concerns were raised on its use in lactating women. However, current information indicates that breastfeeding need not to be interrupted during the short peripartum course of metronidazole. See below for further discussion of this issue.
Piperacillin-tazobactam	Broad in spectrum; excellent anaerobic coverage and likely sufficient coverage of gram-positive and gram-negative genitourinary pathogens depending on local antibiogram. Can replace ampicillin/aminoglycoside/clindamycin triple regimen with a single drug and may present cost savings.[14,15] When given as an extended infusion, the first dose is infused over 30 min and then 4 hours later start a 4-hour infusion (extended infusion may be beneficial for patients with sepsis). Concerns for IV-line access and compatibility during the extended infusions.
Vancomycin	Added to a chorioamnionitis regimen to provide coverage for MRSA, if needed due to colonization, historical infection, or risks factors (i.e. IV drug use, incarceration, multiple dental carries, health-care worker within a facility with high MRSA rates). Can cover *Enterococcus* spp.

RESPONSE

As metronidazole is now one of more widely used antibiotics in obstetrics, further discussion of safety during breastfeeding is warranted. The emergence of significant anerobic bacterial resistance to clindamycin in multiple centers has led to reevaluation of other antibiotics and in particular, metronidazole, to cover anaerobic obstetric infections. While older laboratory experiments showed a potential risk of mutagenesis in bacteria, subsequently no evidence of mutagenicity has been found in humans including a large study of maternal use in the 1st trimester.[16,17] Metronidazole is a recommended choice by ACOG and SMFM for chorioamnionitis with cesarean delivery, endometritis, and sepsis.[7,18] CDC recommends the use of metronidazole for the treatment of bacterial vaginosis during pregnancy.[19] The National Health System UK Medicines Information Service notes: "The balance of current evidence and clinical experience, and the consensus of specialist opinion, is that there is no established mutagenic or carcinogenic risk to infants breastfeeding from mothers receiving routine short-course treatment with metronidazole by any route."[20] Currently, metronidazole is used for maternal treatment in the peripartum period, without restrictions on breastfeeding, by multiple large centers in California including the University of California Medical Centers, Lucile Packard Children's Hospital, Hoag Hospital, and Sharp Mary Birch Hospital for Women and Newborns.

Select updated combinations are offered in Table 4. These recommendations are based on literature, Infectious Diseases Pharmacy team leaders and Infectious Diseases specialists in medicine and obstetrics. When undergoing an evaluative process for antibiotic treatment updates, considerations like preparation time, accessibility and storage feasibility of preferred antibiotics on the obstetric units, cost, and local resistance patterns are important for developing individual hospital system treatment guidelines. Consult with your Infectious Diseases team and antibiogram to develop an optimal local regimen. Streamlining the medication regimen offers a major advantage for nursing time, administration costs, exposure for drug reactions, and for medication storage and retrieval on Labor and Delivery Units.

Coverage of anaerobic bacteria at cesarean for patients with chorioamnionitis is important and should commence as soon as possible during the procedure, if not in the hour before. It should be noted that two regimens in Table 4 (piperacillin-tazobactam or ceftriaxone with metronidazole) stand out for their inclusion of anaerobic coverage from the beginning and their potential ability to cover more serious infections with end-organ injury (sepsis). The regimen of ampicillin-sulbactam with an aminoglycoside also provides broad-spectrum bacteria including anaerobic bacteria. However, if the patient is presenting with a more serious infection with a likelihood of end-organ injury, aminoglycosides may be associated with worse outcomes in most sepsis settings (except perhaps with pyelonephritis).[21,22] The local antibiogram is instructive for evaluating the resistance patterns for the empiric antibiotic regimen, particularly concerning aminoglycosides, ampicillin-sulbactam, and clindamycin when choosing the initial regimen; in the case of severe infection, one of the two newer regimens is recommended. It should be noted that these alternative regimens have limited data across multiple centers, and we await further published studies.

Table 4. Empiric Management of Chorioamnionitis/Endomyometritis

Setting	Preferred Regimens	Type I Allergy to Penicillin (immediate hypersensitivity-hives, wheezing, anaphylaxis)	Type I Allergy to Cephalosporins OR Type II-IV Allergy to Penicillin[4]
Uncomplicated Chorioamnionitis/ Endomyometritis	Ampicillin 2g IV q6h **AND** Aminoglycoside[a] **IF having a cesarean, ADD** Metronidazole 500mg PO/IV q8h)[b] **OR** Clindamycin 900mg IV q8h	Ceftriaxone 2g IV q24h **AND** Metronidazole 500mg PO/IV q8h	Ertapenem 1g IV q24 hours[e] **OR** Meropenem 1g IV q8 hours[f]
	OR Piperacillin-tazobactam 4.5g IV q8h, 4-h infusion[c]		
	OR Ceftriaxone 2g IV q24h **AND** Metronidazole 500mg PO/IV q8h		
	OR Ampicillin-sulbactam 3g IV q6h **AND** Aminoglycoside[a]		
Serious Illness (signs of end-organ injury) **(If different from the routine chorioamnionitis regimen above, replace with one of these regimens)**	Piperacillin-tazobactam 4.5g IV q8h, 4-h infusion[c]	Ceftriaxone 2g IV q24h **AND** Metronidazole 500mg PO/IV q8h	Meropenem 1g IV q8 hours[f]
	OR Ceftriaxone 2g IV q24h **AND** Metronidazole 500mg PO/IV q8h		
Critical Illness (requiring broad spectrum coverage)	Refer to Appendix L: Antibiotic Considerations for Sepsis of Unknown Source or Septic Shock		

a. ***Aminoglycosides:*** *Gentamicin or tobramycin may be administered as high dose extended interval or conventional dosing strategy. Dosing and monitoring provided here is for high dose extended interval regimens; gentamicin or tobramycin 5-7 mg/kg IV q24h. Therapeutic drug monitoring (TDM) should be performed for all patients. TDM target: C_{max}: 15 – 30 mcg/mL, trough: < 0.3 - 0.5 mcg/mL. Pharmacists trained in pharmacokinetic dosing of aminoglycosides are recommended to assist with dosing and monitoring. Preference and use of gentamicin or tobramycin should be guided by institutional policy and local antibiogram.*

b. ***Metronidazole*** *has 100% bioavailability and can be given IV or PO in those who have normal gut absorption.*

RESPONSE

c. ***Piperacillin-tazobactam,*** *when used for sepsis, should be started with a 4.5 g IVPB loading (bolus) dose infused over 30 minutes with maintenance dose of 4.5 g IV q8h which is started 4 hours following the maintenance dose and administered as an extended infusion over 4 hours. If patient does not have access to allow for extended infusion, administration of piperacillin-tazobactam 4.5 g IV q6h given as a 30-minute intermittent infusion is recommended.*
d. ***For patients allergic to penicillin****, cephalosporins, AND carbapenems: Clindamycin 900 mg IV q8h (or Metronidazole 500 mg IV/PO q8h) + Vancomycin + Aminoglycoside[a] is an option for the management of chorioamnionitis/ endomyometritis.*
e. ***Ertapenem*** *is a broad-spectrum antibiotic, but compared to meropenem, it lacks coverage of Enterococcus spp., Pseudomonas aeruginosa, and Acinetobacter spp. These pathogens are less commonly encountered in routine chorioamnionitis; the exceptions could be patients failing to respond or occasionally in post-surgical endomyometritis. In this situation, escalation to meropenem can be considered.*
f. ***Meropenem*** *dosing may be different based on institutional guidelines. Meropenem may be administered as an extended infusion over 3 hours and given every 8 hours or provided as a 30-minute infusion and given every 6 hours.*

See Management of Allergies to Penicillin and Beta-Lactam Antibiotics for a detailed discussion of the management of patients with reported allergies. This includes a discussion of the importance of identification and evolution during prenatal care.

The growing concerns around multidrug-resistant organisms (MDROs), including extended-spectrum beta-lactamase (ESBL)-producing gram-negative pathogens, underscore the need to consider local community resistance rates when selecting appropriate empiric therapy for chorioamnionitis. In areas with elevated community ESBL rates, it may become necessary to employ carbapenems, such as meropenem, as part of empiric therapy. Institutions are advised to analyze local antibiograms, preferably utilizing multi-year data, to accurately assess MDRO prevalence. However, carbapenems are a critical, limited resource, and their overuse can increase selective pressuring, driving further resistance, including carbapenem-resistant organisms. Implementing antimicrobial stewardship strategies, including drug restriction and requiring Infectious Diseases specialist approval, can promote judicious carbapenem use and help mitigate the development of further resistance.

Postdelivery continuation of antibiotics depends on the type of delivery and seriousness of the infection. Most women with a vaginal birth will not need continued antibiotics or at most a single dose. For women undergoing cesarean deliveries, most California centers continue the antibiotic regimen until afebrile (<38[C]) for 24-48 hours post-op. The current (2017) ACOG guidance is to give at least one additional dose after cesarean delivery, unless higher risk factors are present such as continued fever, unstable vital signs, or bacteremia. This recommendation has been made more complicated by the widespread use of continuous Toradol® (ketorolac), acetaminophen, and/or ibuprofen as part of an Enhanced Recovery After Surgery (ERAS) program. This regimen may blunt the development of fever, so an assessment needs to be based on other signs and symptoms.

Strategies to achieve rapid antibiotic administration

Sepsis Guidelines and ACOG recommendations for the treatment of chorioamnionitis/IAI urge for initiation of appropriate antibiotics within 60 minutes of diagnosis.[1] Units can review their standard protocols and store a selection of antibiotics on Labor and Delivery. However, aminoglycosides require weight-based-administration (mg/kg) and therefore require patient-specific dosing, sterile compounding, and antibiotic delivery by pharmacy. This logistical need may consequently result in antibiotic administration delays. Other areas potentially affected by logistical aminoglycoside delays

include pre-surgical antibiotic prophylaxis, when an aminoglycoside is indicated for cephalosporin allergic patients (see Management of Allergies to Penicillin and Beta-Lactam Antibiotics). Some hospitals have developed a workflow for quick access by the bedside care team to an appropriate aminoglycoside premixed intravenous piggyback (IVPB). This is accomplished by first identifying commonly calculated aminoglycoside dose(s) in their obstetrics population, having pharmacy batch prepare the commonly identified dose(s), and storing the IVPB aminoglycoside bags in refrigerated medication dispensing machines in Labor and Delivery (LD) and Operating Room (OR) Units, hence the name "Grab-n-Go". Additional doses, as needed, are fulfilled by the pharmacy using standard procedures.

Best Practice: Grab-n-Go bags for Aminoglycosides

Tobramycin: Sharp Mary Birch Hospital for Women and Newborns reviewed a large sample of maternity patient weights and calculated a dosing window that was within 0.5 mg/kg of the target and within 2 standard deviations of the population. As a result, pharmacy premixed and batched "grab-and-go" tobramycin 440 mg IVPB bags for when a STAT order for tobramycin 7 mg/kg is received. The 120 mg is not an override (order placement and verification processes are still required) and all follow-up doses should be monitored by pharmacists trained in pharmacokinetic dosing of aminoglycosides in obstetrics.

Gentamicin: Stanford Medicine Children's Health uses a similar strategy, using weight stratified categories for pre-operative gentamicin administration. The optimal doses for the most common patient weights were calculated based on two weight stratified categories (<120 kg and >120 kg) using approximately 2 mg/kg dosing for pre-operative antibiotic administration. 120 mg bags are stored refrigerated on the Labor and Delivery unit. Patients with weights <120 kg receive 240 mg (2 bags) while patients with weights >120 kg receive 360 mg (3 bags).

Neonatal Considerations

Considerations for neonates born in the setting of chorioamnionitis/IAI are important to mention. These infants have an increased risk for early onset sepsis (EOS).[23] Other maternal risk factors like group B *Streptococcus* (GBS) infection. and/or colonization, as well as preterm birth and prolonged ruptured membranes, also increase the risk of EOS.[24] The expansion of treatment for fever in labor and IAI can impact the pediatric care of an infant born to a mother with chorioamnionitis/IAI in multiple ways. ACOG guidance recommends that communication with the neonatal care team is essential in these cases to optimize neonatal evaluation particularly if there is a culture-positive infection and especially if it includes a MDRO.[1] Prior CDC recommendations led to high rate of laboratory testing, antibiotic use, and NICU stays for many of these infants. This approach has now been replaced by the validated Kaiser Neonatal Early-Onset Sepsis (EOS) Calculator.[24,25,26] Using this tool, the risk of EOS can be calculated for infants born ≥34 weeks' gestational age. The interactive calculator produces the probability of EOS per 1,000 neonates by entering values for specific maternal risk factors and integrating defined standards of clinical presentation/evaluative findings. The scoring system evaluates all neonates on

admission and includes clinical risk factors including GBS status, gestational age, duration of membrane rupture, highest maternal temperature, and type and duration of intrapartum antibiotics, all in the context of the incidence of EOS in the institution. Of note, maternal broad-spectrum antibiotics, such as those recommended for chorioamnionitis/IAI, significantly reduce the risk of neonatal infection. The risk score is then placed into context by a clinical exam with defined parameters for each category (well appearing, equivocal, clinical illness), and recommendations are made (i.e., observe, obtain blood cultures, or start antibiotics). The result has been a large reduction of term infants undergoing laboratory testing and antibiotic treatment, reduced admission to the NICU, and reduction in neonatal length of stay. Overall, it is important to recognize the interconnection between the diagnosis and treatment of maternal chorioamnionitis/IAI and neonatal treatments and outcomes.

Recommendations (Level of Evidence)

1. Obstetric unit leadership should collaborate with the antibiotic stewardship team to review their local antibiogram and update standard chorioamnionitis/IAI treatment regimens as needed. (LEVEL B)
2. Given the generally low cost of the recommended antibiotics and the growing concern for bacterial resistance, priority should be placed on selecting antibiotic regimens that provide appropriate aerobic and anaerobic bacterial coverage, while also considering nursing administration efficiency (e.g. frequency of individual doses to administer). (LEVEL B)
3. A standardized unit approach to chorioamnionitis/IAI treatment is strongly recommended, including development of electronic health record (EHR) order sets. This will streamline antibiotic selection, facilitate faster pharmacy response times, and ensure clear options for patients with beta-lactam allergies. (LEVEL B)

Educational Tools/Sample Resources

1. Appendix Q: Empiric Antibiotics for Chorioamnionitis/Endomyometritis

References:

1. American College of Obstetricians and Gynecologists. Intrapartum management of intraamniotic infection. Committee Opinion No. 712. Obstet Gynecol 2017;130:e95–101.
2. Jung E, Romero R, Suksai M, Gotsch F, Chaemsaithong P, Erez O, Conde-Agudelo A, Gomez-Lopez N, Berry SM, Meyyazhagan A, Yoon BH. Clinical chorioamnionitis at term: definition, pathogenesis, microbiology, diagnosis, and treatment. Am J Obstet Gynecol. 2024 Mar;230(3S):S807-S840. doi: 10.1016/j.ajog.2023.02.002. Epub 2023 Mar 21.
3. Goetzl L. Maternal fever in labor: etiologies, consequences, and clinical management. Am J Obstet Gynecol. 2023 May;228(5S):S1274-S1282. doi: 10.1016/j.ajog.2022.11.002.
4. Main EK, Fuller M, Kovacheva VP, et.al. Performance Characteristics of Sepsis Screening Tools During Delivery Admissions. Obstet Gynecol. 2024; 143(3):326-335.
5. Abu Shqara R, Glikman D, Jad S, et al. Antibiotic treatment of women with isolated intrapartum fever vs clinical chorioamnionitis: maternal and neonatal outcomes. Am J Obstet Gynecol 2023;229:540.e1-9.
6. Avila C, Willins JL, Jackson M, Mathai J, Jabsky M, Kong A, Callaghan F, Ishkin S, Shroyer AL. Usefulness of two clinical chorioamnionitis definitions in predicting neonatal infectious outcomes: a systematic review. Am J Perinatol. 2015 Sep;32(11):1001-9.

7. ACOG Clinical Practice Update: Update on Criteria for Suspected Diagnosis of Intraamniotic Infection. Obstetrics & Gynecology 144(1):p e17-e19, July 2024.
8. Lappen JR, Keene M, Lore M, Grobman WA, Gossett DR. Existing models fail to predict sepsis in an obstetric population with intrauterine infection. Am J Obstet Gynecol. 2010 Dec;203(6):573.e1-5.
9. Hensel D, Zhang F, Carter EB, Frolova AI, Odibo AO, Kelly JC, Cahill AG, Raghuraman N. Severity of intrapartum fever and neonatal outcomes. Am J Obstet Gynecol. 2022 Sep;227(3):513.e1-513.e8.
10. Patel S, et al. Epidural-related maternal fever: incidence, pathophysiology, outcomes, and management. Am J Obstet Gynecol 2023 May Suppl:S1284-S1304.
11. Fusi L, Steer PJ, Maresh MJ, Beard RW. Maternal pyrexia associated with the use of epidural analgesia in labour. Lancet 1989;1: 1250–2.
12. Parry Smith WR, Papadopoulou A, Thomas E, Tobias A, Price MJ, Meher S, Alfirevic Z, Weeks AD, Hofmeyr GJ, Gülmezoglu AM, Widmer M, Oladapo OT, Vogel JP, Althabe F, Coomarasamy A, Gallos ID. Uterotonic agents for first-line treatment of postpartum haemorrhage: a network meta-analysis. Cochrane Database Syst Rev. 2020 Nov 24;11(11):CD012754. doi: 10.1002/14651858.CD012754.pub2
13. Conde-Agudelo A, Romero R, Jung EJ, Garcia Sánchez ÁJ. Management of clinical chorioamnionitis: an evidence-based approach. Am J Obstet Gynecol. 2020 Dec;223(6):848-869. doi: 10.1016/j.ajog.2020.09.044.
14. Anderson K, Scarpaci M, Hardy E, Li C, Lewkowitz AK, Rouse DJ, Polnaszek BE. Piperacillin-tazobactam compared with ampicillin-gentamicin for intraamniotic infection: a noninferior and propensity-matched analysis. Am J Obstet Gynecol. 2024 Jul;231(1):e9-e11. doi: 10.1016/j.ajog.2024.02.290.
15. Smiley C, Rizzuto J, White N, Fiske C, Thompson J, Zhang M, Ereshefsky B, Staub M. Implementing Updated Intraamniotic Infection Guidelines at a Large Academic Medical Center. Open Forum Infect Dis. 2024 Sep 5;11(9):ofae475. doi: 10.1093/ofid/ofae475.
16. Sheehy O, Santos F, Ferreira E, Berard A. The use of metronidazole during pregnancy: a review of evidence. Curr Drug Saf. 2015;10(2):170-9. doi: 10.2174/1574886310021505151245 48.
17. Koss CA, Baras DC, Lane SD, Aubry R, Marcus M, Markowitz LE, Koumans EH. Investigation of metronidazole use during pregnancy and adverse birth outcomes. Antimicrob Agents Chemother. 2012 Sep;56(9):4800-5. doi: 10.1128/AAC.06477-11.
18. Shields AD, Plante LA, Pacheco LD, Louis JM; SMFM Publications Committee. Society for Maternal-Fetal Medicine Consult Series #67: Maternal sepsis. Am J Obstet Gynecol. 2023 Sep;229(3):B2-B19. doi: 10.1016/j.ajog.2023.05.019
19. Muzny CA, Balkus J, Mitchell C, Sobel JD, Workowski K, Marrazzo J, Schwebke JR. Diagnosis and Management of Bacterial Vaginosis: Summary of Evidence Reviewed for the 2021 Centers for Disease Control and Prevention Sexually Transmitted Infections Treatment Guidelines. Clin Infect Dis. 2022 Apr 13;74(Suppl_2):S144-S151. doi: 10.1093/cid/ciac021.
20. NHS/UK Medicines Information: Metronidazole–is it safe to use with breastfeeding? March 2012. https://studylib.net/doc/7341270/metronidazole-in-breastfeeding-mothers Accessed March 31,2025
21. Heffernan AJ, Sime FB, Sun J, et al. β-lactam antibiotic versus combined β-lactam antibiotics and single daily dosing regimens of aminoglycosides for treating serious infections: A meta-analysis. Int J Antimicrob Agents. 2020;55(3):105839. doi:10.1016/j.ijantimicag.2019.10.020
22. Thy M, Timsit J, de Montmollin E. Aminoglycosides for the treatment of severe infection due to resistant gram-negative pathogens. Antibiotics. 2023. 6;12(5)860. Doi: 10.3390/antibiotics12050860
23. Puopolo KM, Benitz WE, Zaoutis TE; COMMITTEE ON FETUS AND NEWBORN; COMMITTEE ON INFECTIOUS DISEASES. Management of Neonates Born at ≥35 0/7 Weeks' Gestation With Suspected or Proven Early-Onset Bacterial Sepsis. Pediatrics. 2018 Dec;142(6):e20182894. doi: 10.1542/peds.2018-2894. PMID: 30455342.
24. Puopolo KM, Draper D, Wi S, Newman TB, Zupancic J, Lieberman E, Smith M, Escobar GJ. Estimating the probability of neonatal early-onset infection on the basis of maternal risk factors. Pediatrics. 2011 Nov;128(5):e1155-63. doi: 10.1542/peds.2010-3464. Epub 2011 Oct 24. PMID: 22025590; PMCID: PMC3208962.
25. Kuzniewicz MW, Puopolo KM, Fischer A, Walsh EM, Li S, Newman TB, Kipnis P, Escobar GJ. A Quantitative, Risk-Based Approach to the Management of Neonatal Early-Onset Sepsis. JAMA Pediatr. 2017 Apr 1;171(4):365-371. doi: 10.1001/jamapediatrics.2016.4678. PMID: 28241253
26. Kuzniewicz MW, Walsh EM, Li S, Fischer A, Escobar GJ. Development and Implementation of an Early-Onset Sepsis Calculator to Guide Antibiotic Management in Late Preterm and Term Neonates. Jt Comm J Qual Patient Saf. 2016 May;42(5):232-9. PMID: 27066927

RESPONSE

Prophylactic Antibiotics on Labor and Delivery

Natali Aziz, MD, MS, Stanford University School of Medicine
Kathleen Andonian, PharmD, Sharp Mary Birch Hospital for Women and Newborns
Lauren Puckett, PharmD, Stanford Medicine Children's Health
Elliott K. Main, MD, Stanford University School of Medicine

Key Principles:

1. There are multiple settings in Obstetrics where the use of prophylactic antibiotics has had a significant impact including Cesarean delivery, 3rd/4th degree lacerations and PPROM Latency.
2. Newer recommendations for antibiotic combinations offer advantages for infection prevention, particularly in the setting of cesarean birth.
3. Protocols for antibiotic prophylaxis prior to cesarean delivery need to address multiple issues including obesity, concurrent antibiotics for treatment of chorioamnionitis and for GBS prophylaxis, and penicillin allergies.

Introduction

There is strong evidence and specialty society support for the use of antibiotics to prevent infection in several settings on Labor and Delivery. In this chapter, we will address several important questions about antibiotic use for cesarean prophylaxis, preterm premature rupture of membranes (PPROM) latency, and 3rd/4th degree perineal lacerations. For a longer discussion that includes other prophylactic antibiotic settings in obstetrics, review of the ACOG Practice Committee 199 (September 2018) is highly recommended.[1]

Cesarean Delivery

The use of prophylactic antibiotics at cesarean delivery is now standard of care throughout the United States. Cefazolin is the drug of choice due to low cost, ease of administration, and comparable efficacy to other cephalosporins.[1] Surgical prophylaxis should be dose adjusted for weight and administered up to 1-hour prior to skin incision. Initiation before cord clamping is superior, and initiation beyond 60 minutes before incision is associated with less favorable outcomes.[2] Pharmacokinetic and pharmacodynamic studies suggest that there may be an ideal timing for administration of cefazolin prior to initial surgical incision; the suggested optimal window based on PK/PD studies is between 10 and 20 minutes prior to initial incision. However, the literature has not clearly identified solid evidence for a narrower window of time from 0 to 60 minutes for administration of pre-surgical cefazolin.[3,4,5] Optimizing aseptic surgical technique, pre-surgical antibiotic prophylaxis, and pre-procedural skin and vaginal antimicrobial preparations are considered a cornerstone for the reduction of surgical site infection risk. This area has been studied intensively, taking a bundled approach, with the aim to reduce

surgical site infections (SSI). Updated recommendations are discussed below. A comprehensive flow chart for prophylactic antibiotics is found in the chapter Educational Tools and Sample Resources.

1. **What is the optimal dose of cefazolin? And should you adjust for weight/BMI?** The current ACOG recommendation is 1g IV of cefazolin before skin incision; cefazolin 2g is recommended for persons with a weight >80kg.[1] Cefazolin 3g IV has been suggested for persons weighing 120kg or more, but there is incomplete data in obstetrics. However, national consensus guidelines in non-obstetric patients recommend 2g if <120kg (or BMI <40) and 3g if ≥ 120 kg (BMI ≥ 40).[2,6] Utilization of this dosing strategy for pre-cesarean cefazolin makes sense for consistency and simplicity. In patients living with obesity, these are two recent RCTs suggesting that in addition to intrapartum antibiotics, an additional 48 hours of oral cephalexin with metronidazole (both 500mg PO Q8 hours) can further decrease surgical site infections.[7,8] It should be noted that neither study used the higher dose of cefazolin nor azithromycin.
2. **Azithromycin is an important addition as adjunctive prophylaxis for unscheduled cesarean in the setting of labor or ruptured membranes and in the absence of intrapartum chorioamnionitis.** A large multicenter RCT established the value of azithromycin 500mg IV pre-operatively once in addition to cefazolin for non-elective cesarean deliveries.[9] Women treated with azithromycin together with cefazolin had a 50% reduction in the primary composite rate of wound infections, endometritis and other infections. There is no evidence to demonstrate the benefit of azithromycin use for elective cesarean delivery, so it is not recommended. Azithromycin is usually administered over 1-hour, so at times, the infusion may be completed beyond the surgery end time.
3. **Pre-cesarean surgical prophylaxis for patients already on antibiotics for chorioamnionitis:** In most circumstances, treatment of chorioamnionitis cannot replace pre-cesarean surgical prophylaxis. Single dose, weight-adjusted surgical prophylaxis with cefazolin within 1-hour of incision is still necessary for the purpose of adequate and time-sensitive coverage of skin flora (e.g. *Staphylococcus aureus*). It is also very important that patients with chorioamnionitis undergoing cesarean delivery receive anaerobic coverage. Historically, clindamycin was commonly used in this setting. However, due to concerns of increasing levels of resistance to clindamycin, metronidazole 500 mg IV may be considered superior to clindamycin in empiric coverage of pelvic anaerobic bacteria, including *Bacteroides* spp.[10,11] Discussion with your local hospital antibiotic stewardship team and review of your local antibiogram are recommended to decide between clindamycin and metronidazole regimens (or other choices for anaerobic bacteria coverage). If the patient is already receiving an antibiotic regimen for routine chorioamnionitis which includes coverage for anaerobic organisms, such as piperacillin-tazobactam or ampicillin-sulbactam, additional anaerobic coverage is not necessary. For patients receiving antibiotics for treatment of chorioamnionitis (as above) who then undergo a non-elective cesarean, the value of azithromycin as adjunctive surgical prophylaxis is of limited, if any, value and therefore is not recommended in this scenario.[12]
4. **Pre-cesarean surgical prophylaxis for patients already on antibiotics for GBS prophylaxis:** Penicillin and ampicillin do not provide adequate coverage of skin flora (e.g., *Staphylococcus aureus*). Therefore, weight-adjusted, pre-surgical cefazolin is still required to be administered within 1-hour of initial incision. Azithromycin adjunctive surgical prophylaxis should follow pre-surgical cefazolin administration for non-elective cesareans.
5. **Pre-cesarean surgical prophylaxis in the penicillin allergic patient:** As discussed in greater detail in the chapter, Management of Patients with Beta-Lactam (Penicillins and Cephalosporins) Allergies, the first step for appropriate antibiotic selection is to obtain a thorough allergy

history. If the history identifies a significant current (Type I-IV) allergy, ACOG 2018 guidelines recommend clindamycin 900mg IV and gentamicin 5mg/kg IV.[1] However, as discussed in the Management of Patients with Beta-Lactam (Penicillins and Cephalosporins) Allergies chapter, cefazolin can safely be administered to patients with history of non-anaphylactic (e.g., mild rash, urticaria) and anaphylaxis to penicillins, as cefazolin is not structurally similar. Patients with delayed type IV hypersensitivities to penicillins (e.g., SJS/TEN, DRESS) or moderate-to-severe allergy reactions to cephalosporins are recommended to receive clindamycin and an aminoglycoside. It is important to note that this alternative regimen is inferior to cefazolin as there is emerging evidence for rising resistance of *Streptococcus* spp. to clindamycin and gram-negative bacteria (e.g. *E. coli*) to gentamicin.[13] Although clindamycin may have reduced susceptibilities to streptococci, clindamycin appears to currently retain susceptibility to most strains of staphylococci, the main target of pre-surgical prophylaxis. To combat the resistance trends per local antibiograms, some institutions have moved away from gentamicin 5 mg/kg to tobramycin 7 mg/kg. Clindamycin and aminoglycoside infusion completion prior to emergent cesarean start can often present logistical difficulties; they are, however, compatible and can be co-infused via Y-site. It is for these reasons that clinicians are urged to reserve the alternative pre-surgical prophylaxis of clindamycin plus an aminoglycoside (adjusted per institutional antibiogram) for patients who cannot tolerate cefazolin.

3rd/4th Degree Perineal Lacerations

Antibiotic prophylaxis for 3rd/4th degree perineal lacerations should be strongly considered. This is a newer recommendation based on retrospective and prospective cohort studies which found that intrapartum antibiotic administration showed 50% to 70% reduction in perineal wound complications.[14,15] A follow-up multicenter RCT in California demonstrated a 60% reduction in perineal wound complications when a single dose of cefoxitin or cefotetan (or clindamycin for penicillin allergic patients) was administered at the time of the repair.[16] These results prompted ACOG guidance for consideration of antibiotic prophylaxis for 3rd/4th degree lacerations.[17] Cefotetan and cefoxitin are second generation cephalosporins and uniquely cover select anaerobic bacteria commonly found in the large bowel and rectum (e.g. *Bacteroides* spp.). Recent literature suggests cefotetan is inferior to cefoxitin in respects to coverage of *Bacteroides* spp.[8,9] The CMQCC taskforce recommends a single dose of cefoxitin 1-2g IV at the time of 3rd/4th degree perineal laceration repair (cefoxitin 1g was used in the OB RCT, but cefoxitin 2g was recommended in the surgical literature as noted above).[2]

Prophylaxis for PPROM Latency

Antibiotic prophylaxis for PPROM latency has a revised regimen. In the setting of rupture of membranes without labor prior to 34 0/7 weeks of gestation, the use of prophylactic antibiotics is indicated for latency.[1] A large multicenter RCT showed a reduction in neonatal morbidity and mortality with a regimen of ampicillin (2g IV q6h) with erythromycin (250 mg IV q6h) for 48 hours, followed by amoxicillin (250 mg PO q8h) and erythromycin (333 mg PO q8h) for a total of 7 days.[18] Unfortunately, erythromycin has notable GI tolerability issues, is costly, and has experienced intermittent shortages. During a time of shortage, azithromycin proved to be non-inferior and better tolerated. It is also significantly less expensive (~95% cheaper!). A meta-analysis of five studies comparing azithromycin with erythromycin for PPROM in approximately 1290 patients demonstrated that azithromycin had lower rates of clinical chorioamnionitis (14.5% versus 24.4%; pooled OR 0.53, 95% CI [0.39-0.71]).[19]

RESPONSE

There was no difference in latency. The current modified regimen at Stanford Children's Hospital is azithromycin 1g PO x1 (which replaces the 7 days of erythromycin), ampicillin 2 g IV q6h for 48h followed by amoxicillin 250mg po q8h for an additional 5 days. Other considerations for oral amoxicillin dosing include 875 mg q12h or 500 mg q8h. This regimen has many advantages, but likely represents a work in progress. Neither the original erythromycin regimen nor the currently recommended regimen containing azithromycin adequately empirically covers *E. coli* (depending on local antibiogram). Furthermore, *E. coli* is the leading cause of neonatal sepsis in low-birth weight infants.[20,21] For institutions with high rates of *E. coli* resistance to ampicillin, identifying a PPROM regimen with adequate coverage to prevent *E. coli* early onset neonatal sepsis (EONS) is needed but not yet guided by the literature. Therefore, this taskforce recognizes the need for further research for new PPROM latency antibiotic strategies to prevent *E. coli* EONS by extending the spectrum of antibiotic activity to include *E. coli* resistant to ampicillin.

Recommendations (Level of Evidence)

1. Every unit should develop protocols for the routine use of prophylactic antibiotics in obstetrics. (LEVEL A)
2. The protocol for pre-cesarean prophylaxis should include discussion of obesity, azithromycin, patients with chorioamnionitis, patients receiving GBS prophylaxis, and penicillin allergic patients. (LEVEL A)
3. Appropriate antibiotics should be readily available on Labor and Delivery for rapid administration. (LEVEL A)

Educational Tools and Sample Resources

1. Appendix T: Example Flow Chart for Prophylactic Antibiotics at Cesarean Delivery

References:

1. Use of prophylactic antibiotics in labor and delivery. ACOG Practice Bulletin No. 199. American College of Obstetricians and Gynecologists. Obstet Gynecol 2018;132:e103–19.
2. Bratzler DW, Dellinger EP, Olsen KM, et al. Clinical practice guidelines for antimicrobial prophylaxis in surgery. Am J Health Syst Pharm. 2013;70:195–283.
3. Cholewka K, et al. Cephalosporin clinical concentration - time profile modeling and in-vitro bactericidal effects on Escherichia coli. Journal of Antimicrobial Chemotherapy. 1999. (44): 471-476.
4. Weber, et al. Timing of Surgical antimicrobial prophylaxis: a phase 3 randomized controlled trial. Lancet. 2017. (17): 605-14
5. WHO Global Guidelines for the Prevention of Surgical Site Infection, Web Appendix 5. Summary of a systemic review on optimal timing for preoperative surgical antibiotic prophylaxis. appendix5.pdf
6. Anderson DJ , Podgorny K , Berrios-Torres SI , Bratzler DW , Dellinger E , Greene L , et al . Strategies to prevent surgical site infections in acute care hospitals: 2014 update . Infect Control Hosp Epidemiol 2014; 35:605 – 27.
7. Valent AM, DeArmond C, Houston JM, Reddy S, Masters HR, Gold A, Boldt M, DeFranco E, Evans AT, Warshak CR. Effect of Post-Cesarean Delivery Oral Cephalexin and Metronidazole on Surgical Site Infection Among Obese Women: A Randomized Clinical Trial. JAMA. 2017 Sep 19;318(11):1026-1034. doi: 10.1001/jama.2017.10567.
8. Tara F, Danesteh S, Rezaee M, Geraylow KR, Moodi Ghalibaf A, Moeindarbari S. Effectiveness of postoperative oral administration of cephalexin and metronidazole on surgical site infection among obese women undergoing cesarean section: a randomized, double-blind, placebo-controlled, parallel-group study-phase III. Antimicrob Resist Infect Control. 2022 Dec 5;11(1):150. doi: 10.1186/s13756-022-01191-y.

9. Tita AT, Szychowski JM, Boggess K, Saade G, Longo S, et al. Adjunctive azithromycin prophylaxis for cesarean delivery. N Engl J Med 2016;375:1231–41.
10. Bonomo R, et al. 2024 Clinical Practice Guideline Update by Infectious Diseases Society of America on Complicated Intra-Abdominal Infections: Risk Assessment, Diagnostic Imaging, and Microbiological Evaluation in Adults, Children, and Pregnant People. Clinical Infectious Diseases. 2024:79:S81-87.
11. Schuetz A. Antimicrobial Resistance and Susceptibility Testing of Anaerobic Bacteria. Clinical Infectious Diseases, Antimicrobial Resistance. 2014. (59): 689-705.
12. Tita AT, Szychowski JM, Boggess K, Saade G, Longo S, Clark E, Esplin S, Cleary K, Wapner R, Letson K, Owens M, Abramovici A, Ambalavanan N, Cutter G, Andrews W; C/SOAP Trial Consortium. Adjunctive Azithromycin Prophylaxis for Cesarean Delivery. N Engl J Med. 2016 Sep 29;375(13):1231-41.
13. Updated Aminoglycoside Breakpoints for Enterobacterales and Pseudomonas aeruginosa. CLSI Subcommittee on Antimicrobial Susceptability Testing. 2023. https://clsi.org/about/blog/ast-news-update-june-2023-new-clsi-m100-ed33-updated-aminoglycoside-breakpoints-for-enterobacterales-and-pseudomonas-aeruginosa/
14. Stock L, Basham E, Gossett DR, Lewick-Gaupp C. Factors associated with wound complications in women with obstetric anal sphincter injuries (OASIS). Am J Obstet Gynecol 2013;208:327.
15. Lewicky-Gaupp C, Leader-Cramer A, Johnson LL, Kenton K, Gossett DR. Wound complications after obstetric anal sphincter injuries. Obstet Gynecol 2015;125:1088–93.
16. Duggal N, Mercado C, Daniels K, Bujor A, Caughey AB, El-Sayed YY. Antibiotic prophylaxis for prevention of postpartum perineal wound complications: a randomized controlled trial. Obstet Gynecol. 2008 Jun;111(6):1268-7
17. Prevention and management of obstetric lacerations at vaginal delivery. ACOG Practice Bulletin No. 198. American College of Obstetricians and Gynecologists. Obstet Gynecol 2018;132:e87–102.
18. B.M. Mercer, M. Miodovnik, G.R. Thurnau, et al. Antibiotic therapy for reduction of infant morbidity after preterm premature rupture of the membranes. A randomized controlled trial. National Institute of Child Health and Human Development Maternal-Fetal Medicine Units Network. JAMA, 278 (1997), pp. 989-995
19. Seaman RD, Kopkin RH, Turrentine MA. Erythromycin vs azithromycin for treatment of preterm prelabor rupture of membranes: a systematic review and meta-analysis. Am J Obstet Gynecol. 2022 Jun;226(6):794-801.e1. doi: 10.1016/j.ajog.2021.12.262.
20. Stoll BJ, Puopolo KM, Hansen NI, et al. Early-Onset Neonatal Sepsis 2015 to 2017, the Rise of Escherichia coli, and the Need for Novel Prevention Strategies. JAMA Pediatr. 2020;174(7):e200593. doi:10.1001/jamapediatrics.2020.0593
21. Centers for Disease Control. Early-Onset Neonatal Sepsis Surveillance and Trends. https://www.cdc.gov/abcs/reports/neonatal-sepsis.html#:~:text=In%20very%2Dlow%2Dbirthweight%20infants,very%2Dlow%2Dbirthweight%20infants. Accessed March 25, 2025.

Management of Patients with Beta-Lactam (Penicillins and Cephalosporins) Allergies

Lauren Puckett, PharmD, Stanford Medicine Children's Health
Kathleen Andonian, PharmD, Sharp Mary Birch Hospital for Women and Newborns
Natali Aziz, MD, MS, Stanford University School of Medicine
Elliott K. Main, MD, Stanford University School of Medicine

Key Principles:

1. While many persons report a penicillin class allergy, less than 1% are truly allergic.
2. An important task during prenatal care is to re-assess and "de-label" persons with reported allergies determined to be inaccurate or intolerances.
3. Most cephalosporins are safe to use in patients with Type I immediate hypersensitivity reactions (i.e. anaphylaxis).

Introduction

Penicillin and ampicillin play important roles in prophylaxis and treatment of obstetric infections (particularly for in the treatment of *Streptococcus* spp.), but many patients report histories suggestive of penicillin allergy. Approximately 10% of patients will report having a penicillin class antibiotic allergy, but fewer than 1% of the population is truly allergic to penicillins.[1] Furthermore, up to 80% of patients with a true IgE allergic reaction earlier in life lose their sensitivity over time, so even patients with a remote history of true allergy may be able to currently receive this class of antibiotics safely.[2,3] Therefore, a very important task during prenatal care is to evaluate and potentially "de-label" persons with a reported penicillin allergy that are determined to be inaccurate, temporally irrelevant, or intolerances.[4] Beta-lactam antibiotics play a critical role in the management of obstetric sepsis and severe infections. Selecting the appropriate antibiotic regimen for patients with a reported beta-lactam allergy can be challenging. First-line agents in treatment regimens are preferred, when possible, to optimize therapeutic outcomes, as alternative antibiotics are often overly broad in spectrum or lack robust evidence to support efficacy and safety in obstetric infections.

Definitions of Allergic Reactions

Type I Hypersensitivity refers to an immunoglobulin E (IgE)-mediated reaction that typically presents within 1 hour, but in some cases within ≤ 6 hours, of exposure to an antigen and manifests in the following:

A. **Hives:** multiple red, raised areas of skin accompanied by extreme itching

B. **Angioedema:** painless, non-itchy swelling of the lips, tongue or cheeks

C. **Anaphylaxis:** hypotension alone in the setting of a known allergen exposure OR signs or symptoms in at least two of the following systems within minutes to hours:

   a. Skin: hives, flushing, itching and/or angioedema

   b. Respiratory: cough, shortness of breath, chest tightness, wheezing, sensation of throat closure or choking and/or change in voice-quality (laryngeal edema)

   c. Cardiovascular: hypotension, faintness, tachycardia (or less commonly, bradycardia), tunnel vision, chest pain, sense of impending doom and/or loss of consciousness

   d. Gastrointestinal: nausea/vomiting, abdominal cramping and diarrhea

   Discussion of drugs to treat anaphylaxis will be discussed later in Table 2.

Type II – IV Hypersensitivity are delayed hypersensitivity reactions, meaning they occur at least 6 hours after exposure to a Beta-lactam, with most occurring 1-2 weeks after therapy initiation. These may include, but are not limited to the following

A. **Stevens Johnson Syndrome (SJS)/Toxic Epidermal Necrolysis (TEN):** life-threatening reaction which involves skin pain, flu-like symptoms, a rash covering 30% of the body, blisters and areas of peeling skin, and/or sores, swelling/crusting of mucous membranes, including mouth, eyes, and genitalia

B. **Drug Reaction with Eosinophilia and Systemic Symptoms (DRESS):** usually develops 2-8 weeks after use of the drug and may involve fever, rash, and hematological findings such as leukocytosis and/or eosinophilia

Beta-lactam (Penicillins and Cephalosporins) Allergy Assessment and De-labeling

Evaluation of reported penicillin and cephalosporin allergies is ideally addressed in the outpatient antepartum setting. If the reported allergy is determined to be an intolerance, incorrect, or irrelevant, "de-labeling" the patient's allergy in the electronic health record is essential. If a reported allergy is suspected to be high risk for a severe reaction such as recent history of anaphylaxis, symptoms consistent with a type I IgE–mediated allergic reaction after recent penicillin exposure (such as respiratory compromise including dyspnea, stridor or hypoxemia), or a prior reaction history consistent with Type II-IV Hypersensitivity as noted above, it may be acceptable to accept the label. For all others, skin testing is very valuable and recommended by ACOG, particularly since penicillins remain the most effective antibiotic for group B *Streptococcus* prophylaxis.[5,6] A recent study of 46 medium risk pregnant patients

found 43 (93%) to be penicillin tolerant on testing, consistent with two other studies.[7] Several options are available for clinically stable patients who are found to be truly penicillin and/or cephalosporin allergic and may include hospitalized desensitization protocols and inpatient/outpatient oral graded provocation challenges depending on the severity of the reaction.[8,9,10] If the patient with obstetric sepsis has a reported beta-lactam allergy that is concern for a severe hypersensitivity reaction, alternative antibiotics may be necessary. In these patients, after resolution of the infection, clinical stabilization, and hospital discharge, the patient should be referred to an outpatient allergy specialist for comprehensive allergy evaluation.

Choosing Alternative Antibiotics for Patients with Beta-Lactam Type 1 Ige-Mediated Hypersensitivity

Current evidence suggests that cross-reactivity between beta-lactam antibiotics is largely due to structural similarities in the R1 side chains rather than the core beta-lactam molecular structure. Clinicians should be aware of R1 side chain similarities when prescribing alternative beta-lactams (see Table 1 for potential for cross-reactivity). The American Academy of Allergy, Asthma, and Immunology (AAAI) recommends categorizing patient allergies based on the type of reaction (i.e., anaphylactic vs. non-anaphylactic) and the level of certainty of the reaction (i.e., verified vs. unverified).[11] This approach helps clinicians stratify risk and guide antibiotic selection more accurately for patients with reported beta-lactam allergies to safer and more effective care. See Figure 1 for the beta-lactam allergy pathway. Although the data has shown that the risk of an allergic reaction to a beta-lactam that is structurally unique is very unlikely, an allergic reaction may occur regardless. After stopping the causative medication(s), medications that should be readily available to manage an allergic reaction can be found in Table 2. Pretreatment with the medications listed in Table 2 is not recommended as they may mask early signs of a hypersensitivity reaction.

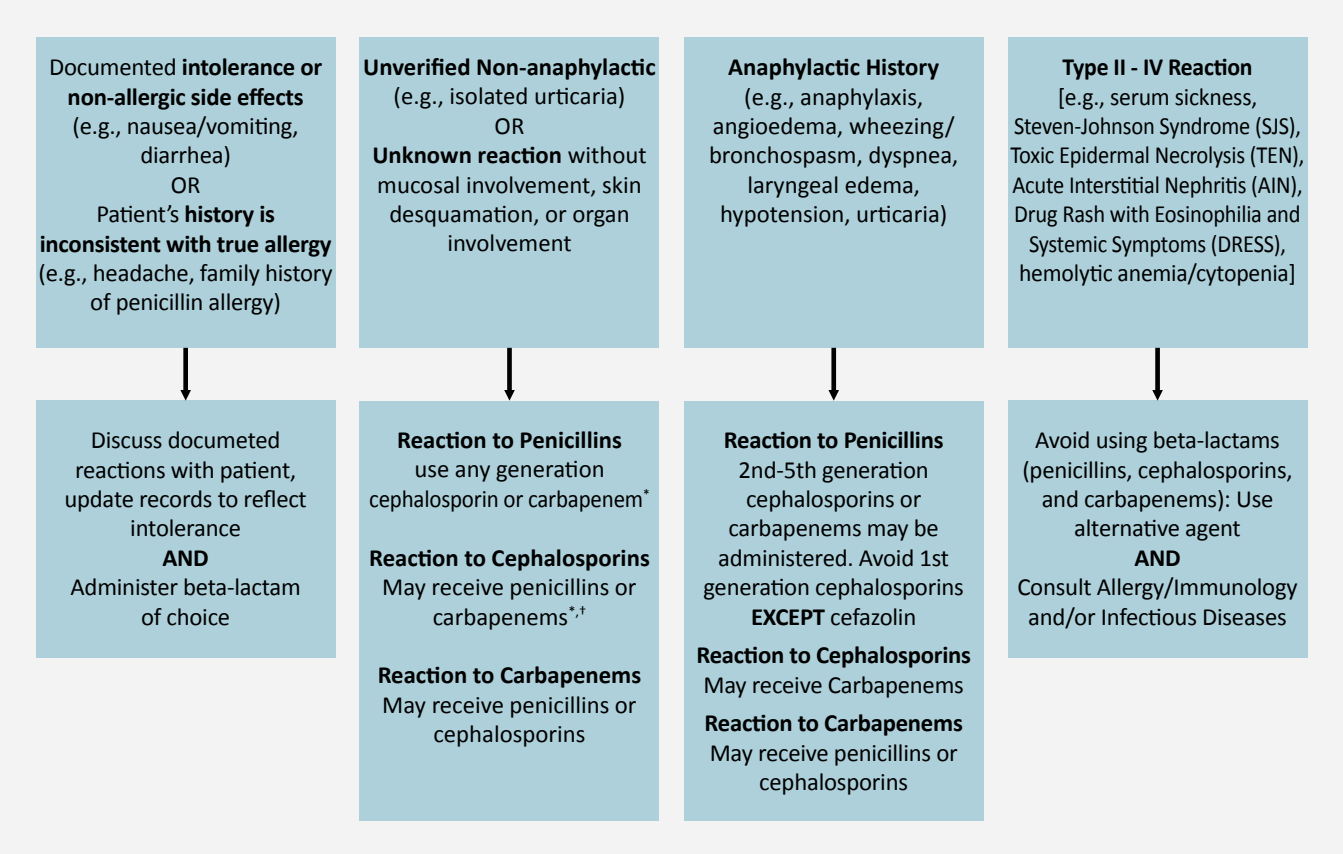
Table 1. Stage Agents with Potential for Cross-reactivity in Setting of Type 1 IgE-mediated Hypersensitivity.

	Verified Antibiotic Allergy		
Antibiotic Ordered	**Penicillins**	**Cephalosporins**	
		Cephalexin, Cefadroxil, Cefaclor, Cefprozil	**Cefazolin, 2nd – 5th Gen Cephalosporins***
Penicillins, ampicillin†	**DO NOT GIVE**	**DO NOT GIVE**	Safe to administer
Cephalosporins Cephalexin, Cefadroxil, Cefaclor, Cefprozil	**DO NOT GIVE**	**DO NOT GIVE**	**DO NOT GIVE**
Cefazolin Cephalosporins 2nd – 5th Gen.Cephalosporins	**DO NOT GIVE**	**DO NOT GIVE**	**DO NOT GIVE**

**Notable 2nd – 5th generation cephalosporins include, but are not limited to the following: ceftriaxone, cefpodoxime, cefdinir, cefepime, and ceftazidime.*
†Penicillins can be given to patients with demonstrated tolerance to penicillins through previous medication therapy or if a history of negative penicillin skin testing and/or drug challenge.

RESPONSE

Figure 1. Beta-lactam Allergy Pathway



**Amoxicillin and ampicillin have cross reactivity with 1st generation cephalosporins (e.g., cephalexin, cefadroxil, cefaclor, cefprozil) EXEPT cefazolin.*
†Clinically stable patients with a history of non-anaphylactic reaction to cephalosporins where cephalosporin use is desired may be eligible to receive an oral drug challenge. Consult Allergy/Immunology for further evaluation and recommendations.

RESPONSE

Table 2. Medications for Management of Allergy-related Reactions

Medication*	Dose
Diphenhydramine	25-50 mg IV push (over 5 minutes) every 4-6 hours PRN for any allergic reaction. For mild to moderate cutaneous reactions (e.g, pruritus): 25 mg PO every 4-6 hours PRN
Cetirizine	10 mg IV or PO as single dose. If used for management of anaphylaxis should be adjunct to epinephrine.
Epinephrine (1 mg/mL)	0.3 or 0.5 mg (use 0.5 mg in patients >50 kg if available) IM; may repeat every 5 - 15 minutes (or sooner if clinically indicated) if patient does not respond adequately. Note: Physician should be at bedside and there should be immediate access to telemetry monitoring or as per institutional guidelines for use.
Famotidine	20 mg IV push every 12 hours PRN in combination with H1 antihistamine (e.g., cetirizine, diphenhydramine)
Albuterol MDI (with or without spacer)	Inhale 2 puffs every 4 hours PRN shortness of breath, or Inhale 4 puffs every 20 minutes PRN for anaphylaxis (use facemask if needed), up to 8 hours

**Do NOT pretreat with these medications as they may mask early signs of a hypersensitivity reaction*

Recommendations (Level Of Evidence)

1. Persons with a history of penicillin or other beta-lactam allergy should be evaluated during prenatal care for potential “de-labeling”. (LEVEL A)
2. Medications for the treatment of potential allergy-related reactions should be immediately available on Labor and Delivery. (LEVEL B)
3. A standard path for alternative antibiotic choices in the setting of penicillin/beta-lactam allergies should be available in the EHR order sets. (LEVEL C)

Educational Tools/Sample Resources

1. This short chapter could be copied and kept available on Labor and Delivery (either using paper or electronic means).

References:

1. Joint Task Force on Practice Parameters. American Academy of Allergy, Asthma and Immunology; American College of Allergy, Asthma and Immunology; Joint Council of Allergy, Asthma and Immunology. Drug allergy: an updated practice parameter. Ann Allergy Asthma Immunol. 2010;105(4):259–73. doi:10.1016/j.anai.2010.08.002.
2. Blanca M, Torres MJ, García JJ, et al. Natural evolution of skin test sensitivity in patients allergic to beta-lactam antibiotics. J Allergy Clin Immun. 1999;103(5 Pt 1):918–24.
3. Sullivan TJ, Wedner HJ, Shatz GS, Yecies LD, Parker CW. Skin testing to detect penicillin allergy. J Allergy Clin Immunol. 1981;68(3):171–80.
4. Turrentine MA, King TL, Silverman NS. Penicillin Allergy in Pregnancy: Moving From "Rash" Decisions to Accurate Diagnosis. Obstet Gynecol. 2020 Feb;135(2):401-408. doi: 10.1097/AOG.0000000000003662.
5. ACOG Practice Bulletin No. 199: Use of Prophylactic Antibiotics in Labor and Delivery. Obstetrics and Gynecology. 2019. 134(4):883-884

6. ACOG Committee Opinion No. 797: Prevention of Group B Streptococcal Early-Onset Disease in Newborns. Obstetrics and Gynecology. 2020. 135(2):e51-72.
7. Desravines N, et al. Outpatient Penicillin Allergy Testing in Pregnant Women Who Report an Allergy. Obstetrics and Gynecology. 2020. 137(1):56-61
8. CDC, Sexually Transmitted Infections Treatment Guidelines (2021): Managing Persons Who Have a History of Penicillin Allergy. Penicillin Allergy - STI Treatment Guidelines
9. Hay Wong JM, et al. Antepartum vs postpartum amoxicillin oral challenge in pregnant patients with a reported penicillin allergy: a two-center prospective cohort study. AOGS. 2024. 103:2289-2295. DOI: 10.1111/aogs.14964
10. Mak R, et al. Safety of direct oral challenge to amoxicillin in pregnant patients at a Canadian tertiary hospital. Journal of Allergy and Clinical Immunology Practice. 2022. 10(7):1919-21
11. Khan DA, Banerji A, Blumenthal KG, et al. Drug allergy: A 2022 practice parameter update. J Allergy Clin Immunol. 2022;150(6):1333-1393. doi:10.1016/j.jaci.2022.08.028
12. Jeimy, S., Ben-Shoshan, M., Abrams, E.M. et al. Practical guide for evaluation and management of beta-lactam allergy: position statement from the Canadian Society of Allergy and Clinical Immunology. Allergy Asthma Clin Immunol 16, 95 (2020). https://doi.org/10.1186/s13223-020-00494-2

Reporting and Systems Learning

This domain is designed to aid hospital leaders in balancing use of the CMS SEP-1 measure with new definitions of sepsis. Structure, process, and outcome measures for sepsis bundle implementation are presented and review of sepsis cases to identify opportunities for quality improvement is discussed.

In this section you will find the following:

- Measuring Quality in the Care of Obstetric Sepsis / SEP-1 Measure
- Measures for Obstetric Sepsis Bundle Implementation
- Debriefs and Multidisciplinary Case Review Guidance

Measuring Quality in the Care of Obstetric Sepsis / SEP-1 Measure

Elliott K. Main, MD, Stanford University School of Medicine
Melissa E. Bauer, DO, Duke University School of Medicine

Key Principles

1. MS SEP-1 measure uses the Sepsis-1 (1992) definition of sepsis using SIRS criteria which markedly overdiagnoses sepsis during pregnancy.
2. The actual measure denominator for SEP-1 is severe sepsis (sepsis with end-organ injury). In Sepsis-3, this is the definition of "sepsis".
3. Use of the ACOG/SMFM/CDC/WHO modern (Sepsis-3) definition of sepsis (infection with dysregulated host response with end-organ injury) also fits the SEP-1 measure denominator, does not overdiagnose sepsis in pregnancy, and does not falsely raise the Severe Maternal Morbidity (SMM) /Severe Obstetric Complication publicly reported measures.

Introduction

This chapter will first identify a solution for the hospital challenge of diagnosing obstetric patients using the CMS SEP-1 measure. The CMS definition of sepsis continues to use SIRS vital signs criteria in combination with documentation of infection, which means the majority of patients with chorioamnionitis meet sepsis criteria by default. The consequences of overdiagnosing sepsis are now significant with the introduction of the new CMS Severe Obstetric Complications measure that includes sepsis.[1] Furthermore, this measure will be a key part of the national publicly reported Birthing Friendly Initiative. In 2023, CMS launched the Birthing Friendly Initiative to designate hospitals that provide high-quality maternity care, by identifying health systems that participate in a statewide or national perinatal quality improvement collaborative program.[2]

This chapter will go on to examine structure, process and outcome measures used for hospital, system and state-level sepsis quality improvement projects. This will be followed by tools to use for review of sepsis cases both as part of Severe Maternal Morbidity (SMM) case reviews and more specifically as reviews of sepsis cases.

Navigating the Definition of OB Sepsis for National Reporting

The definition of sepsis has undergone significant change over the last decade. In 2016, new data led to a third consensus panel, Sepsis-3, which revamped the definition of sepsis to "life-threatening organ dysfunction caused by a dysregulated host response to infection" and discarded SIRS as a criterion.[3] This definition by the Society of Critical Care Medicine has been endorsed by the CDC[4], American College of Emergency Physicians, American Thoracic Society, and the American Association of Critical-Care Nurses,

among many others. In pregnancy with physiologic changes of vital signs, SIRS criteria have proven especially unsatisfactory. For example, over 90% of patients with chorioamnionitis meet standard SIRS criteria, while less than 5% have sepsis.[5] The Sepsis-3 criteria have been widely adopted by major OB-GYN organizations for use in obstetric care, including the World Health Organization (WHO) in 2017[6], the International Federation of Gynecology and Obstetrics (FIGO) in 2018, the American College of Obstetricians and Gynecologists (ACOG) in 2023, and the Society for Maternal Fetal Medicine (SMFM) in 2023.[7] All of these organizations have declared that SIRS alone should not be used to diagnose sepsis in pregnancy.

What are the down sides of using the SEP-1 definition with SIRS? The overdiagnosis of obstetric patients with infection plus SIRS (such as the majority of patients with chorioamnionitis) has real consequences beyond potential overtreatment. Sepsis ICD-10 codes are included in the new national Severe Obstetric Complications measure sponsored by both CMS and The Joint Commission (TJC). This measure is a hospital-level version of the CDC Severe Maternal Morbidity measure that includes ICD-10 sepsis codes.[8] Beginning with 2024 hospital discharges, this metric is required to be publicly reported by all U.S. hospitals with maternity care and will be included as part of the Birthing-Friendly designation in 2026, recognizing hospitals with high quality care. Hospitals using the SIRS criteria to define obstetric sepsis have particularly high (outlier) rates of sepsis based on ICD-10 coding and likely will not qualify for the Birthing-Friendly designation. On the other hand, defining sepsis as infection plus end-organ injury has been criticized as it may delay aggressive treatment until end-organ injury is already present. The approach featured in this chapter avoids both undesirable outcomes. Table 1 provides a review of sepsis terminology and the recommended approach to coding sepsis to navigate both SEP-1 and Severe Obstetric Complications measures (and Birthing-Friendly designation) while providing good patient care.

Table 1. Maternal Sepsis Terminology and ICD-10 Codes

Organization	Infection with SIRS/Abnormal VS	Infection with End-Organ Injury	Sepsis with Shock
Sepsis-1 Consensus (Society of Critical Care Medicine - 1992)	Sepsis	Severe Sepsis	Septic Shock
SEP-1 Measure (CMS 2015)	Sepsis	Severe Sepsis	Septic Shock
Sepsis-3 Consensus (Society of Critical Care Medicine - 2016)	<No Term>	Sepsis*	Septic Shock
Maternal Sepsis — WHO (2017)	<No Term>	Sepsis*	Septic Shock
Maternal Sepsis — ACOG, SMFM (2023)	<No Term>	Sepsis*	Septic Shock
Sepsis-- CDC (2023)	Serious Infection	Sepsis*	Septic Shock
Maternal Sepsis — CMQCC (2024)	Serious Infection	Sepsis*	Septic Shock

**These organizations have eliminated "Severe Sepsis" as a category*

ICD diagnosis codes are entirely dependent on what the provider documents. The clinician is free to follow specialty guidance, chart, and diagnose sepsis only when serious infection with end-organ injury is present. It is also necessary to document the organ dysfunction related to sepsis. CMS SEP-1 follows the clinical criteria as outlined in the next section rather than ICD-10 codes for sepsis based on SIRS, freeing the clinician to document (see Table 2). However, if the clinician documents sepsis in the chart it will be assigned an ICD code and reported as such.

Table 2. CMQCC Recommendations for ICD-10 Codes for Obstetric Infections/ Sepsis

Organization	Infection with SIRS/Abnormal VS	Infection with End-Organ Injury*	Sepsis with Shock
California Maternal Quality Care Collaborative (CMQCC)	Specific infection code Examples O86.x Other puerperal infections… O75.3—Other infection During Labor-can include sepsis only if A40/A41 is included-see next column	O85—Puerperal Sepsis (postpartum involving the genital track) A40.x or A41.x—Sepsis specific types added to other infection codes R6520—Severe Sepsis (with end-organ injury)	R6521—Septic Shock (often with other sepsis codes)

**During pregnancy admissions, the leading diagnosis code should be in the "O" series. O75.3 should be followed with an A40x or A41x code (see Table 2) to provide specificity as to what type of sepsis. O85 and O86.x are not followed by "A" codes but by B95-B97 to identify the infecting organism, if known.*

In 2021, after consultation with CMQCC Toolkit authors, CMS adjusted the SIRS criteria for pregnancy physiologic changes (see following sections). These pregnancy-adjusted criteria were recently validated in a very large multi-center study of Electronic Health Record (EHR) data from nearly 3,000 cases of obstetric sepsis and matched controls.[5] However, these changes still did not result in an accurate diagnosis of sepsis. For example, in the case of chorioamnionitis, 60% of cases identified using the pregnancy adjusted criteria were false positives, versus 87% with the unadjusted criteria. This confirmed the need for a second step to identify end-organ injury to diagnose sepsis (consistent with Sepsis-3). Importantly, CMQCC calls for action with a positive screen and a bedside evaluation to rule out alternative diagnoses and identify an infection source; commencing treatment (antibiotics and fluids), increasing surveillance, and performing laboratory studies to rule out end-organ injury.

Comparing CMS SEP-1 and CMQCC Serious Infection Flow Chart Criteria

It is understood that hospitals need to follow SEP-1 reporting guidance. So how can a hospital legitimately navigate SEP-1, Sepsis 3, ACOG/SMFM/CDC, Severe Obstetric Complications and Birthing-Friendly designation measure specifications and still treat patients in an appropriate and timely manner? The CMQCC Serious Infection Evaluation Flow Chart offers a reasonable solution that can be used in full compliance with SEP-1. Tables 3-5 review in detail the SEP-1 measure specifications[9] side-by-side with the CMQCC Obstetric Serious Infection Evaluation Flow Chart. Table 3 describes the establishment of the diagnosis of Severe Sepsis—the denominator for SEP-1, Table 4 compares the criteria for pregnancy adjusted SIRS, and Table 5 compares the criteria for organ dysfunction. The wording is taken exactly from the SEP-1 specifications manual.

Table 3. Establishment of the Diagnosis of Severe Sepsis: SEP-1 Compared to CMQCC Criteria

SEP-1 Specifications Manual[9]	CMQCC Obstetric Serious Infection Evaluation Flow Chart
To establish the presence of severe sepsis by clinical criteria, all three clinical criteria (a), (b), and (c) must be met within six hours of each other. The three clinical criteria do not need to be documented in any particular order.	CMQCC uses the Sepsis-3 definition that requires sepsis to have end-organ injury. This equates sepsis with severe sepsis, but the three clinical criteria are identical to SEP-1. In the flow chart, (b) often comes before (a) as pregnancy modified SIRS criteria in (b) can be used for screening.
(a) Documentation of an infection.	(a) Identification of a probable infection and exclusion of other causes during bedside evaluation for the abnormal screen.
(b) Two or more manifestations of systemic infection according to the Systemic Inflammatory Response Syndrome (SIRS) criteria: Note different SIRS criteria are used in pregnancy ≥20 weeks of gestation through day 3 post-delivery (see Table 4 below).	(b) Any two or more criteria of the pregnancy-modified SIRS for pregnancies ≥20 weeks of gestation through day 3 post-delivery (see Table 4 below).
(c) Organ dysfunction evidenced by any one from the Table 5 below. Note: do not use the abnormal value if caused by another condition or medication (documented).	(c) End-organ Injury evidenced by any one from the Table 5 below. Note: do not use the abnormal value if caused by another condition or medication.

Table 4. Systemic Inflammatory Response Syndrome (SIRS) Criteria: SEP-1 Compared to CMQCC Criteria

SEP-1 Specifications Manual[9]		CMQCC Obstetric Serious Infection Evaluation Flow Chart
Non-Pregnant Patients*	**Pregnant 20 weeks through Day 3 Post-delivery Patients**	**Pregnant 20 weeks through Day 3 Post-delivery Patients**
Oral Temperature >38.3C or <36.0C	Oral Temperature >38.0C or <36.0C	Oral Temperature >38.0C or <36.0C
Heart rate: >90 per minute	Heart rate: >110 per minute	Heart rate: >110 per minute
Respiratory rate: >20 per minute	Respiratory rate: >24 per minute	Respiratory rate: >24 per minute
WBC >12,000 or <4,000 or >10% bands	WBC >15,000 or <4,000 or >10% bands	WBC >15,000 or <4,000 or >10% bands

**Includes pregnant patients <20 weeks and after 3 days post-delivery*

REPORTING

The SIRS criteria are identical for pregnancy between SEP-1 and CMQCC. After the publication of the first edition of the CMQCC Toolkit for the Improving Diagnosis and Treatment of Maternal Sepsis in 2020[10], CMS adjusted the SIRS criteria for pregnancy. The next step in both SEP-1 and CMQCC is evaluation for organ dysfunction. The criteria are shown below in Table 5. There was coordination between CMS and CMQCC to align criteria.

Table 5. Criteria for Organ Dysfunction/End-Organ Injury: SEP-1 Compared to CMQCC Criteria

SEP-1 Specifications Manual		CMQCC Obstetric Serious Infection Evaluation Flow Chart
Non-Pregnant Patients*	**Pregnant 20 weeks through Day 3 Post-delivery Patients**	**Pregnant 20 weeks through Day 3 Post-delivery Patients**
Hypotension: SBP <90 mmHg or MAP <65mmHg or SBP decrease >40 mmHg **Respiratory:** New mechanical or non-invasive ventilation (e.g. CPAP, BiPAP)	**Hypotension:** SBP <85 mmHg or MAP <65mmHg or SBP decrease >40 mmHg **Respiratory:** New mechanical or non-invasive ventilation (e.g. CPAP, BiPAP)	**Hypotension:** SBP <85 mmHg or MAP <65mmHg or SBP decrease >40 mmHg **Respiratory:** New mechanical or non-invasive ventilation (e.g. CPAP, BiPAP, or O2 sat <92%, or O2 requirement)
Renal: Creatinine >2.0 mg/dL or Urine Output <0.5ml/kg/hour for two consecutive hours **Liver:** Total Bilirubin >2 mg/dL **Coagulation:** Platelet count <100,000, or INR >1.5, or aPTT >60 sec **Lactate:** >2mmol/L	**Renal:** Creatinine >1.2 mg/dL or Urine Output <0.5ml/kg/hour for two consecutive hours **Liver:** Total Bilirubin >2 mg/dL **Coagulation:** Platelet count <100,000, or INR >1.5, or aPTT >60 sec **Lactate:** >2mmol/L (NOTE: Do not use lactate obtained during active labor through delivery)	**Renal:** Creatinine >1.2 mg/dL or Urine Output <60ml for two consecutive hours **Liver:** Total Bilirubin >2 mg/dL **Coagulation:** Platelet count <100,000, or INR >1.5, or aPTT >60 sec (PT and aPTT may not be routinely collected in obstetrics) **Lactate:** >2mmol/L (NOTE: Do not use lactate obtained during active labor through one hour postpartum). In Sepsis-3, Lactate is a measure of severity rather than an indicator of end-organ injury.

**Includes pregnant patients <20 weeks and after 3 days post-delivery*

It is important for the clinician to document non-infectious reasons for hypotension (e.g. neuraxial anesthesia/analgesia or hemorrhage) and another organ dysfunction if present. It is not required by CMS to draw all of the labs in the table above, but if they are drawn, they will be used for the SEP-1 evaluation. PT/aPTT labs (which are the most costly) may be postponed unless or until the patient has other end-organ injuries or is admitted to the ICU.

Concerns regarding organ dysfunction are addressed by first identifying those with infection using a pregnancy-adjusted abnormal vital signs screen as a "serious infection" (which is also CDC language). See the earlier chapter on Diagnosis and Screening for Obstetric Sepsis for further detail and discussion. End-organ injury is specifically evaluated while care for serious infection is provided immediately, and surveillance is

raised to a higher level. In this approach, only those with end-organ injury receive the diagnosis of sepsis with appropriate sepsis ICD-10 codes. The intent of SEP-1 is preserved, as only patients with acute organ dysfunction or shock are included in the measure denominator, and only patients with true sepsis (Sepsis-3) are included in the Severe Obstetric Complications (SOC) measure and the Birthing- Friendly designation. This is fully consistent with ACOG, SMFM, and WHO guidance (as well as all of the organizations endorsing Sepsis-3 criteria). This two-step approach for diagnosis has been endorsed by ACOG and SMFM.[7]

To complete the specifications for the SEP-1 measure the numerator criteria are presented below, direct from the coding manual.[9] The numerator criteria are fully applicable for use in obstetric patients using the end-organ injury definition of sepsis. However, further discussion is warranted for the collection of blood cultures prior to the use of antibiotics. There is an exclusion for this checkpoint for those for whom antibiotics were started for an infection prior to the diagnosis of end-organ injury. In the CMQCC flowchart, antibiotics are administered within an hour for all serious infections while laboratory tests are sent to screen for end-organ injury. These results should be available within an hour which could then call for the collection of blood cultures. Recent evidence indicates that cultures collected within an hour of antibiotic administration do not impact the validity of the blood cultures.[10]

SEP-1 Numerator--Patients who received ALL of the following[9]:

1. Within three hours of presentation of severe sepsis:
   - Initial lactate level measurement
   - Broad spectrum or other antibiotics administered
   - Blood cultures drawn prior to antibiotics

AND

2. Received within six hours of presentation of severe sepsis. ONLY if the initial lactate is elevated:
   - Repeat lactate level measurement

AND

3. Within three hours of initial hypotension:
   - Resuscitation with 30 mL/kg crystalloid fluids
   - OR within three hours of septic shock:
   - Resuscitation with 30 mL/kg crystalloid fluids

AND

4. Within six hours of septic shock presentation, ONLY if hypotension persists after fluid administration:
   - Vasopressors are administered

AND

5. Within six hours of septic shock presentation, if hypotension persists after fluid administration or initial lactate >= 4 mmol/L:
   - Repeat volume status and tissue perfusion assessment is performed

In summary, the message to providers is to refrain from documenting sepsis unless you have confirmed infection AND acute organ dysfunction. Precise language is crucial to avoid over-coding. It is important that cases of serious infection (without end-organ injury) not be documented as sepsis, otherwise the case will fall into the CMS SEP-1 measure and the CMS Severe Obstetric Complications measure. Sepsis should be coded only in the presence of end-organ injury (ideally with the end-organ injury modifier). Then the case is appropriately eligible for both the CMS SEP-1 measure and the CMS Severe Obstetric Complications measure.

Recommendations (Level of Evidence)

1. All obstetric providers should receive education regarding the modern definition of obstetric sepsis and the correct descriptions to use in charting. (LEVEL C)
2. All coders for obstetric patients and QI staff for the SEP-1 measure team should receive education regarding the nuances for ICD-10 coding for obstetric sepsis and serious infections during pregnancy. (LEVEL C)
3. This chapter can provide the needed education for providers, coders and QI teams and should be widely shared. (LEVEL C)

Educational Tools and Sample Resources

1. CMS Specifications Manual for SEP-1 (Specifically section 1b-DD. Pages 1-136 to 1-140.)
2. Appendix U: Comparison of Sep-1 to CMQCC Criteria

References

1. CMS. Severe Obstetric Complications Electronic Clinical Quality Measure (eCQM) Methodology Report, Version 1.0 October 2021. https://www.cms.gov/files/document/measure-methodology-report.pdf (accessed January 20, 2025).
2. Biden-Harris Administration Launches "Birthing-Friendly" Designation on Web-based Care Comparison Tool. November 8, 2023. https://www.cms.gov/newsroom/press-releases/biden-harris-administration-launches-birthing-friendly-designation-web-based-care-compare-tool (accessed January 20, 2025).
3. Singer M, Deutschman CS, Seymour CW, Shankar-Hari M, Annane D, Bauer M, Bellomo R, Bernard GR, Chiche JD, Coopersmith CM, Hotchkiss RS, Levy MM, Marshall JC, Martin GS, Opal SM, Rubenfeld GD, van der Poll T, Vincent JL, Angus DC. The Third International Consensus Definitions for Sepsis and Septic Shock (Sepsis-3). JAMA. 2016 Feb 23;315(8):801-10. doi: 10.1001/jama.2016.0287.
4. CDC Hospital Sepsis Program-Core Elements (2023). https://www.cdc.gov/sepsis/hcp/core-elements/index.html (accessed January 20, 2025).
5. Main EK, Fuller M, Kovacheva VP, Elkhateb R, Azar K, Caldwell M, Chiem V, Foster M, Gibbs R, Hughes BL, Johnson R, Kottukapally N, Cortes MS, Rosenstein MG, Shields LE, Sudat S, Sutton CD, Toledo P, Traylor A, Wharton K, Bauer ME. Performance Characteristics of Sepsis Screening Tools During Delivery Admissions. Obstet Gynecol. 2024 Mar 1;143(3):326-335.
6. WHO Statement on Maternal Sepsis (2017). http://apps.who.int/iris/bitstream/10665/254608/1/WHORHR-17.02-eng.pdf (accessed January 20, 2025).
7. Shields AD, Plante LA, Pacheco LD, Louis JM. Society for Maternal-Fetal Medicine Consult Series #67: Maternal sepsis. Am J Obstet Gynecol. 2023 Sep;229(3):B2-B19. doi: 10.1016/j.ajog.2023.05.019.
8. Maternal and Child Health Bureau. Federally Available Data (FAD) Resource Document. Accessed January 20, 2025. https://mchb.tvisdata.hrsa.gov/Home/FADDocuments
9. CMS Specifications Manual for National Hospital Inpatient Quality Measures. Discharges 01-01-25 (1Q25) through 12-31-25 (4Q25). See Section 1b-DD. Pages 1-136 to 1-144 are most valuable for pregnancy considerations. https://qualitynet.cms.gov/inpatient/specifications-manuals. This site is updated with the latest updates to the measure. Accessed January 23, 2025.
10. Gibbs R, Bauer M, Olvera L, Sakowski C, Cape V, Main E. Improving Diagnosis and Treatment of Maternal Sepsis: A Quality Improvement Toolkit. Stanford, CA: California Maternal Quality Care Collaborative. https://www.cmqcc.org/resources-toolkits/toolkits/improving-diagnosis-and-treatment-maternal-sepsis. Accessed January 20, 2025.
11. Zornitzki L, Anuk L, Frydman S, et.al. Rate and predictors of blood culture positivity after antibiotic administration: a prospective single-center study. Infection. 2024 Apr;52(2):483-490

Measures for Obstetric Sepsis Bundle Implementation

Elliott K. Main, MD, Stanford University School of Medicine
Christa Sakowski, MSN, RN, C-ONQS, C-EFM, CLE, Stanford University School of Medicine, CMQCC

Key Principles

1. As obstetric sepsis is uncommon, hospital quality improvement efforts are focused on implementation of structure measures rather than process or outcome measures.
2. The ACOG/AIM National Safety Bundle, Sepsis In Obstetrics, has developed a set of multidisciplinary structure measures that have been vetted by multitude organizations. The limited set of process and outcome measures provide additional value especially at the hospital system or state level.

Introduction

Quality improvement (QI) activities typically have measures that fall into three domains: structure, process, and outcome measures. Structure measures identify practices, equipment, and education that should be implemented on every unit over the course of the QI project. Structure measure data is usually collected as Yes/No (or more granularly as: Completed, In Process, Not Started). The ten ACOG /AIM Structure Measures for the National AIM Safety Bundle: Sepsis In Obstetric Care[1] are listed in Table 1. These are recommended for use in every QI project addressing severe infections and sepsis in obstetrics. This toolkit is designed to support such efforts and the index following Table 1 guides the user to resources to accomplish each structure measure.

ACOG/AIM Structure Measures for Sepsis in Obstetric Care

1. Patient Event Debriefs (included in all ACOG/AIM Bundles) – Has your department established a standardized process to conduct debriefs with patients after a severe event?

2. Clinical Team Debriefs (included in all ACOG/AIM Bundles) – Has your department established a system to perform regular formal debriefs with the clinical team after cases with major complications?

3. Multidisciplinary Case Reviews for Obstetric Sepsis – Has your hospital established a process to perform multidisciplinary systems level reviews on cases of sepsis that occur during pregnancy, birth, and the postpartum period?

4. Obstetric Sepsis Screening & Diagnosis System – Has your facility implemented a system for screening and diagnosis of pregnant and postpartum people for sepsis?

5. Protocols for Management of Suspected and Confirmed Obstetric Sepsis – Has your facility established standard protocols and escalation policies for management of pregnant and postpartum people with suspected sepsis and sepsis that include:

- Rapid response protocol for unstable patients
- Standardized order set for sepsis evaluation/management
- Rapid access to laboratory results to assist in identifying severity and potential source
- Protocol for source control starting with least invasive means

6. Patient Education Materials on Urgent Postpartum Warning Signs (included in all ACOG/AIM Bundles) – Has your department developed/curated patient education materials on urgent postpartum warning signs that align with culturally and linguistically appropriate standards?

7. Emergency Department (ED) Screening for Current or Recent Pregnancy (included in all ACOG/AIM Bundles) – Has your ED established or continued standardized verbal screening for current pregnancy and pregnancy in the past year as part of its triage process?

8. Identification of Post-Obstetric Sepsis Resources and Referral Pathways – Has your facility created a comprehensive list of resources and referral pathways tailored to people who experienced obstetric sepsis?

9. Emergency Department (ED) Education Program on Recognition of Obstetric Emergencies – Has your facility developed a process and/or program for educating ED staff on signs and symptoms of potential obstetric emergencies?

10. OB Provider and Nursing Education – Provide education to all staff and providers who treat pregnant and postpartum patients about the hospital's sepsis procedure. At a minimum, education occurs at orientation, whenever changes to the procedure occur, or every two years.

- Note: Education provided should be role-specific, and cover Obstetric Sepsis and Respectful Care

To assist in implementation, all the above Sepsis Structure Measures have been built into the CMQCC Maternal Data Center (MDC) for ease of tracking. These are for the confidential use of the hospital and for use in large QI collaboratives for the purposes of progress management. The Sepsis Structure Measures have been very beneficial for moving the implementation process forward.

Process and Outcome Measures for Sepsis Implementation Collaboratives

Process measures count the frequency of appropriate adherence to activities in the care pathway in order to reinforce the implementation of the QI bundle. They can be measured by week, month, or other time period depending on specific measure and resources available. Process measures are very powerful levers for change but consume significant unit resources so should be used sparingly. They can be particularly useful early in the QI project and then can be used as "check-ins" from time to time. In many ways, process measures are similar to the Study part of the familiar Plan-Do-Study-Act (PDSA) cycle. For the AIM Bundle, some of the structure measures (e.g. provider/nursing education and multidisciplinary case reviews) were rewritten as process measures to drive implementation.

Outcome measures are often viewed as the most important way of measuring improvement: Have health outcomes improved? In obstetrics, where most patients are healthy and poor outcomes are relatively rare, outcome measures are more challenging to evaluate as they often require large sample sizes over a long period of time. This is particularly true for obstetric sepsis which has a very low population incidence but can be catastrophic when it occurs. So much so, it is now the leading cause of pregnancy-related maternal mortality by the CDC.[2] Compounding this challenge is the controversy around how to actually define sepsis among obstetric patients as described in detail in the first part of this section. For these reasons, the Obstetric Sepsis QI project promoted a focus on structure measures as a measurement of implementation success and less so on the improvement of process and outcome measures. AIM Process and Outcome measures for the Sepsis in Obstetric Care Bundle are presented in the box.[1] For the reasons stated above, it is hard to create a meaningful hospital outcome measure, so the frequency of sepsis is often measured at the hospital system, collaborative, or state level using the codes in Table 1.[3] The Severe Maternal Morbidity or Severe Obstetric Complications measures required by CMS/The Joint Commission can be collected at the hospital level, but those are composites of multiple morbidities that can obscure the frequency of sepsis. It should be noted that when SIRS is used to diagnose obstetric sepsis (as in SEP-1), the rate of obstetric sepsis and therefore the rate of Severe Maternal Morbidity are markedly increased.

ACOG/AIM Process and Outcome Measures for Sepsis in Obstetric Care

Process Measures

P1. OB Provider and Nursing Education on Obstetric Sepsis – At the end of this reporting period, what cumulative proportion of OB clinicians has received in the last 2 years education on the recognition of and/or unit-standard response to suspected and confirmed obstetric sepsis?

P2. Multidisciplinary Case Reviews for Obstetric Patients with Sepsis – Denominator: All diagnosed instances of obstetric patients with sepsis during the reporting period, including those that occurred prenatally, during the birth admission, and postpartum. Numerator: Among the denominator, those that had a structured multidisciplinary case review documented.

Ad Hoc Audits – Many centers will perform periodic audits of the consistent actions, such as use of the Serious Infection/Sepsis Evaluation Flow Chart and adminstration of antibiotic and fluids within one hour, in order to asses educational opportunities and system improvements.

Outcome Measure

State Surveillance only (due to the low frequency of obstetric sepsis)

SS1. Patients Diagnosed with Sepsis During the Birth Admission
Denominator: All qualifying pregnant and postpartum people during their birth admission (using the Severe Maternal Morbidity denominator).
Numerator: Among the denominator, those who were diagnosed with sepsis (see ICD-10 codes in Table 8)

Table 1 provides the ICD-10 codes used by the CDC and HRSA for the sepsis indicator within the Severe Maternal Morbidity National Outcome Measure and used by AIM in their data center. These measures are used for public reporting in the Inpatient Quality Report (IQR) and, beginning in 2026, as part of the CMS Birthing Friendly Designation. Note however, this code set does NOT include several ICD-10 obstetric-series codes for sepsis (see Table 2). Notably many of these codes occur in early pregnancy which is an area that also deserves active surveillance.

Table 1. Sepsis Codes Used in the Numerators for Severe Maternal Morbidity (SMM) and Severe Obstetric Complications (SOC) Measures[3]

ICD-10-CM Code	Code Description
A40.x	Streptococcal sepsis
A41.x	Other sepsis
A32.7	Listeria sepsis
I76	Septic arterial embolism
O85	Puerperal sepsis
O86.04	Sepsis following an obstetrical procedure
R65.20	Severe sepsis without septic shock
R65.21	Severe sepsis with septic shock
T81.44XA	Sepsis following a procedure
T81.12XA	Postprocedural septic shock

Orange color indicates codes that are also in CMS SEP-1 measure

Table 2. ICD-10 Pregnancy-related (O-chapter) Sepsis Codes

ICD-10-CM Code	Code Description
O75.3	Other infection during labor
O85	Puerperal sepsis
O86.04	Sepsis following an obstetrical procedure
The following codes are used in early previable pregnancies	
O03.37	Sepsis following incomplete spontaneous abortion
O03.87	Sepsis following complete or unspecified spontaneous abortion
O04.87	Sepsis following (induced) termination of pregnancy
O07.37	Sepsis following failed attempted termination of pregnancy
O08.82	Sepsis following ectopic and molar pregnancy

Orange color indicates codes that are also used in the Severe Maternal Morbidity and Severe Obstetric Complications measures in Table 1 on page 16.

Recommendations (Evidence Grade)

1. The structure measures listed in the ACOG/AIM Safety Bundle, Sepsis in Obstetric Care, are recommended for adoption by all hospitals. (LEVEL C)
2. The structure measures should be reviewed and updated on a regular basis. (LEVEL C)

Educational Tools and Sample Resources

This Toolkit provides resources to address all the Structure Measures in the ACOG/AIM Sepsis in Obstetrics bundle. These can be found in formal Toolkit sections and in the Appendices.

1. ACOG/AIM Sepsis in Obstetric Care Bundle with additional implementation materials

References

1. Alliance for Innovation on Maternal Health. Sepsis in Obstetric Care https://saferbirth.org/psbs/sepsis-in-obstetric-care/. Accessed January 22, 2025.
2. Centers for Disease Control and Prevention. Pregnancy Mortality Surveillance System: Maternal Mortality Prevention. https://www.cdc.gov/maternal-mortality/php/pregnancy-mortality-surveillance/index.html Accessed January 22, 2025.
3. Maternal and Child Health Bureau. Federally Available Data (FAD) Resource Document. Accessed January 20, 2025. https://mchb.tvisdata.hrsa.gov/Home/FADDocuments

Debrief and Multidisciplinary Case Review Guidance

Melissa G. Rosenstein, MD, MAS, University of California, San Francisco
Jamie Vincent, MSN, APRN-CNS, RNC-OB, C-EFM, C-ONQS, John Muir Health
Christa Sakowski, MSN, RN, C-ONQS, C-EFM, CLE, Stanford University

Key Principles

1. Debriefs and case reviews create a culture of learning and continuous improvement that is crucial to developing and maintaining safe processes of care.
2. Debriefs should occur after all major events, including sepsis cases, and include team members involved in care.
3. Multidisciplinary case reviews occur after the event and are focused on system improvements which can be shared with a wider audience, separate from the peer-review process.
4. Both debriefs and case reviews should promote just culture and be protected from legal discovery.

Background

Perinatal leaders at facilities that provide obstetric care must prioritize systems-learning and integrate quality improvement into their work culture to achieve optimal patient outcomes and reduce severe maternal morbidity (SMM). Part of developing and promoting a just culture occurs when debriefing is consistently done after severe maternal events.[1,2] This practice fosters continuous quality improvement and ensures the clinical team is utilizing evidence-based protocols and procedures.

The goal of a multidisciplinary review is to formally assess the overall care that the health care team provided and review for potential gaps in the care system. Using these reviews to guide quality improvement initiatives or system enhancements will improve care throughout the facility.

Conducting severe maternal event (SME) case reviews on a regular basis led by a designated perinatal quality committee or physician and nurse reviewers are two key workflows that are strongly encouraged.[3-6]

Post-event clinical team debriefs should not be confused with a Patient-Family Care Discussion which is a sit-down review with the patient and their support persons of what their condition was, what happened in their specific case, provide an opportunity to answer any questions they have and review what to expect next. This generally should happen prior to discharge. This topic is covered in depth in Initiating Healing After a Severe Maternal Event.

Debrief

The review of debriefing by Salas and colleagues provides 12 evidence based best practices and tips and should be widely shared.[18] Debriefs serve many purposes:

- Allow the team to come together to discuss a case, celebrate successes, identify areas for improvement and identify immediate safety concerns that need to be addressed.
- Highlight the importance of teamwork by including the multidisciplinary team involved in patient care. This type of debriefing can strengthen relationships by fostering interdisciplinary communication and collaborative problem solving. Adverse clinical outcomes can be stressful and debriefing as a team can help clinicians work through these difficult events and feel supported.[7,8]
- Many hospitals have "second victim" support programs to help clinicians recover from emotional trauma they have experienced during and after an adverse, or unexpected severe event.[9-11] The Joint Commission has an Issue Brief on the topic and urges health care organizations to address second victim effects, such as difficulty sleeping, reduced job satisfaction, guilt and anxiety (including fear of litigation or job loss) – all of which affect medical judgment and subsequently compromise patient safety.[12-16]

This debrief description focuses on sepsis cases, but the principles are the same for other events with adverse or unexpected outcomes.

The goal of a debrief should be to establish and maintain a just culture that promotes debriefing as a key part of the culture of safety.[2] Debriefing should be a routine part of the obstetric workflow. This repetition will diminish the fear of blame that can often lead to avoidance of debriefs, as well as hardwire familiarity with sepsis protocols, increase comfort discussing complications and efficiency in conducting the debrief. Simulation activities usually include a debrief which helps to ensure a familiarity with the debriefing process to be used for real cases[6] (see chapter Educational Tools and Sample Resources).

What events should be debriefed?

Clearly defining which severe maternal events should be debriefed is recommended. This makes the expectation of debriefing the standard of care, particularly after a difficult case or when there is reluctance to proceed with the debrief. Keeping track of compliance with debriefs for these specified cases can be a useful process measure to track. In addition, defining a debriefing process meets the Alliance for Innovation on Maternal Health (AIM) bundle element.[17] (See section Measuring Quality in the Care of Obstetric Sepsis/Sep-1 Measure). It is important to remember to align with defined organizational perinatal risk types (i.e., patient safety reporting) to optimize existing workflows that may already be in place that promote debriefing for unexpected clinical events [i.e., TeamSTEPPS®, Comprehensive Unit-based Safety Program (CUSP)]. It is highly recommended that perinatal QI leaders learn more about the primary drivers of severe maternal morbidity at the birth facility so, if necessary, other case criteria can be added to the examples below.

Examples of sepsis cases to be debriefed:[18]

- Any case requiring transfer to a higher level of care
- Cases where an unexpected complication occurred
- Cases with delays in recognition or treatment

When should the debrief occur?

The debrief should occur as soon after the transfer as possible. The more time that elapses, the more difficult it is to get all members of the team together, and the important aspect of team building and support is diminished. Providers may have competing clinical responsibilities, so the sooner the debrief occurs, the less likely it is that the obstetric providers will get caught up in subsequent patient care activities. It is crucial to have their participation in debriefing for a thorough picture of events.

Who should be at the debrief?

Everyone involved in the event should be expected to participate in the debrief, including obstetric providers, anesthesia providers, nurses, obstetric support staff and other services involved (e.g., blood bank, lab, ICU). If the bedside nurse is involved with direct patient care duties, a mechanism for coverage by the charge nurse or resource nurse should be put in place so that the bedside nurse is able to attend. Although the obstetric provider may have conflicting clinical responsibilities, it is critical for them to be present.

Where should the debrief occur?

For privacy and candor, the debrief should be held in a work room, conference room, or break room, but not in direct patient care areas. If providers are not able to be on site, secure video conferencing can be used (utilizing a password or the "waiting room" function can ensure security). Follow institutional guidelines for secure remote conferencing.

Who should lead the debrief?

Developing and promoting the practice of debriefing is the shared responsibility of the perinatal clinical care team. Any team member should be empowered to initiate and lead a debrief. In particular, the bedside or charge nurse should be empowered to initiate the debrief if the physician does not. Once a culture of debriefing is established, all team members will be comfortable and respected when calling for a debrief.

What happens at the debrief?

A debrief should always begin with a statement acknowledging the difficult clinical situation that just occurred, and a reminder that the intent of the debrief is not to point fingers or assign blame, but to review events with the goal for future improvements and identify successes. The importance of confidentiality and the legally protected nature of the conversation should also be made clear.[18,19]

(See chapter Educational Tools and Sample Resources for the CMQCC Maternal Sepsis Debriefing Form).

Using a Debrief Form

A debrief form is useful to guide the discussion. Some forms ask for a clearer review of the clinical steps used, while others focus more on teamwork and communication.[20]

A useful debrief should address both clinical and communication processes and highlight both successes and challenges encountered. A pre-printed paper form is useful because it:

- Guides the conversation.
- Prompts issues to review (can be modified to highlight particular issues at the institution, with blood bank, or medications, etc.).
- Serves as a place to document findings and should be passed along to a perinatal QI Committee or designated physician/nurse reviewer for review so that any solutions that are brainstormed at the time can be considered; major issues can then be explored or implemented.
- Can be used to further measure compliance with the serious infection protocol itself.
- Documents the interdisciplinary communication that occurred around challenges and multidisciplinary solutions, which can be useful for getting buy-in when new processes or QI initiatives are suggested.
- Identifies cases of severe morbidity that require further multidisciplinary review.
- Can be used to track the observed vs. expected number of debriefs as a process measure which further emphasizes the importance the unit places on a culture of safety.

Tracking these events using forms can also be helpful in identifying trends. If the site is utilizing paper forms, it is important to create a standardized workflow for documentation management (i.e., scanning and saving on a secure drive) and compiling the data into a centralized tracker for data analysis on an ongoing basis. Whenever possible, optimize existing technology platforms to centralize data and minimize administrative burden.

Multidisciplinary Case Review

Multidisciplinary case reviews allow clinical team members to identify opportunities for improvement and share systems-learnings that in turn enhance the provision of timely, safe, efficient, effective, equitable and patient-centered care. Case reviews provide opportunities to learn from severe maternal events to improve patient outcomes, mitigate risks, address inequities and enhance clinical decision making. Many facilities have a perinatal quality and safety committee or a perinatal morbidity and mortality review committee which are an ideal forum to review cases and communicate systems-learning to a broad audience. For maternal events, a formal root cause analysis (RCA) or peer review may also be conducted. An RCA or peer review has a separate workflow and purpose. This taskforce strongly recommends casting a wider net than sentinel events for formal case review. The purpose of the case review is to identify systems-wide issues and improve overall patient care.[21] For hospitals participating in CMQCC's Maternal Data Center, there are a myriad of case review tools available to you within the Maternal Data Center interface, including a SMM Case Review form (see chapter Educational Tools and Sample Resources).

How are cases for a multidisciplinary case review identified?

Cases can be identified through the debrief process, facility incident reporting, facility specific data reports that track key clinical data elements, or through a SMM review. The Council on Patient Safety in Women's Health Care and AIM recommend multidisciplinary, systems-focused reviews for sepsis cases.[17]

What is presented during a multidisciplinary case review?

Utilizing the framework of Readiness, Recognition and Response, the key aspects of the case including patient's history and details of the event are presented and discussed. Experts provide information regarding best practices, professional guidelines and expert opinions that were contributing factors in the case. During the review, systems-issues and/or opportunities for improvement are identified and shared to enhance situational awareness and systems-learning. This is also an opportunity to identify if racism and/or implicit bias impacted patient care.

Who should participate in the multidisciplinary case review?

Multidisciplinary case reviews are intended to provide an opportunity for systems-learning and should be open to perinatal clinical team members (i.e., OBs, anesthesiology, RNs, quality, patient safety and risk management, leadership). Whenever possible, ***include a patient and/or family advocate***. Small centers may consider partnering with a regional perinatal center to conduct the review. All case reviews should be conducted by a designated perinatal committee that is supported by leadership, protected from discovery and kept confidential. Teaching facilities should invite residents, fellows and medical students to learn the principles of case review and patient safety.[22] It is highly encouraged that facilities provide ongoing training to staff (OB, RN, resident, medical students) on how to conduct an effective severe maternal case review to identify opportunities for improvement, address system-wide issues and share systems-learnings.

Case review of a patient with a postpartum infection evolving into sepsis.

Let's look at a hypothetical patient: Denise presents in active labor at term in her first pregnancy. After 5 hours, at 7 centimeters dilation she had a cesarean delivery for an active phase arrest. She had a low grade temperature during labor to 37.8C that persisted for the first 24 hours post delivery. On postpartum day 3 she developed chills and became very anxious. However, her temperature was still 37.5C and her pulse was 105 which were assessed to be in the normal range. She was told this was normal postpartum and she was just anxious about taking her newborn home. Just before discharge, she had sweats that drenched her hospital gown but was still afebrile. Her pulse was 112 but it was felt to be related to her anxiety. She was given anti-anxiety medication. She returned 2 days later with a temperature of 39C, pulse of 130 and respiratory rate of 28. Her lactate was 4.2 and her WBC was 28,000. Her uterus was now 4+ tender. Her blood pressure fell to 74/30 and she was admitted to the ICU for septic shock.

There are multiple lessons to take in the postpartum period. To start: (1) 25% of sepsis patients do not have a fever; (2) elevated pulse rate should raise suspicion; (3) symptoms of chills sweats and anxiety are serious and need laboratory evaluation and not dismissal.

Recommendations (Level of Evidence)

1. Debriefs should occur after all major events, including sepsis cases, should involve the team members involved in care and occur shortly after the event. (LEVEL B)
2. Multidisciplinary case reviews occur after the event and are focused on systems-level improvements which can be shared with a wider audience, separate from the peer-review and formal root cause analysis processes. (LEVEL C)
3. Both debrief and case reviews should occur in a safe environment, free from blame and protected from legal discovery in alignment with the concept of a just culture environment. (LEVEL C)
4. Systems-learning acquired from debriefs and multidisciplinary reviews should be acted on, with findings and action steps shared with staff. This creates a culture where debriefing and case reviews are seen as a positive and worthwhile step in quality improvement. (LEVEL C)

Educational Tools and Sample Resources

1. TJC RCA Framework
2. VHA National Center for Patient Safety: Root Cause Analysis
3. National Patient Safety Foundation: RCA2: Improving Root Cause Analyses and Actions to Prevent Harm
4. AIM Severe Maternal Morbidity Form
5. AIM Severe Maternal Morbidity Form CMQCC Severe Maternal Morbidity Case Review PDF Form - Members Only Resource
6. Appendix V: Sample: Maternal Sepsis Debriefing Form

References

1. Duffy, W. Improving patient safety by practicing in a just culture. AORN Journal. 2017;106(1):66-68.
2. Paradiso, L, Sweeney, N. Just culture: It's more than policy. Nursing Management. 2019;50(6):38-45.
3. McQuaid-Hanson, E, Pian-Smith, MC. Huddles and debriefings: Improving communication on labor and delivery. Anesthesiology Clinics. 2017;35(1):59-67.
4. Liberati, EG, Tarrant, C, Willars, J, et al. Seven features of safety in maternity units: A framework based on multisite ethnography and stakeholder consultation. British Medical Journal of Quality and Safety. 2020.
5. Liberati, EG, Tarrant, C, Willars, J, et al. How to be a very safe maternity unit: An ethnographic study. Social Science and Medicine. 2019;223:64-72.
6. Trejo, FE, Igel, CM, Chuang, M, Bajaj, K, Bernstein, PS. Checklists, huddles, and debriefs: Critical tools to improve team performance in obstetrics. Clinical Obstetrics and Gynecology. 2019;62(3):518-527.
7. Morton, CH, Hall, MF, Shaefer, SJM, et al. National partnership for maternal safety: Consensus bundle on support after a severe maternal event. Journal of Obstetric, Gynecologic, and Neonatal Nursing: JOGNN. 2021;50(1):88-101.
8. Slade, P, Balling, K, Sheen, K, et al. Work-related post-traumatic stress symptoms in obstetricians and gynaecologists: Findings from INDIGO, a mixed-methods study with a cross-sectional survey and in-depth interviews. BJOG. 2020;127(5):600-608.
9. Edrees, HH, Morlock, L, Wu, AW. Do hospitals support second victims? Collective insights from patient safety leaders in Maryland. Joint Commission Journal of Quality and Patient Safety. 2017;43(9):471-483.

10. Pratt, S, Kenney, L, Scott, SD, Wu, AW. How to develop a second victim support program: A toolkit for health care organizations. Joint Commission Journal of Quality and Patient Safety. 2012;38(5):235-240, 193.
11. Scott, SD, Hirschinger, LE, Cox, KR, et al. Caring for our own: Deploying a systemwide second victim rapid response team. Joint Commission Journal of Quality and Patient Safety. 2010;36(5):233-240.
12. Joint Commission. Supporting second victims. Quick Safety. 2018;39:1-3.
13. Burlison, JD, Quillivan, RR, Scott, SD, Johnson, S, Hoffman, JM. The effects of the second victim phenomenon on work-related outcomes: Connecting self-reported caregiver distress to turnover intentions and absenteeism. Journal of Patient Safety. 2016.
14. Busch, IM, Moretti, F, Purgato, M, Barbui, C, Wu, AW, Rimondini, M. Psychological and psychosomatic symptoms of second victims of adverse events: A systematic review and meta-analysis. Journal of Patient Safety. 2020;16(2):e61-e74.
15. Quillivan, RR, Burlison, JD, Browne, EK, Scott, SD, Hoffman, JM. Patient safety culture and the second victim phenomenon: Connecting culture to staff distress in nurses. Joint Commission Journal of Quality and Patient Safety. 2016;42(8):377-386.
16. Ullstrom, S, Andreen Sachs, M, Hansson, J, Ovretveit, J, Brommels, M. Suffering in silence: A qualitative study of second victims of adverse events. British Medical Journal of Quality and Safety. 2014;23(4):325-331.
17. AIM Sepsis in Obstetric Care Patient Safety Bundle https://saferbirth.org/wp-content/uploads/U3-FINAL_AIM_Bundle_SOC.pdf
18. Salas E, Klein C, King H, Salisbury M, Augenstein JS, Birnbach DJ, Robinson DW, Upshaw C. Debriefing medical teams: 12 evidence-based best practices and tips. Jt Comm J Qual Patient Saf. 2008 Sep;34(9):518-27. doi: 10.1016/s1553-7250(08)34066-5.
19. Bajaj, K, Meguerdichian, M, Thoma, B, Huang, S, Eppich, W, Cheng, A. The PEARLS healthcare debriefing tool. Acad Med. 2018;93(2):336. doi:10.1097/ACM.0000000000002035
20. American College of Obstetricians and Gynecologists. Obstetric team debriefing form. Maternal Safety Bundles Web site. https://www.who.int/patientsafety/safesurgery/ss_checklist/en/. Published 2019. Accessed 2/18/2021.
21. Kilpatrick, SJ, Berg, C, Bernstein, P, et al. Standardized severe maternal morbidity review: Rationale and process. Journal of Obstetric, Gynecologic, and Neonatal Nursing: JOGNN. 2014;43(4):403-408.
22. Ogunyemi, D, Hage, N, Kim, SK, Friedman, P. A multidisciplinary model for reviewing severe maternal morbidity cases and teaching residents patient safety principles. Joint Commission Journal of Quality and Patient Safety. 2019;45(6):423-430.

Respectful and Supportive Care

This section is designed to aid clinicians, nurse leaders, and quality leads to design systems to support patients after a severe maternal event and engage the community to develop meaningful partnerships for designing and supporting programs to reduce complications from maternal morbidities. Highlights covered include practical patient and clinician resources for supportive care and descriptions of effective partnering experiences in developing the multi-state Maternal Sepsis collaborative.

In this section you will find the following chapters:

- Initiating Healing After a Severe Maternal Event
- Connecting with Community and Patient Advocates

Initiating Healing After a Severe Maternal Event

Kayleigh Summers, LCSW, The Birth Trauma Mama Therapy & Support Services
Melissa E. Bauer, DO, Duke University School of Medicine
Arianna G. Cassidy, MD, University of California, San Francisco
April Chavez, Sepsis Survivor
Elliott K. Main, MD, Stanford University School of Medicine
Ruhi Nath, MPH, Stanford University School of Medicine
Danielle M. Panelli, MD, Stanford University School of Medicine
Christa Sakowski, RN MSN, CMQCC
Maricar A. Tabios, LCSW, University of California, San Francisco

Key Principles

1. Patients who have experienced a severe maternal event will greatly benefit from supportive care.
2. Words matter, review the "Words Not to Say and Why" document.
3. A pre-discharge discussion with the patient and their family describing what happened and what to expect next is an important step in healing.

Background

Why is birth trauma important in the context of Severe Maternal Events?

Birth trauma is any experience related to birth that overwhelms the nervous system's ability to cope. Up to 45% of pregnant patients report feeling traumatized by their birth experience.[1] Research indicates that experiencing an SME increases the risk of developing PTSD as well as other mental health conditions postpartum.[2,3] A patient's expected outcome for their birth often lies in stark contrast to the experience of almost dying, making this reality difficult for most to comprehend. Many patients report leaving the hospital with no clear understanding of the events of their birth, which can lead to further confusion and feelings of isolation, compounding symptoms of trauma.

How can you help mitigate trauma and improve mental health outcomes?

Not all trauma within the context of severe maternal events can be prevented, but it can be mitigated through compassion, acknowledgment, and detailed care discussions. Pre-discharge care discussions play a crucial role in trauma-informed care for patients following a severe maternal event. One of the most common concerns from patients after experiencing a traumatic birth is that they do not fully understand what happened during their birth. Healthcare providers should take the time to meet with patients who have experienced a severe maternal event to ensure a thorough understanding of what occurred, address any questions or concerns, and plan ongoing care. By offering a care discussion,

patients gain a clearer understanding of their treatment and have the opportunity to ask questions. Care discussions not only offer information, but for many patients, they provide a starting point for their physical and emotional healing after an SME.

This discussion, ideally involving familiar faces such as the senior physician, a known nurse, and a social worker, helps initiate the process of closure and provides emotional support. Providers must use clear, empathetic language, avoid assigning blame, and facilitate an open dialogue to support the patient's recovery and future health. This careful approach helps in creating a supportive environment for the patient and her family, ensuring they feel heard and understood, and preparing them for the next steps in their care journey.

The authors who developed these resources represent a multi-disciplinary team with extensive experience supporting patients with severe maternal events. The resources were well received and widely utilized in the recent Improving Diagnosis and Treatment of Obstetric Sepsis Care Collaborative.

Supportive Communication After a Severe Maternal Event: What Not to Say and Why

Your words matter after a severe maternal event. Patients are in an incredibly vulnerable state given what they've just experienced. The words you use and the statements you make have the potential to stick with patients for the rest of their lives, for better or worse. Providers have the power to mitigate further trauma and start patients on the path toward healing after a severe maternal event. (See chapter Educational Tools and Sample Resources for a stand-alone document of this section).

Phrases To Avoid After a Severe Maternal Event:

Instead of: "You almost died, but we were able to save you"

Try: "You were quite sick, but your body is tough and resilient."

Why: No matter how hard the team may have worked, this comment is self-aggrandizing and takes away from the patient's strength and agency which will be needed to the patient to recover.

Instead of: "All that matters is a healthy mom and healthy baby."

Try: "I know this wasn't the birth experience you expected. It's okay to have feelings about that."

Why: A healthy mom and baby matter, but so does the patient's experience of their birth. This statement dismisses any feelings they might be having about almost dying.

Instead of: "I can't believe you're alive" or "You are very lucky to be alive" or "Thank God, you're OK".

Try: Provide a brief overview of what happened to the patient and the interventions used.

Why: After a Severe Maternal Event, most patients feel unsafe in the world. They wonder when the next time the rug will be pulled out from underneath of them, and they will almost die again. When someone on their medical team expresses disbelief at their survival, it further compounds this lack of safety and dismisses the on-going trauma.

Instead of: "Everything happens for a reason."

Try: "This wasn't your fault. Here's what we know about why this may have happened to you."

Why: This phrase is a platitude that attempts to put a positive spin on what is often a devastating experience. It is dismissive of the grief and trauma the patient has experienced.

Instead of: Anything that begins with "at least"

Try: "You've been through a lot. You are probably going to feel many complicated and conflicting emotions. That's normal after an event like this."

Why: The term "at least" uses comparison to dismiss a patient's experience. Something can always be worse, but that doesn't mean it's not traumatic.

Instead of: "You should be so grateful."

Try: "I know this might be scary and a lot to process. What questions can I help you answer?"

Why: There is nothing wrong with expressing gratitude, but forced gratitude is unhelpful, particularly after a severe maternal event. The provider's experience of this event often differs greatly from the patient's. For most patients, they walked into the hospital to have a baby and go home, instead they and/or their baby almost lost their lives. They are likely grateful to be alive, but they also need the space and permission to feel sad, angry, and devastated that this happened to them.

Summary For Why Not To Use These Phrases:

These statements are said with the intention to improve patient outcomes by helping patients move past the experience. Unfortunately, the impact can be the opposite, and these statements often dismiss or minimize a patient's experience. When a patient feels dismissed after trauma, especially by someone in a position of authority, they feel their experience of the birth and the emotions that come with it are not valid. This often leads to ignoring or suppressing emotions and inevitably delaying psychological recovery. When a patient is instead offered validation and empathy, the door is opened to access support and treatment for their experience, leading to better outcomes postpartum and longer term.

Pre-Discharge Care Discussion (aka Patient Debrief)

Following a severe maternal event, many patients (and their families) have little concept of what happened to them. What they recall is often incomplete or even inaccurate. This gap is very unhelpful in processing the event and moving towards healing. Patients also commonly report a sense of abandonment following discharge, not knowing what follow-up care is needed and whom to see. Clearly more communications is required. A term that clinicians are familiar with is a "Debrief" but that was not well understood by patients so we collaboratively settled on a "Care Discussion".

The purpose of the Care Discussion is to review what happened, answer questions, and plan on-going care with the patient and whoever the patient chooses to invite. The discussion would ideally include a senior physician and a nurse known to the patient, and a social worker. Known faces are important for support and starting the process of healing and closure. Timing should be after the patient is fully aware and near to discharge. This is not to replace earlier shorter care updates provided to the patient and family.

There are five parts to a Care Discussion that we call steps, as they occur in a sequence. These are displayed belowand are formatted as a checklist (see chapter Educational Tools and Sample Resources).

Guide For Pre-Discharge Care Discussion

Step 1: Assess Patient Understanding

- ☐ "Now that you have had a few days to process, can you recap in your own words what you understand about what you experienced." "In a moment we will go through your story in detail."
  - Do not stop the patient to correct information
- ☐ "What are your biggest concerns about what happened?

Step 2: Provide an overarching description of the condition

- ☐ Define (in lay terms) the condition that they experienced, including how common
- ☐ Briefly review risk factors and in general the diagnosis and treatment approaches

Step 3: What happened with this specific patient

- ☐ Review in lay terms, how the patient presented and how the diagnosis was made
- ☐ What specific consultations and treatments were made
- ☐ How the patient responded to the treatments
- ☐ If and why they were transferred to a higher level of care (such as an ICU) and what happened there
- ☐ What has happened in the recovery phase
- ☐ Provide the summary document of the key elements of the diagnosis and care for her to share with her follow-up providers (see CMQCC Sepsis Toolkit for an example)
- ☐ Stress that this was not her fault

Step 4: Pause for questions

- ☐ "I have just given you a lot of information
  What questions do you have? What are your concerns going forward?"

Step 5: Review what to expect next

- ☐ Review plans for discharge, including who and when to see for follow up (ideal to identify an "anchor" provider)
  - The Discharge Follow-up Checklist is very useful
  - Early follow-up is almost always required
- ☐ Discuss return precautions and "what to watch for", involving the patient's family and/or those who may be helping support them
  - Emphasize the need for support from providers, family, and others
- ☐ Broadly review how this event may affect future health and future pregnancies, if relevant
- ☐ Emphasize the importance of continuing discussions
- ☐ Give opportunity for more questions

Post-Discharge Care

Following a severe maternal event, a comprehensive approach to postpartum care is indicated. In general, the fist visit should be within the first 1-2 weeks following discharge. Outpatient referrals often include: postpartum support group, social work, lactation consultant (for support or suppression after a major illness or loss). If the patient was cared for in the ICU, Occupational therapy and physical therapy are often indicated. Serial mental health assessments and referrals are needed for up to a year postpartum. Contraception needs may be more complex in the context of a medical condition. A Post-Discharge Care After a Severe Maternal Event checklist is provided in chapter Educational Tools and Sample Resources.

Implementation Tips

We recognize that these tools represent a change in practice. The following are tips to help facilitate adoption. The first step is to share the "Words Not to Say and Why" document. That immediately opens clinicians to understanding the importance and the need for support. Secondly, engage the clinicians caring for the highest-risk patients (generally the MFM physicians) to pilot the "Pre-Discharge Care Discussion (aka Patient Debrief)" so that local logistics can be sorted out. They can then become champions for the process. One additional prepared document that can be locally produced is an invitation to the patient and family explaining what will happen at the session so they can come prepared. These sessions are very rewarding for all involved!

Recommendations (Level of Evidence)

1. The document "Supportive Communication After a Severe Maternal Event: What Not to Say and Why" should be shard among all clinicians (LEVEL C)
2. A "Pre-Discharge Care Discussion (aka Patient Debrief)" should occur in one form or another for all patients who experienced a severe maternal event. (LEVEL C)
3. Post-discharge care for patients with a severe maternal event needs specific planning including outpatient support groups and mental health services. (LEVEL B)

Educational Tools and Sample Resources

1. Appendix X: Importance Of The Pre-Discharge Care Discussion
2. Appendix Y: Supportive Communication After a Severe Maternal Event: What Not to Say and Why
3. Appendix Z: Guide For Pre-Discharge Care Discussion After An SME
4. Appendix AA: Sample Patient Summary Form: Severe Maternal Event
5. Appendix BB: Guide for Post-Discharge Care After an SME
6. Appendix CC: Trauma Care Flow Chart
7. Appendix DD: Life After Experiencing Sepsis
8. Appendix EE: Resources for Severe Maternal Event Survivors
9. Appendix FF: Guide to Recognizing Acute Stress Disorder in the Hospital Setting

References

1. Beck CT, Watson S, Gable RK. Traumatic Childbirth and Its Aftermath: Is There Anything Positive? J Perinat Educ. 2018 Jun;27(3):175-184. doi: 10.1891/1058-1243.27.3.175.
2. Lewkowitz AK, Rosenbloom JI, Keller M, López JD, Macones GA, Olsen MA, Cahill AG. Association Between Severe Maternal Morbidity and Psychiatric Illness Within 1 Year of Hospital Discharge After Delivery. Obstet Gynecol. 2019 Oct;134(4):695-707. doi:10.1097/AOG.0000000000003434.
3. Duval CJ, Youssefzadeh AC, Sweeney HE, McGough AM, Mandelbaum RS, Ouzounian JG, Matsuo K. Association of severe maternal morbidity and post-traumatic stress disorder. AJOG Glob Rep. 2022 Sep 28;2(4):100111. doi: 10.1016/j.xagr.2022.100111. Connecting with Community and Patient Advocates

Connecting with Community and Patient Advocates

Kendra Smith, PhD, MPH, Smith Research and Consulting LLC
Lindsay du Plessis, DrPH, MPH, CMQCC
Leah Bahrencu, CPT, PN1 Certified Patient Family Partner, MoMMAs Voices
April Chavez, MA, Certified Patient Family Partner, MoMMAs Voices
Sara McMannus, RN, BSN, MBA Sepsis Alliance
Gwendolyn Norman, PhD, Wayne State University School of Medicine

Key Principles

1. Patient and community engagement is a key step not only for improving immediate outcomes but for sustaining long term improvement.
2. Engagement of community leaders and patient advocates are essential for success, and they should be compensated for their time.
3. Power barriers are present throughout healthcare and should be addressed openly.
4. Regular feedback from patients is an important part of medical care and quality improvement.

Introduction

Engaging community and patient advocates in sepsis care is not only about improving clinical outcomes but also about ensuring that the care provided is culturally competent and deeply rooted in the communities served. Hospitals are best served by partnering with patients and community groups to create protocols that are patient centered; to create and review patient educational materials, and to disseminate education in their communities. By acknowledging the cultural constructions of risk, amplifying the voices of those with lived experience, ensuring fair compensation, and promoting ongoing feedback, we have the opportunity to build a more just healthcare system that reduces disparities and empowers communities to take an active role in patient care. It is for these reasons that the Institute of Healthcare Improvement (IHI) strongly recommends including patients and community members in the development of the sepsis change package and related implementation tools.

Involving community leaders and patient advocates in a sepsis improvement project is considered a best practice and acts as a crucial driver of empowerment. This participation invites individuals and communities to actively engage in their healthcare, make informed choices, express their needs, and influence delivery of care. Participation fosters a sense of ownership and agency, turning healthcare interactions into collaborative, patient-centered experiences. When advocates and community members collaborate from the outset, it creates opportunities to understand and address how cultural

factors shape health decisions and behaviors, resulting in more effective interventions. Acknowledging that risk is constructed within cultural contexts, it is vital that the language and activities designed to tackle sepsis risk are crafted with an awareness of how these risks are perceived and acted upon in various cultural settings. This collaborative approach guarantees that messaging and care practices are suitable, relevant, and resonate with the diverse communities served.[1] In addition, these partnerships aid dissemination of education in the local community and can lead to better patient outcomes since at least half of obstetric sepsis cases occur outside of the hospital.

Process

At the onset of an intervention project, it's crucial to gather community leaders, patient advocates, and individuals with lived experience to collaboratively design sepsis care initiatives. The input from these groups is both uniquely valuable and essential for success. Community leaders and advocates often provide a depth of understanding derived from their personal experiences and their ties to the broader community. Their perspectives ensure that care strategies are not only clinically sound but also culturally relevant and sensitive to the needs of those most affected by sepsis.[2] By amplifying the voices of patients and advocates, care models can better reflect the values and priorities of the community.

A critical part of this process is ensuring that all patient advocates and community representatives are fairly compensated for their time and expertise. Compensation should be equal and designed to avoid any structural barriers to participation, particularly for individuals from marginalized communities. This promotes an inclusive environment where all voices are valued and ensures that participation is accessible to everyone, regardless of socioeconomic status.[3] Fair compensation also reinforces the importance of their contributions and acknowledges the value they bring to the process.

Through ongoing engagement with patients and community advocates, it is essential to monitor progress and gather regular feedback on what works and what doesn't. This feedback loop fosters an environment for open dialogue and continuous improvement, allowing advocates and community members to share their thoughts, provide suggestions, and address any challenges. This collaborative approach enables real-time adjustments to care practices, ensuring that interventions are both effective and consistently aligned with the community's needs.[4]

Recognition of Power Barriers

Research on maternal health has shown that pregnant individuals routinely feel ignored. This issue has also been chronicled in video documentaries such as No Woman, No Cry and Aftershock as highlighted in Every Mother Counts.[5] These challenges significantly impact birthing individuals of color, exacerbated by racism and racist stereotypes that contribute to inequitable care.[6,7,8] In a recent study examining barriers to sepsis care, patients who have endured severe cases of sepsis report feeling ignored and unheard when they communicated their symptoms, leading to their concerns being dismissed.[9]

Power barriers can emerge in patient-provider communication due to the significant power imbalance between healthcare professionals and patients. The authority of healthcare professionals arises from their medical expertise and status in the healthcare setting. Moreover, the social characteristics of individual healthcare providers, such as gender, cultural background, race, education, and economic status, can further bolster their power in a clinical environment. In contrast, patients typically hold

limited power within the clinical context. They often lack medical knowledge and authority, and, depending on the individual, may face restricted autonomy in their decision-making due to fear, illness, and insufficient time and information to make informed choices.

There are several ways to address power barriers. Chief among them is reviewing and tackling bias, unconscious bias, and racism, and understanding how these factors contribute to inequitable and disrespectful care. Additionally, it is crucial to listen to patients to comprehend what they are saying and experiencing. Often, patients remember feeling dismissed and being denied care. When patients ask questions or request more information, it is essential to facilitate conversations that help them understand the recommendations for their care.

When patients feel unheard and express their dissatisfaction, healthcare professionals must adopt effective coping strategies for these complaints. Advocacy Tips for Patients (see chapter Educational Tools and Sample Resources) is a document on patient advocacy language intended for patients to utilize when they feel dismissed and overlooked. As a provider, it is essential to review this document and sincerely examine your thoughts and emotions when faced with this type of language. Listening tips for clinicians are provided in Appendix A and Appendix X (see chapter Educational Tools and Sample Resources). Furthermore, consider how your reaction to this language and existing power dynamics may affect the course of patient care.

Following Up

After experiencing sepsis, returning to normalcy can be uncertain for both the patient and their family. It is critical to be transparent with patients about the short-term changes they will face and provide resources to help manage those changes. Acknowledging the severity of their episode and the need for healing time is essential. Holding a debrief with the patient once they start to feel better can be helpful for discussing their experience and aftercare recommendations. This could also serve as a valuable opportunity to ask for feedback from the patient and their support person(s). Additionally, offering resources like those listed below can facilitate the patient's recovery.

Recommendations (Level of Evidence)

1. During the design of a QI project patient and community advocates should be actively engaged as partners. (LEVEL C)
2. Community and patient partners should be adequately compensated for their time. (LEVEL B)
3. An assessment of power barriers should be tested on a regular basis with partners. (LEVEL C)
4. A process for patient feedback should be established. (LEVEL C)

Educational tools and Sample Resources

1. Appendix B: Advocacy Tips for Patients and Families (English)
2. Appendix C: Advocacy Tips for Patients and Families (Spanish)
3. Sepsis Alliance Advocacy Training: Maternal Sepsis: Raising Awareness to Save Lives Recorded Webinar
4. MoMMA's Voices Training Programs for Patients and Providers

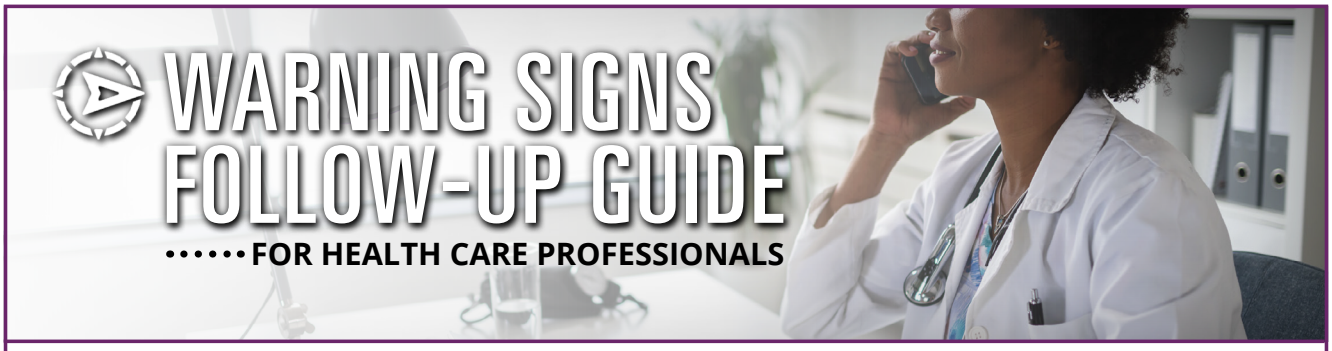
References

1. Thomas TW, Hooker SA, Schmittdiel JA. Principles for Stakeholder Engagement in Observational Health Research. JAMA Health Forum. 2024;5(3):e240114. doi:10.1001/jamahealthforum.2024.0114
2. Smith KL, Main E, Bauer ME; Maternal Sepsis Community Leadership Board. Moving from Principle to Practice: A Researcher's Guide to Co-Leading Engaged Research with Community Partners and Patients with Lived Experience to Reduce Maternal Mortality and Morbidity for Maternal Sepsis. Matern Child Health J. 2024;28(8):1315-1323. doi:10.1007/s10995-024-03954-y
3. Williams DR, Jackson PB. Social sources of racial disparities in health. Health Aff (Millwood). 2005 Mar-Apr;24(2):325-34. doi: 10.1377/hlthaff.24.2.325.
4. Jackson, K. T. ., Burgess, S. ., Toms, F. ., & Cuthbertson, E. L. . (2018). Community Engagement: Using Feedback Loops to Empower Residents and Influence Systemic Change in Culturally Diverse Communities. Global Journal of Community Psychology Practice, 9(2). https://doi.org/10.17161/gjcpp.v9i2.20713
5. Baumont MS, Dekker CS, Rabinovitch Blecker N, Turlington Burns C, Strauss NE. Every Mother Counts: listening to mothers to transform maternity care. Am J Obstet Gynecol. 2023 May;228(5S):S954-S964. doi: 10.1016/j.ajog.2022.12.306.
6. Chambers BD, Taylor B, Nelson T, Harrison J, Bell A, O'Leary A, Arega HA, Hashemi S, McKenzie-Sampson S, Scott KA, Raine-Bennett T, Jackson AV, Kuppermann M, McLemore MR. Clinicians' Perspectives on Racism and Black Women's Maternal Health. Womens Health Rep (New Rochelle). 2022 May 4;3(1):476-482. doi: 10.1089/whr.2021.0148.
7. Altman MR, McLemore MR, Oseguera T, Lyndon A, Franck LS. Listening to Women: Recommendations from Women of Color to Improve Experiences in Pregnancy and Birth Care. J Midwifery Womens Health. 2020 Jul;65(4):466-473. doi: 10.1111/jmwh.13102.
8. Smith KL, Shipchandler F, Kudumu M, Davies-Balch S, Leonard SA. "Ignored and Invisible": Perspectives from Black Women, Clinicians, and Community-Based Organizations for Reducing Preterm Birth. Matern Child Health J. 2022 Apr;26(4):726-735. doi: 10.1007/s10995-021-03367-1.
9. Bauer ME, Perez SL, Main EK, Norman GS, Fish LJ, Caldwell MA, Allen C, Hughes BL, Gibbs RS, Smith KL. Near-miss and maternal sepsis mortality: A qualitative study of survivors and support persons. Eur J Obstet Gynecol Reprod Biol. 2024 Aug;299:136-142. doi: 10.1016/j.ejogrb.2024.05.038.

Appendices

- Appendix A: Warning Signs Follow-Up Guide For Health Care Professionals
- Appendix B: Advocacy Tips For Patients And Families (English)
- Appendix C: Advocacy Tips For Patients And Families (Spanish)
- Appendix D: Obstetric Serious Infection/Sepsis Evaluation Flow Chart
- Appendix E: Teaching Points For Obstetric Serious Infection/Sepsis Evaluation Flow Chart
- Appendix F: Sample: HOAG Obstetric Serious Infection Care Pathway
- Appendix G: The Importance Of Taking A Respiratory Rate
- Appendix H: How To Take An Oral Temperature Measurement
- Appendix I: Collecting A Urine Specimen From A Foley Catheter
- Appendix J: Sample: LLU Sepsis Decision Flowchart
- Appendix K: Sample: LLU Nursing Standard Order Set
- Appendix L: Antibiotic Considerations for Sepsis of Unknown Source or Septic Shock
- Appendix M: Antibiotic Considerations for Serious Infections by Source in Obstetric Patients
- Appendix N: Lactation Safety of Antimicrobials Used for Treatment of Sepsis
- Appendix O: Antibiotic IV Compatibility Chart for Use in Co-Administration of Antibiotics in Initial Management of Severe Infections & Sepsis
- Appendix P: Sample: Miller Sepsis/Chorio Order Sets
- Appendix Q: Empiric Antibiotics for Chorioamnionitis/Endomyometritis
- Appendix R: Medications for Management of Allergy-related Reactions
- Appendix S: Beta-lactam Allergy Pathway
- Appendix T: Example Flow Chart For Prophylactic Antibiotics At Cesarean Delivery
- Appendix U: Comparison Of Sep-1 To CMQCC Criteria
- Appendix V: Sample: Maternal Sepsis Debriefing Form
- Appendix W: Sample: UC Davis Health Maternal Sepsis Drill Scenario
- Appendix X: Importance Of The Pre-Discharge Care Discussion
- Appendix Y: Supportive Communication After a Severe Maternal Event: What Not to Say and Why
- Appendix Z: Guide For Pre-Discharge Care Discussion After An SME
- Appendix AA: Sample: Patient Summary Form: Severe Maternal Event
- Appendix BB: Guide For Post-Discharge Care After An SME
- Appendix CC: Trauma Care Flow Chart
- Appendix DD: Life After Experiencing Sepsis
- Appendix EE: Resources For Severe Maternal Event Survivors
- Appendix FF: Guide To Recognizing Acute Stress Disorder In The Hospital Setting
- Appendix GG: Stop Sign Graphic

Appendix A



WARNING SIGNS FOLLOW-UP GUIDE

FOR HEALTH CARE PROFESSIONALS

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.

CMQCC California Maternal Quality Care Collaborative

MI AIM MICHIGAN ALLIANCE FOR INNOVATION ON MATERNAL HEALTH

Stanford MEDICINE Dunlevie Maternal-Fetal Medicine Center for Discovery, Innovation and Clinical Impact

Disclaimer: The information provided on the MI AIM site is for educational purposes only, and does not substitute for professional medical advice.

Appendix B

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.

CMQCC California Maternal Quality Care Collaborative

MI AIM MICHIGAN ALLIANCE FOR INNOVATION ON MATERNAL HEALTH

Stanford MEDICINE Dunlevie Maternal-Fetal Medicine Center for Discovery, Innovation and Clinical Impact

**Disclaimer: The information provided on the MI AIM site is for educational purposes only, and does not substitute for professional medical advice.*

Appendix C (Spanish)

EJEMPLOS DE LENGUAJE DE ABOGACÍA

Usted tiene derecho legal a que se le proporcione un traductor que hable español para comunicarse con el equipo de atención médica. Solicite un traductor para que se entiendan sus inquietudes y pueda comprender lo que le dicen.

- Estoy muy preocupada y siento que no me están escuchando. ¿Cuáles son mis próximos pasos u alternativas?
- Esto es realmente diferente para mí. Nunca me he sentido así en mi vida. Para mi beneficio y el de mi familia, debería ser atendida.
- Entiendo que algunos de estos síntomas pueden ser normales durante el embarazo o el tiempo posparto, pero estoy muy preocupada y necesito que me evalúen.
- He llamado varias veces y probado las sugerencias que me han brindado, pero no siento que estoy mejorando.
- ¿Podría referirme a alguien que pueda ayudarme? Estoy realmente preocupada.
- Mi médico me dijo que llamara si tengo X, Y o Z. Tengo X, Y o Z. Me gustaría ser vista.
- Quiero hablar con otra persona para asegurarme que no tengo una condición grave. ¿Puede referirme a alguien que me pueda ayudar? Estoy realmente preocupada.
- No me siento bien, estoy preocupada que me esté pasando algo malo.

CONSEJOS PARA LA ABOGACÍA

- Sus inquietudes y sentimientos son válidos, sea persistente en obtener las respuestas o la atención que necesita.
- Si tiene una emergencia médica, llame al 911 o vaya a la sala de emergencias más cercana.
- Pida hablar con la enfermera a cargo o con el representante de relaciones con el paciente si no la escuchan.
- Si no obtiene la respuesta que necesita, puede acudir al triaje de enfermería en la sala de partos o a la sala de emergencias. No necesita permiso de nadie para hacerlo.
- También puede ir a otro hospital o centro de atención de urgencia si no recibe la atención que necesita.
- Considere la posibilidad de que otra persona la acompañe para ayudar a defenderla (persona de apoyo, familiar, doula, etc.)
- Traiga una lista de las inquietudes que le gustaría que se atiendan.
- Comience su preocupación con el efecto que usted está teniendo, por ejemplo: "Estoy tan cansada que no puedo levantarme de la cama;" "Tengo tanto dolor que no puedo dormir," etc.

CMQCC California Maternal Quality Care Collaborative

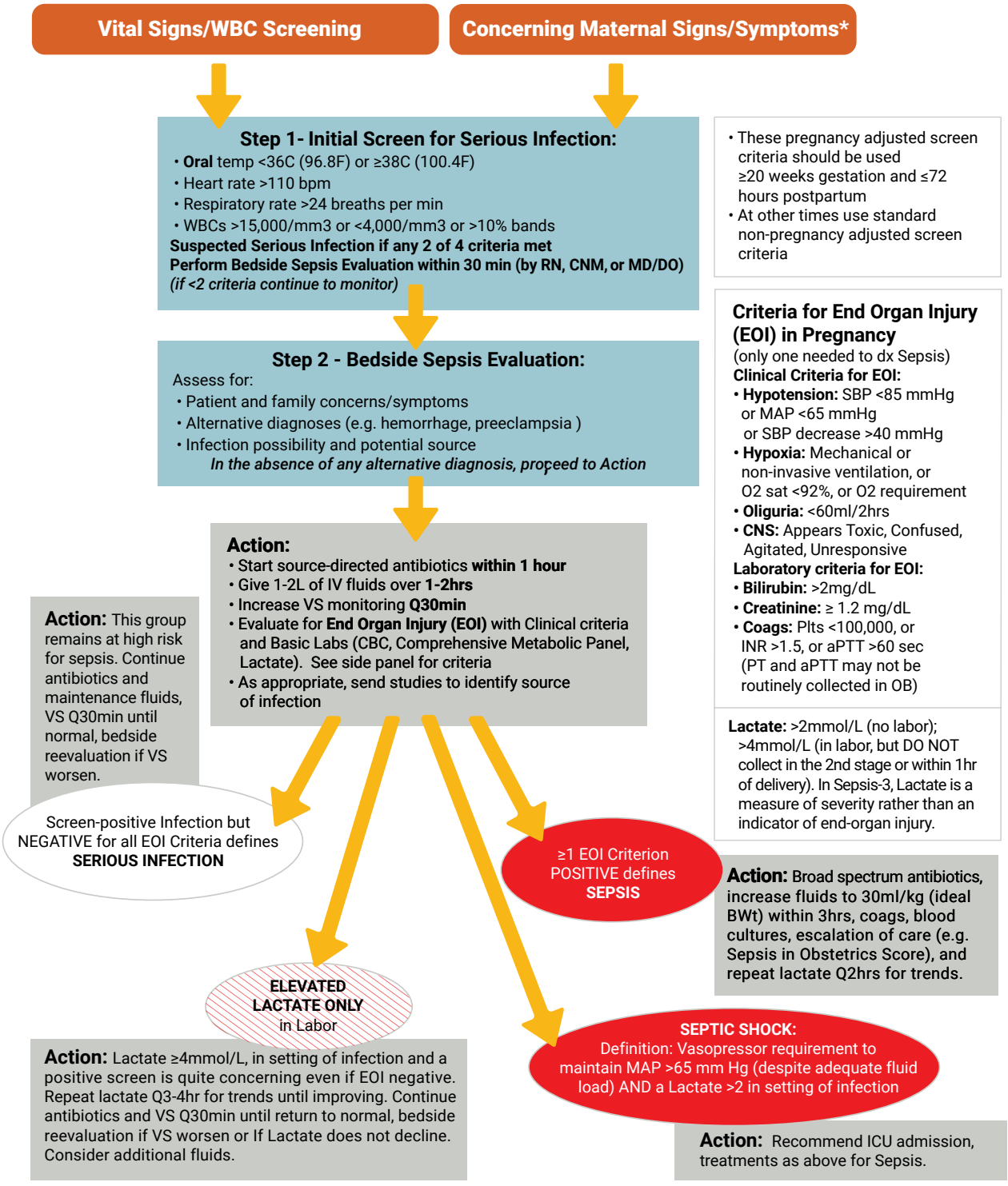
MI AIM MICHIGAN ALLIANCE FOR INNOVATION ON MATERNAL HEALTH

Stanford MEDICINE Dunlevie Maternal-Fetal Medicine Center for Discovery, Innovation and Clinical Impact

**Descargo de responsabilidad: La información proporcionada en los sitios MI AIM y CMQCC tiene fines educativos únicamente y no sustituye el asesoramiento médico profesional.*

Appendix D

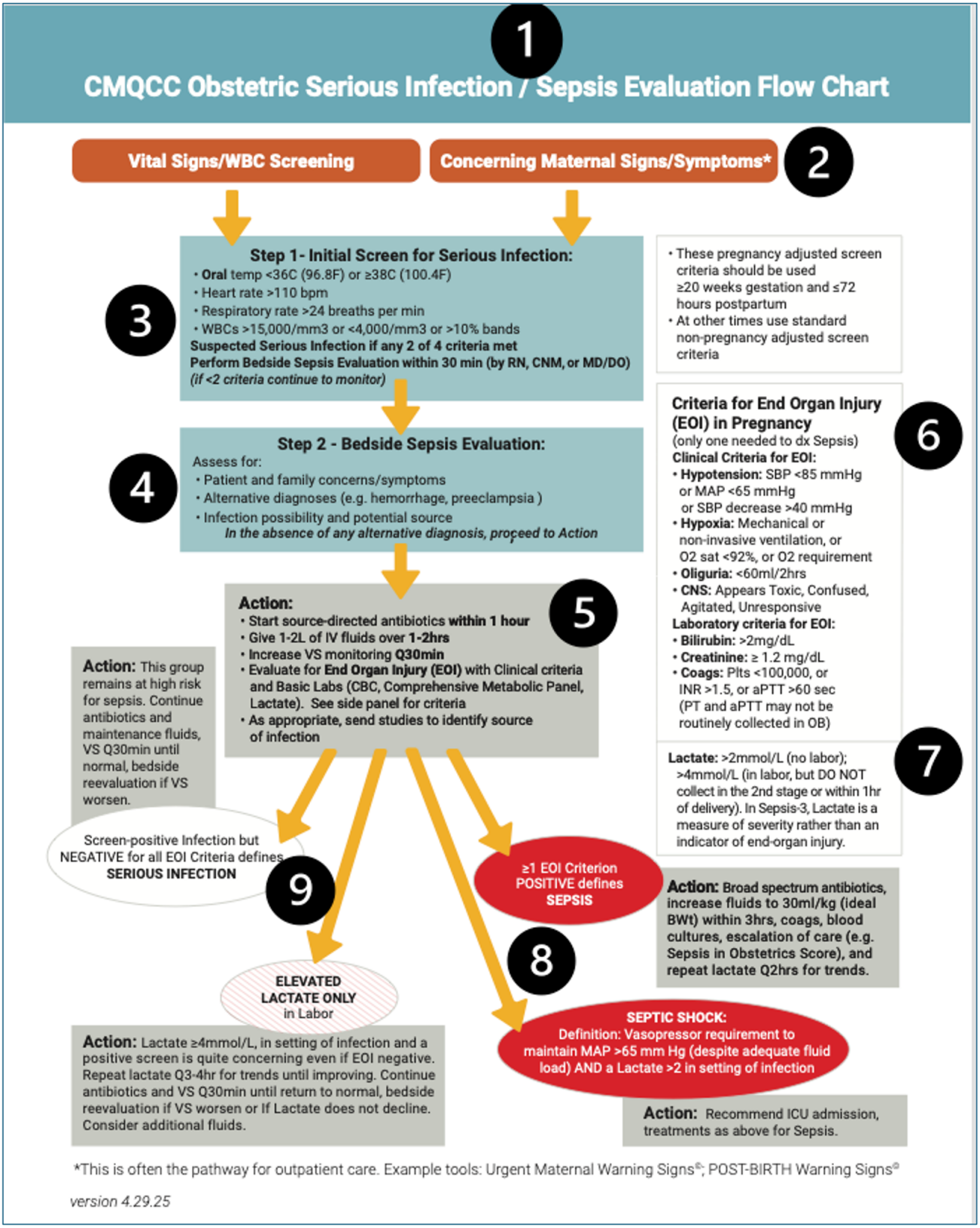
CMQCC Obstetric Serious Infection / Sepsis Evaluation Flow Chart



*This is often the pathway for outpatient care. Example tools: Urgent Maternal Warning Signs©; POST-BIRTH Warning Signs©

version 4.29.25

Appendix E: Teaching Points For Obstetric Serious Infection/Sepsis Evaluation Flow Chart



Appendix E: Teaching Points For Obstetric Serious Infection/Sepsis Evaluation Flow Chart (Continued)

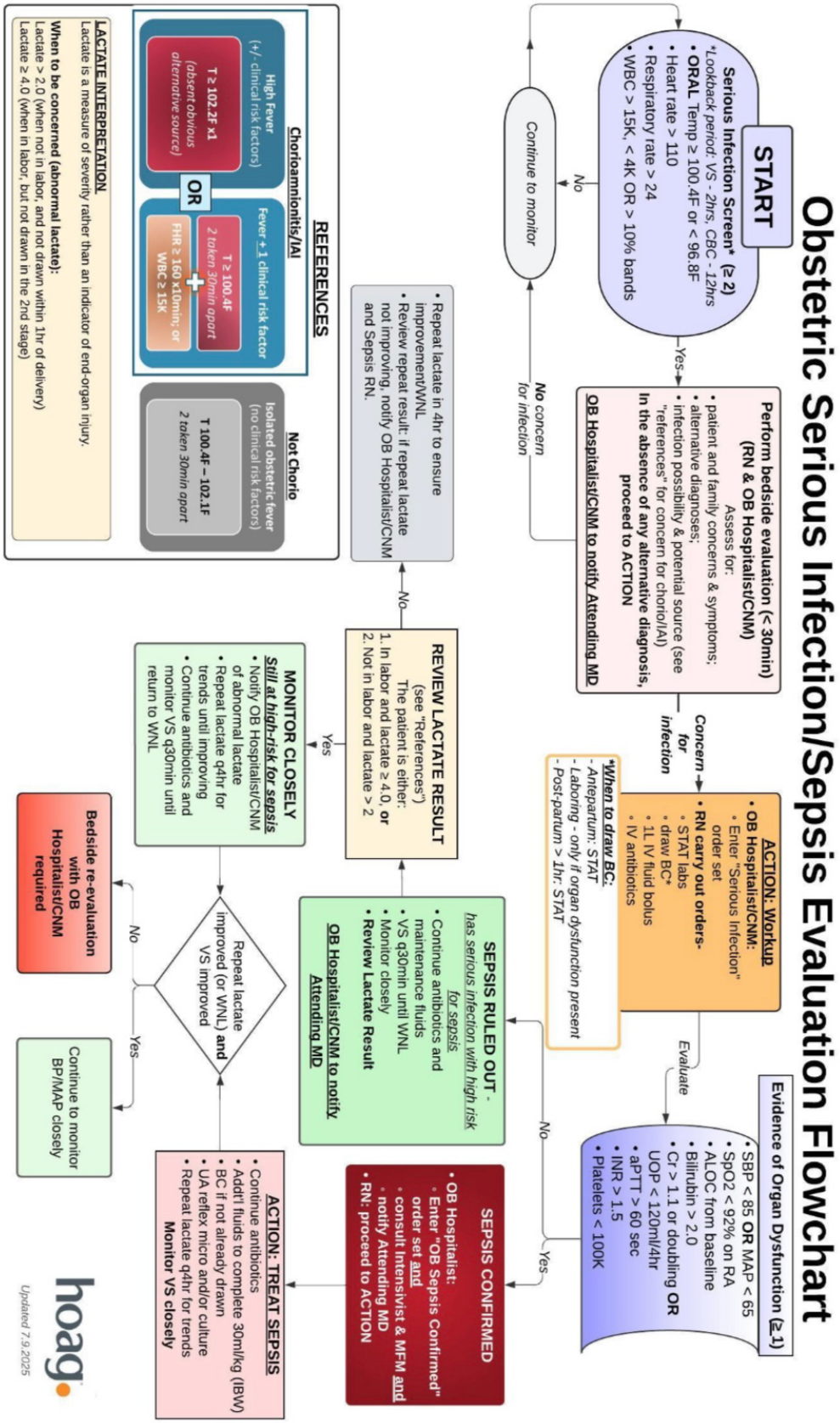
Teaching Points for the CMQCC Serious Infection / Sepsis Evaluation Flow Chart

1. It is imperative to stress that this is a screening system first for Serious Infections and then secondarily for Sepsis. Both diagnoses have important therapeutic considerations. Language used in charting is very important, do not use terms like "r/o sepsis" or even "sepsis" unless end-organ injury is present.
2. Half of obstetric sepsis cases (which includes antepartum, intrapartum, and postpartum timeframes) present as outpatients and symptoms may be non-specific such as increased pain in abdomen or incisional pain (abdomen or perineum), extreme tiredness, confusion/anxiety, difficulty breathing or chills/sweats. Fever is an important sign, but fever is missing in a quarter of obstetric sepsis cases.
3. To trigger the initial screen, pulse rate > 110 and/or respiratory rate needs to be sustained for at least 15-20 minutes whereas temperature elevations need to be within 2 hours of other abnormal values. Temperature MUST BE oral. The WBC should be within last 24 hours. Hypotension that doesn't respond to 30ml/kg fluid bolus in the presence of infection moves the focus straight to the sepsis/ septic shock pathway.
4. The Bedside Evaluation is the most important step in the diagnostic pathway. All cases with sustained abnormal vital signs should be evaluated to confirm the presence of infection, exclude other diagnoses and assess for end organ injury signs and laboratory findings. Please share the Bedside Evaluation chapter from the CMQCC Sepsis Toolkit.
5. Patients with any infection and abnormal vital signs require extra fluids. Those who also have preeclampsia will need individual evaluation of fluid status.
6. The current criteria for sepsis end-organ injury are listed. Patients with abnormal vital signs and abnormal clinical criteria that don't quite meet those for end-organ injury (e.g. O2 saturation less than 95, or creatinine greater than 0.8,or borderline BP) should be carefully watched as these may be early signs of severity and need for intervention, prior to officially meeting criteria for end organ dysfunction.
7. The use of lactic acid raises many questions that are partly addressed here and in the action arm. Also review the section in the Diagnosis chapter in the Sepsis Toolkit. Key education regarding Lactic acid should be focused on indication of disease severity and fluid status, and no longer criteria for sepsis.
8. Once the diagnosis of Sepsis or Septic Shock is made, engagement of the hospital sepsis team is advised and evaluation for escalation of care using tools such as the Sepsis in Obstetrics Score.
9. Patients with serious infections (infection with significant abnormal vital signs) but without end-organ injuries need careful continuous monitoring and treatment with fluids and antibiotics at minimum, with time goals for administration of fluids and antibiotics with in 60 minutes of suspected infection diagnosis. Delays in antibiotic administration are directly associated with increasing mortality.
10. An important consideration is the need for and timing of blood culture collection. Blood cultures should be considered when a patient has a serious infection. However, blood cultures may be delayed until a diagnosis of sepsis is made or when patient has end organ injury. In cases of Chorioamnionitis, blood cultures are only recommended if there is a progression to sepsis or septic shock.

Appendix F: Sample: HOAG Obstetric Serious Infection Care Pathway

Note: This is a SAMPLE developed for a particular facility as an example to work from. You may need to adjust based on the individual circumstances of your facility.

Do not forget to document the event: .OBRNinfectioneval



Appendix G: The Importance Of Taking A Respiratory Rate

The respiratory rate (RR) is a vital sign, but is frequently omitted, inaccurately measured or not recorded.[1] Respiration measurements are not viewed as a priority possibly due to automation and may not be routinely available on labor and delivery units.[2] Most vital signs are done with automatic machines, whereas there is no technology for respiratory monitoring and measurements must be manually recorded into the electronic medical record.

Semler et al. (2013) found a significant difference between actual RR and the one that was recorded.[3] Out of 368 recordings, 72% indicated 18 or 20 breaths per minute whereas only 13% were within that range. In another study of 211 postoperative patients, 15% of the RR were not documented.[4]

When counting the RR, patients may alter their breathing when they know they are being watched.[2] Techniques to assist in obtaining an accurate RR include discreetly counting respirations while checking the radial pulse. Assessment of respirations should include observing a full cycle of breath for 30-60 seconds.

A small change of the patient's normal RR of 3-5 breaths per minute could be an early sign of deterioration.[5] Therefore, a RR outside of the normal range should be monitored closely. Monitoring and recording of the RR should be part of the patient's assessment. It must be interpreted in the clinical context of the patient's presentation as well as other aspects of respiration including depth, pattern, and effort of breathing. For patients with possible sepsis, the accurate documentation of the RR is crucial, as the body will increase the RR in an attempt to maintain oxygen delivery to the tissues.

References:

1. Kelly C. Why accurate measurement and recording are crucial. 2018 Nus Times 114:4, 23-24.
2. Elliott M. Why is respiratory rate the neglected vital sign? A narrative review. Int Arch Nurs Health Care 2-16 2:050:1-4.
3. Semler M, Stover DG, Copland AP, et al. Flash mob research: a single day, multicenter, resident-directed study of respiratory rate. 2013 Chest June;143(6):1740-1744.
4. McGain F, Cretikos MA, Jones D, et al. Documentation of clinical review and vital signs after major surgery. Med J Aust 2008 Oct;6;189(7):380-383.
5. Dougherty and Lister. The Royal Marsden Manual of Clinical Nursing Procedures. Oxford: Wiley-Blackwell) 2015.

Appendix H: How To Take An Oral Temperature Measurement

Failure to obtain an accurate temperature can result in improper treatment. The validity of temperature comparisons is greatest when the thermometer type and measurement location are consistent. Caution should be taken when identifying trends or comparing temperatures obtained using different methods.

The purpose of measuring body temperature is to obtain a representative average temperature of core body tissues. Although no individual peripheral site correlates exactly with core temperature, a site near a major artery gives the most accurate measurement. Sites reflecting core temperature (e.g. rectum, tympanic membrane, esophagus, pulmonary artery, and urinary bladder) are more reliable indicators of body temperature than sites reflecting surface temperature (e.g. skin, oral cavity, and axilla) Rectal temperature measurement is thought to reflect core body temperature most closely. However, since rectal temperatures are not routinely performed on adult patients, the oral site is the preferred consistent location. For oral temperatures, the sublingual pocket in the mouth is close to the sublingual artery. The probe should be placed under the tongue in the posterior sublingual pocket lateral to the center of the lower jaw. The normal range for oral temperature is 36.2°C - 37.7°C (97.2°F - 99.9°F).

Procedure

1. Introduce yourself to the patient and verify the correct patient using two identifiers.
2. Determine the previous baseline temperature and measurement site from the patient's record.
3. Assess the patient for signs and symptoms of temperature alteration.
4. Wait 20 to 30 minutes after the patient smokes, eats, or drinks a hot or cold liquid. Consider delaying temperature assessment for one hour after delivery or any strenuous activity.
5. Obtain an oral thermometer device. If the patient is on isolation precautions, use a disposable thermometer.
6. Perform hand hygiene and wear gloves.
7. Explain the procedure to the patient and obtain verbal consent.
8. Remove the oral thermometer probe from the electronic thermometer housing unit. Grasp the top of the probe stem, being careful not to apply pressure on the ejection button. Slide the disposable cover over the temperature probe until it locks in place.
9. Ask the patient to open his or her mouth. Gently place the temperature probe under the tongue in the posterior sublingual pocket lateral to the center of the lower jaw.
10. Instruct the patient to hold the temperature probe with lips closed.
11. Leave the temperature probe in place until an audible tone indicates completion and the patient's temperature reading appears on the digital display. Remove the probe from under the patient's tongue.
12. Push the ejection button on the temperature probe to discard the probe cover into the proper trash receptacle.

Appendix H: How To Take An Oral Temperature Measurement (Continued)

13. Wipe the probe with approved cleaner, paying attention to ridges where the probe stem connects to the top. Avoid touching the probe cover to reduce the transmission of microorganisms.
14. Insert the temperature probe back into the housing unit.
15. Disinfect the thermometer with approved equipment cleaner.
16. Discard supplies, remove gloves, and perform hand hygiene.
17. Inform the patient of the temperature reading, if appropriate.
18. Return the thermometer to its assigned storage space.
19. Report abnormal findings to the provider.
20. Document the procedure in the electronic health record.

For illustration and other information, please see *Clinical nursing skills & techniques* by Perry, A.G., Potter, P.A., & Ostendorf, W. (2018). St. Louis, MO: Elsevier

Appendix I: Collecting A Urine Specimen From A Foley Catheter

Permission to use and adapt from Shepherd E (2017) Specimen collection 2: obtaining a catheter specimen of urine. Nursing Times 113 8:20-21. https://www.nursingtimes.net/clinical-archive/assessment-skills/specimen-collection-2-obtaining-a-catheter-specimen-of-urine-10-07-2017/

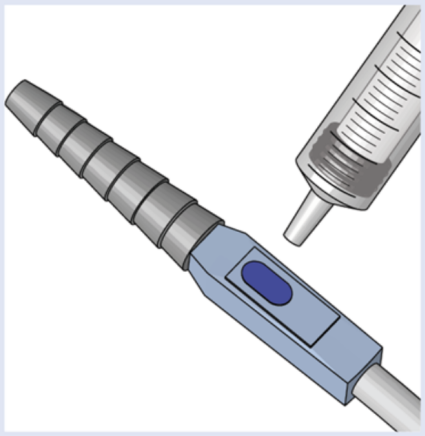
Indwelling urinary catheters are attached to a drainage bag to create a closed system. Breaking this closed system by disconnecting the catheter from the drainage device can increase the risk of a patient developing a catheter-associated urinary tract infection (CAUTI). Samples should not be collected from the drainage bag, as the specimen may be contaminated. Ideally, samples should be collected before antibiotics are administered as they may affect the laboratory result. A catheter specimen must be obtained from the sampling port on the catheter bag. Sampling ports are designed to be accessed directly using a Luer Lock syringe and do not require a needle.

Equipment
- Personal protective equipment (i.e. gloves)
- Sterile 10ml Luer Lock syringe
- Non-traumatic clamp (if catheter does not have a slide clamp)
- Sterile specimen container
- Prep wipes

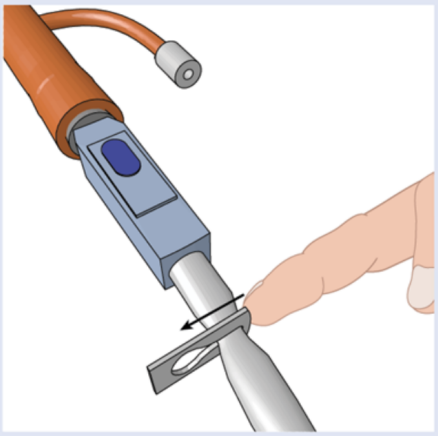
Procedure
(See Figure 1 below)
1. Introduce yourself to the patient and verify the correct patient using two identifiers.
2. Explain the procedure to the patient and gain informed consent to obtain the specimen. Explain why the specimen is being collected, when the results will be available, and implications for treatment.
3. Ensure the patient is comfortable and that privacy and dignity is maintained throughout the procedure.
4. Wash your hands, prepare equipment, and apply personal protective equipment.
5. If taking a specimen from a sampling port (Fig 1a), check first whether there is urine in the catheter tubing. If the tubing is empty, apply a clamp approximately 3 inches below the level of the sampling port (Fig 1b). This allows urine to collect above the clamp so that a sample can be obtained.
6. Clean the sampling port with a prep wipe according to policy and allow to dry (Fig 1c).
7. Stabilize the tubing by holding it below the level of the sampling port.
8. Insert the syringe tip into the sampling port (following manufacturer's instructions) (Fig 1d). Be careful to protect the sterile syringe tip and disinfected sampling port from contamination.
9. Aspirate at least 10 mL of urine and disconnect the syringe.
10. Put the urine into a sterile specimen container, avoiding contact between the syringe and the cup (Fig 1e). Ensure the top of the specimen container is secured to prevent leakage and contamination of the specimen.
11. Wipe the sampling port with a prep swab and allow it to dry. This reduces the risk of cross infection and contamination.
12. If a clamp was used, release it to allow urine to drain freely. Failure to do this will cause the bladder to fill and can result in discomfort.
13. Remove and dispose of personal protective equipment, and perform hand hygiene.
14. Label the specimen and place in a specimen bag following policy.
15. Send the sample to the laboratory immediately or refrigerate until it can be transported to ensure accurate results are obtained.
16. Document the date and time the sample was collected.

Appendix I: Collecting A Urine Specimen From A Foley Catheter (Continued)

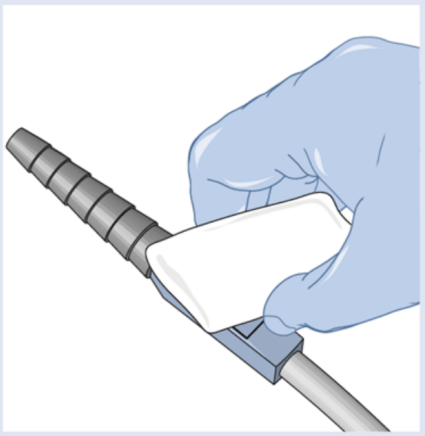
Fig 1. **Collecting a catheter specimen of urine**



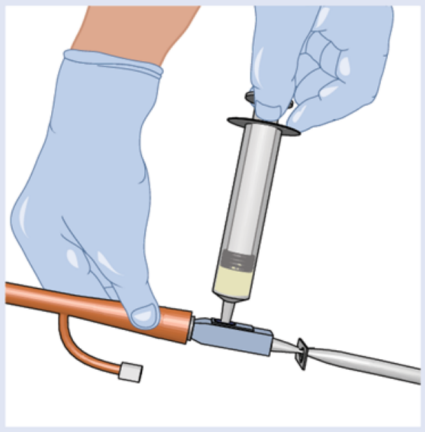
1a. A sampling port can be found on the tubing of the catheter drainage bag – urine should only be obtained from this point.



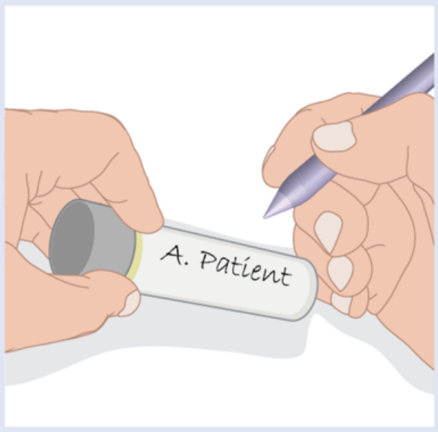
1b. Clamp the catheter below the port so that urine can collect above it in the tubing. Some catheter bags have an integral clamp.



1c. Swab the sampling port with an alcohol-impregnated swab following local policy to reduce the risk of cross infection and contamination of the specimen.



1d. Insert the syringe tip into the sampling port and withdraw the urine following manufacturer's instructions.



1e. Place sample in the specimen pot, avoiding contact with the syringe. Secure top to prevent leakage and contamination, then label, place in a specimen bag and seal.

1f. If the sample is taken from a catheter valve, the valve must be cleaned with an alcohol-impregnated swab first to reduce the risk of cross infection.

Appendix I: Collecting A Urine Specimen From A Foley Catheter (Continued)

References:

1. Brekle B. (2014) Specimen collection - microbiology and virology.

2. Dougherty L, Lister S. (2015) The Royal Marsden Hospital Manual of Clinical Nursing Procedures. Oxford: Wiley-Blackwell.

3. Loveday HP, Wilson JA, Pratt RJ, et al. epic3: National evidence-based guidelines for preventing healthcare-associated infections in NHS hospitals in England. 2014 Jan;86;Supple 1;S1-S70.

4. Perry A, and Potter, P. Clinical Nursing Skills and Techniques, 9th Edition; St. Louis, 2017, Mosby.

5. Rowley S, Clare S. ANTT: A standard approach to aseptic technique. 2011 Nurs Times Sep;13-19;107(36):12-14.

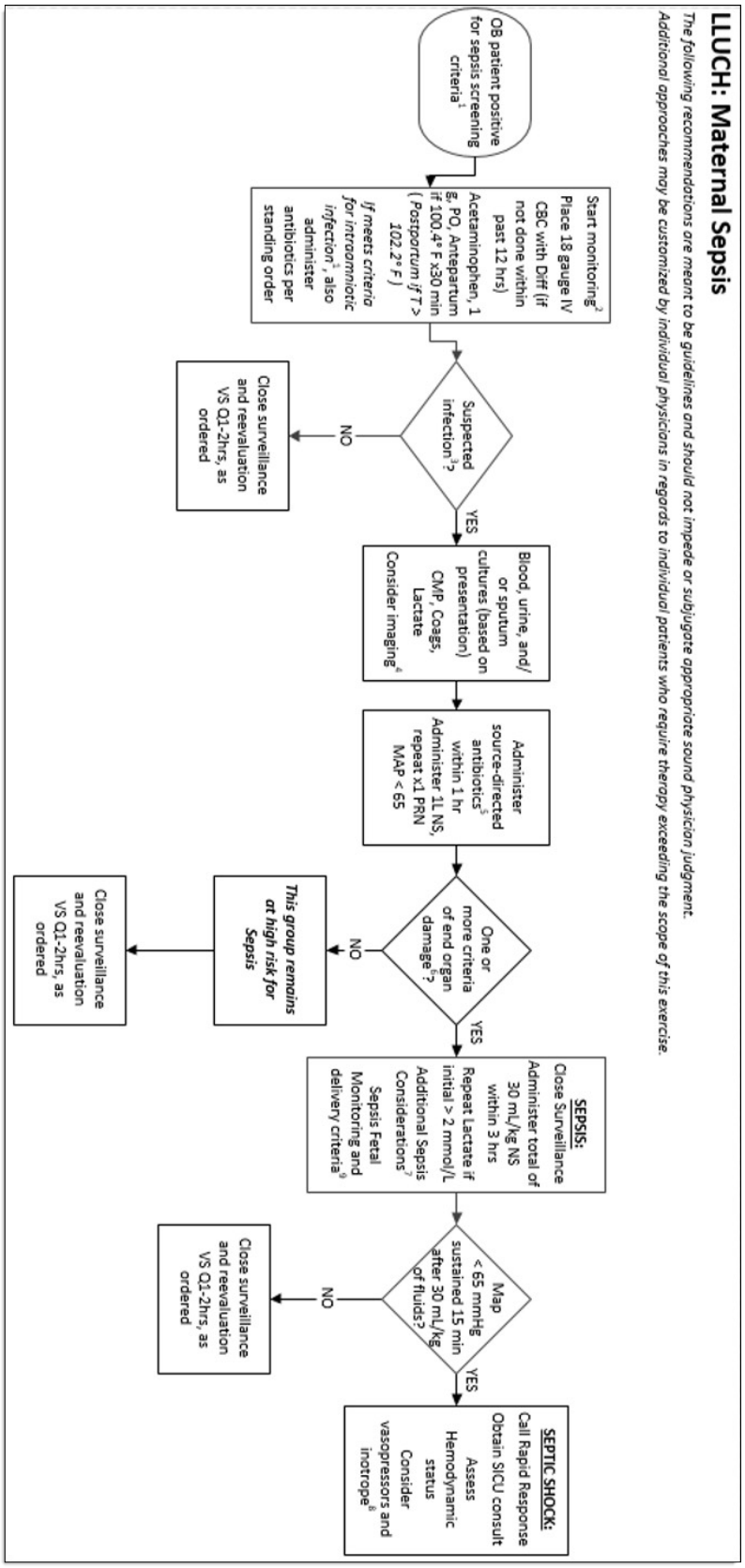
6. Scottish Intercollegiate Guidelines Network (2015) Management of Suspected Bacterial Urinary Tract Infection in Adults.

7. Shepherd E. Specimen collection 2: obtaining a catheter specimen of urine. 2017 Nurs Times [online]; 113, 8, 29-31.

8. Yates A. Urinary catheters 1: male catheterization. 2017b Nurs Times; 113: 1, 32-34.

Appendix J: Sample: LLU Sepsis Decision Flowchart

Note: This is a SAMPLE developed for a particular facility as an example to work from. You may need to adjust based on the individual circumstances of your facility.



Appendix J: Sample: LLU Sepsis Decision Flowchart (Continued)

Table 1: Monitoring

- Continuous Fetal Monitoring, > 24 weeks for antepartum / intrapartum
- Continuous Pulse Oximetry, until vitals signs normal
- Blood Pressure (including MAP), Q30min, until Lactate < 2 mmol/L, then Q2hr for non-laboring pts
- Temperature, Q30min, until Lactate < 2 mmol/L, then Q2hr for non-laboring pts
- Urine output, Q1hr, consider external female urinary catheter (preferred) or Foley catheter with urometer
- Continuous mental status evaluation; note agitation, confusion, or unresponsiveness
- Lactate, Q4hr, until < 2 mmol/L

Table 2: Signs & Symptoms of Infection

Isolated Maternal Fever

- Single oral Temp 39.0° C (102.2° F) or greater **OR**
- Oral Temp 38.0° - 38.9° C (100.4° -102.2° F) that persists for at least 30 minutes **OR**
- Oral Temp lower than 36° C

Suspected Intraamniotic Infection

Maternal fever plus one additional risk factor:

- Maternal leukocytosis
- Purulent cervical drainage
- Fetal tachycardia

Confirmed Intraamniotic Infection

- Positive amniotic fluid test result (gram stain, glucose level, or culture results consistent with infection) **OR**
- Placental pathology with histologic evidence of infection or inflammation

CMQCC Criteria for Sepsis

Refer to Table 5

Table 5: CMQCC Criteria for Sepsis

Initial Screen Positive plus End Organ Injury

- *2 of the following:*
  - Temp > 38.0° C (100.4° F)
  - Pulse > 110 beats per min
  - Respiratory Rate > 24 breaths per min
  - WBC > 15,000/mm^3 **OR** < 4,000/mm^3 (in absence of corticosteroids) **OR** >10% bands
- *Plus evidence of end organ injury:*
  - **Respiratory** – acute respiratory failure needing invasive or non-invasive mechanical ventilation **OR** PaO_2/FiO_2 < 300
  - **Coagulation** –
    - Platelets < 100 x 10^9/L **OR**
    - INR > 1.5 **OR**
    - PTT > 60 seconds
  - **Liver** – Bilirubin > 2 mg/dL
  - **Cardiovascular** – Persistent hypotension after fluid administration
    - SBP < 85 mmHg **OR**
    - MAP < 65 mmHg **OR**
    - > 40 mmHg decrease in SBP
  - **Renal** –
    - Creatinine > 1.2 mg/dL, OR
    - Doubling of creatinine, OR
    - Urine output < 0.5 mL/Kg/hr (for 2 hours)
  - **Mental Status** – Agitation, confusion, or unresponsiveness
  - **Lactic acid** – > 2 mmol/L in absence of labor

Table 3: Imaging to Identify Source of Infection

Neither necessary medications nor diagnostic imaging should be withheld from a pregnant woman because of fetal concerns, although attempts should be made to limit fetal exposure to ionizing radiation and teratogenic medications when feasible.

Appendicitis

Antepartum

- **First choice**: Graded compression ultrasonography
- MRI of pelvis if ultrasound inconclusive
- CT if MRI not available

Postpartum

- CT

Cholecystitis

Antepartum

- Right Upper Quadrant (RUQ) ultrasound is the most reliable modality for cholecystitis and cholelithiasis
- Magnetic Resonance Cholangiopancreatography (MRCP) may be helpful in choledocholithiasis when ultrasound not diagnostic

Postpartum

- RUQ ultrasound or MRCP

Pneumonia

Antepartum

- Chest X-ray gold standard if shortness of breath, cough, fever, tachypnea, hypoxia
- CT-Chest (low dose CT comparable with standard dose CT) generally reserved for suspected pulmonary embolism, with adjustments made for craniocaudal sections to avoid exposure to gravid uterus

Postpartum

- Chest X-ray and/or CT-Chest

Retained Products of Conception / Septic Abortion

Antepartum / Postpartum

- Ultrasound

Pelvic Abscess

Antepartum

- Ultrasound

Postpartum

- **First choice**: Ultrasound (best modality to demonstrate pelvic organs)
- CT scan with IV and oral contrast
- Drainage recommended for abscesses ≥ 7 cm

Pyelonephritis / Renal Abscess / Urogenital Tract Abscess

Antepartum

- Primarily diagnosed clinically
- If not responding to treatment: ultrasound, MRI, and/or CT

Postpartum

- Ultrasound (preferred)
- MRI and/or CT with contrast

Bacteremia / Endocarditis

Antepartum

- Diagnose using blood cultures paired with risk factors and symptoms (i.e Duke's criteria) with imaging diagnosis by transthoracic echocardiogram (TTE)
- If patient able to tolerate sedation, transesophageal echocardiogram (TEE) has better valve visualization

Postpartum

- TTE and/or TEE

Chorioamnionitis / Intraamniotic Infection / Endomyometritis

Antepartum / Postpartum

- Primarily diagnosed clinically

Mastitis / Breast Abscess

Antepartum / Postpartum

- Mastitis primarily diagnosed clinically
- Ultrasound with guided drainage for abscess

Septic Pelvic Thrombophlebitis

Postpartum

- Treat empirically
- CT scan

Skin and Soft Tissue Infections (SSTI)

Antepartum/Postpartum

- Primarily diagnosed clinically

Cesarean Delivery Wound

Postpartum C-section

- Superficial incisional SSI: No imaging needed; generally diagnosed on exam with culture and opening of incision Consider ultrasound
- Deep incisional SSI: CT scan and/or ultrasound
- Organ space SSI: CT scan and/or ultrasound, unless endomyometritis, which is primarily diagnosed and treated clinically

Perineal Abscess

Antepartum/Postpartum

- Primarily diagnosed clinically

Necrotizing Infection

Multi-organ involvement, characterized by two or more of the following:

- Hypotension
- Renal impairment
- Coagulopathy
- Liver involvement
- Acute Respiratory Distress Syndrome
- Erythematous macular rash
- Soft tissue necrosis

Page 2 of 6
2/23/2021

Appendix K: Sample: LLU Nursing Standard Order Set

Note: This is a SAMPLE developed for a particular facility as an example to work from. You may need to adjust based on the individual circumstances of your facility.

LOMA LINDA UNIVERSITY CHILDREN'S HOSPITAL

LOMA LINDA UNIVERSITY CHILDREN'S HOSPITAL

STANDING ORDERS

DEPARTMENT: MATERNITY SERVICES
CODE: CH-MAT-9
EFFECTIVE: 01/2024
SUBJECT: MATERNAL SEPSIS
REPLACES: 07/2022
PAGE: 1 of 2

The following shall be initiated by the Maternity Services Registered Nurses (RN) for pregnant patients and patients up to six weeks postpartum that are positive for at least two initial sepsis screening criteria within 6 hours of each other OR patient meets criteria for intraamniotic infection. See definitions below.

- Initial sepsis screening criteria (must meet at least two within 6 hours of each other):
  - Oral Temp < 96.8° F **OR** ≥ 100.4° F
  - Heart Rate > 110 beats per minute
  - Respiratory Rate > 24 breaths per minute
  - WBC > 15,000/mm^3 **OR** < 4,000/mm^3 **OR** > 10% bands
  - MAP < 65 mmHg sustained for 15 minutes

- Criteria for intraamniotic infection:
  - The patient is in labor with a temperature greater than 102.2° F
    OR
  - The patient has a temperature between or equal to 98.6° F to 102.2° F with fetal tachycardia (160 bpm or greater) AND leukocytes greater than 15 or less than 4

1. Insert a peripheral IV catheter

2. Draw CBC with differential, if not done in the last 12 hrs

3. Draw lactate Q4hrs until lactate below 2 mmol/L or shock index is less than 0.9

4. Administer Acetaminophen:

   4.1. Antepartum: 650 mg, PO, PRN once if temperature sustained ≥ 100.4° F for 30 minutes. If NPO, administer 650 mg, PR.

   4.2. Postpartum: 650 mg, PO, PRN once for temperature ≥ 102.2° F. If NPO, administer 650 mg, PR.

5. Monitor:

Appendix K: Sample: LLU Nursing Standard Order Set (Continued)

DEPARTMENT:	MATERNITY SERVICES	**CODE:**	CH-MAT-9
SUBJECT:	MATERNAL SEPSIS	**PAGE:**	2 of 2

5.1. Continuous fetal monitoring, if more than 24 weeks antepartum or intrapartum

5.2. Continuous pulse oximetry

5.3. Perform the following assessments Q30min until lactate below 2 mmol/L, then Q2hrs for non-laboring patients:
   a. Blood pressure, including MAP
   b. Temperature
   c. Neurological checks

5.4. Measure and record urine output Q1hr

6. If patient meets criteria for intraamniotic infection (see definition above)

6.1. Administer Ceftriaxone, 2 g, IV, once
   a. Do not administer if patient is allergic to cephalosporins. Contact provider for alternative order.

6.2. Administer Metronidazole, 500 mg, IV, once

6.3. Administer NS, 1L, IV, once

APPROVERS: LLUCH Chief Nursing Officer, LLUCH Medical Staff Executive Committee, LLUCH Medical Staff President and Chair of MSEC,, Courtney Martin

Pharmacy and Therapeutics Committee 09/12/2023
Date

CH Medical Staff Executive Committee 10/16/2023
Date

Appendix L: Antibiotic Considerations for Sepsis of Unknown Source or Septic Shock

See footnotes for further explanation

Antibiotic Choices[a] *Empiric coverage for sepsis of unknown source or for septic shock should include coverage for gram-negative bacteria, gram-positive bacteria (including MRSA), and anaerobic bacteria.*	**Duration**
Piperacillin/tazobactam 4.5 g IV q8h[b] **AND** Vancomycin – per institutional protocol (target AUC_{24} 400-600)[c,d]	7-10 days is adequate for most infections[k] 14 days may be indicated in patients who were critically ill (see also source control section)
For Type I Penicillin Allergy (immediate hypersensitivity-hives, wheezing, anaphylaxis)[e]: Cefepime 2 g IV q8h[f] **AND** Metronidazole 500 mg IV/PO q8h **AND** Vancomycin – per institutional protocol (target AUC_{24} 400-600)[c,d]	
For Type I Cephalosporin Allergy[e] : Meropenem 1 g IV q8h (extended infusion) **OR** 500 mg IV q6h[g] **AND** Vancomycin – per institutional protocol (target AUC_{24} 400-600)[c,d]	
For Severe Type II-IV allergy to penicillins or cephalosporins (example: hemolytic anemia, toxic epidermal necrolysis (TEN), Steven's Johnson Syndrome (SJS), interstitial nephritis)[e]: Aztreonam 2 g IV q6h-q8h[h] **AND** Metronidazole 500 mg IV/PO q8h **AND** Vancomycin - per institutional protocol (target AUC_{24} 400-600) [c,d] **OR** Meropenem 1g IV q8h (extended infusion) OR 500 mg IV q6h[g] **AND** Vancomycin – per institutional protocol (target AUC_{24} 400-600) [c,d]	
FOR ALL OF THE ABOVE SCENARIOS: **ADD clindamycin for suspected or known STSS:** Clindamycin 900 mg IV q8h[i] **Risk of Fungemia:** Empiric Antifungal & Consult Infectious Diseases[j]	

Appendix L: Antibiotic Considerations for Sepsis of Unknown Source or Septic Shock (Continued)

Abbreviations: ESBL: extended spectrum beta-lactamase producing organism; MDRO: multi-drug-resistant organism; MRSA: methicillin resistant Staphylococcus aureus; STSS: Streptococcal Toxic Shock Syndrome; VRE: Vancomycin Resistant Enterococcus, GAS: Group A Streptococcus.

Notes:

a. ***Empiric antibiotic recommendations*** *are based on known or strongly suspected source of infection. Recommendations should be tailored to local antibiotic resistance patterns and local microbiological epidemiologic patterns. Antibiotic selection and duration should be adjusted when the pathogens and source(s) are known and controlled and based on patient's clinical response. Antibiotic dosing recommendations are based upon normal renal and hepatic function.*

b. Refer to the following antibiotic allergy section *for further discussion on antibiotic allergy definitions and management strategies.*

c. ***MDRO: Multi-drug-resistant organisms (MDRO)*** *may include ESBL producing Enterobacterales, MRSA, and VRE. Risk factors for MDRO organisms include prior history or present colonization/infection with these organisms.*

d. ***Septic Abortion or Retained Product of Conception:*** *Doxycycline should be considered when there is a need for coverage of atypical pathogens (i.e. Mycoplasma genitalium, Ureaplasma urealyticum). Consider atypical organism coverage for patients with (1) early (< 22 weeks gestational age) spontaneous abortion who undergo surgical uterine aspiration, (2) induced surgical abortion at any gestational age, or (3) lack of clinical improvement. Refer to CDC guidelines (link) for treatment recommendations for patients testing positive for M. genitalium. Clindamycin for STSS is usually provided for 48-72 hours or 24 hours of clinical and hemodynamic stability (whichever is longer). Clindamycin for STSS can replace metronidazole in metronidazole containing regimens based upon local anaerobic resistance trends. The option to use levofloxacin containing regimen should only be in institutions with low gram-negative resistance trends.*

e. ***Piperacillin-tazobactam*** *should be started with a 4.5 g IVPB loading (bolus) dose infused over 30 minutes with maintenance dose of 4.5 g IV q8h started 4 hours following the maintenance dose and administered as an extended infusion over 4 hours.[5,6,7] If patient does not have access to allow for extended infusion, administration of piperacillin-tazobactam 4.5 g IV q6h given as a 30-minute intermittent infusion is recommended.*

f. *Administer* ***cefepime*** *as an extended infusion when available; administer cefepime 2 g IV infused over 30 minutes (loading/bolus) with maintenance dose of 2 g IV over 4 hours starting 8 hours after the bolus.*

g. *Administer* ***meropenem*** *as an extended infusion when available, either 1 g IV infused over 30 minutes (loading/bolus dose) with maintenance dose of 1 g IV infused over 3 hours to start 8 hours after bolus dose or 500 mg IV q6h with a 30-minute infusion based upon institution practice.[8]*

h. ***Imipenem-cilastatin,*** *dosed at 500 mg imipenem component IV Q6h, may be considered as an alternative to meropenem. Ertapenem 1 g IV q24h may also be considered as an alternative to meropenem if Enterococcus spp., Pseudomonas aeruginosa, and Acinetobacter spp. are not frequent pathogens based on local epidemiology.*

i. ***Vancomycin****, when used for sepsis or critically ill patients, is typically started with a loading dose of 25-30 mg/kg. Loading doses greater than 2 g must be divided. Usual maintenance dosing range is 15-20 mg/kg IVPBq8h-q12h and should be adjusted based on TDM and renal function. Monitor serum creatinine and vancomycin serum concentrations closely in patients with sepsis and end-organ injury. Typical target vancomycin 24-hour area under the curve (AUC24) is 400-600 for most indications or ≥ 500 and/or a goal trough of greater than 10 mcg/mL in MRSA bacteremia or critically ill patients. Literature suggests that the risk of AKI increases with AUC > 650 and trough > 15 mcg/mL. Pharmacists trained in pharmacokinetic dosing of vancomycin are recommended to assist with dosing and monitoring of vancomycin. Consider discontinuing vancomycin if no MRSA risk factors are present or when MRSA has not been identified. Testing for MRSA colonization in nares swab, when negative, can provide a strong negative predictive value for MRSA pneumonia. However, a negative predictive value for other sources in sepsis is not clearly identified in the literature. Some experts may recommend swabbing 2-3 locations such as nares, throat, and perineum, to help with early de-escalation and discontinuation of vancomycin in a clinically improving patient in the absence of an MRSA culture result from the suspected source.*

j. *For patients with* ***vancomycin infusion reaction*** *(formerly "red man syndrome"), characterized as maculopapular rash appearing on the face, neck, trunk, and/or upper extremities during vancomycin infusion, decrease the infusion rate to 1.5 - 2 hours per gram and consider premedication with an antihistamine (e.g.* ***cetirizine, diphenhydramine****). For patients with true allergic reactions (excluding aforementioned infusion rate-induced reaction) to vancomycin or a history of vancomycin resistant enterococcus (VRE), substitute vancomycin with daptomycin 8-10 mg/kg IV q24h. Note daptomycin is inactivated by pulmonary surfactant and is not acceptable for treatment of pneumonia. For infections involving the respiratory tract substitute vancomycin with linezolid 600 mg IV/PO q12h.*

Appendix L: Antibiotic Considerations for Sepsis of Unknown Source or Septic Shock (Continued)

k. ***Urosepsis***[9]*: Levofloxacin can be considered in pregnancy and lactation with careful evaluation of the risks to the fetus or breastfed newborn. Aminoglycosides: Gentamicin or tobramycin may be administered as high-dose extended interval or conventional dosing strategy. Dosing and monitoring provided here is for high-dose extended interval regimens: gentamicin or tobramycin 5-7 mg/kg IV q24h. Therapeutic drug monitoring (TDM) should be performed for all patients. TDM target: Cmax: 15 – 30 mcg/mL, trough: < 0.3 mcg/mL. Pharmacists trained in pharmacokinetic dosing of aminoglycosides are recommended to assist with dosing and monitoring of these drugs. Preference and use of gentamicin or tobramycin should be guided by institutional policy and local antibiogram.*

l. ***Intra-abdominal Infection (IAB):*** *a complicated IAB signifies an infection that extends beyond the hollow viscus of origin into the peritoneal space and is associated with either abscess formation or peritonitis. A hospital-associated complicated IAB typically occurs after a surgical procedure or bowel perforation in a currently or recently hospitalized patient. Drainage (percutaneous or surgical) is key to management of IAB; early consultation of interventional radiology is mandatory.* See section on Source Control. *Empiric MRSA coverage is not routinely recommended; MRSA coverage should be considered in patients with MRSA colonization or with MRSA risk factors risk factor which include, but are not limited to prior treatment failure and significant antibiotic exposure. MRSA coverage should be discontinued at 48h if MRSA is not identified in cultures associated with the source of infection. Piperacillin-tazobactam may provide adequate empiric coverage of Enterococcus faecalis but should be confirmed with local antibiogram and susceptibility results if organism is identified in cultures. Consider VRE coverage in septic or severely ill patients with known prior colonization. Initial empiric management of Candida is not recommended in most circumstances.*

m. *Pelvic Abscess: Can be an infectious complication of surgery (i.e. hysterectomy, cesarean, induced abortion) or the result of infectious processes (i.e., pelvic inflammatory disease +/- tubo-ovarian abscess, inflammatory bowel disease, diverticulitis). Early imaging and surgical or interventional radiology consultation for source control is essential for managing pelvic abscesses with the goal to reduce risk on future fertility.*

n. ***Necrotizing Skin and Soft Tissue Infection, Necrotizing Fasciitis, or Gas Gangrene:*** *Source control along with early surgical consultation is mandatory in any patient with concern for necrotizing skin and soft tissue infection. Add clindamycin or linezolid for anti-toxin effect for at least 48-72 hours or until patient is clinically and hemodynamically stable (whichever is later).*

o. ***Cefazolin:*** *If measured bodyweight is >120 kg, consider dosing 2 g IV q6h*

p. ***Community-acquired Pneumonia:*** *CDC respiratory virus guidance is updated annually and are available through the* CDC website (link)*. In California, the influenza season typically occurs October through March (but seasonality may differ by year). Obstetric patients infected with influenza should be treated with oseltamivir 75 mg PO BID x 5 days. There are several treatment options available for COVID-19 positive hospitalized patients. Recommendations for preferred treatment options vary by disease severity and patient comorbidities. Refer to IDSA guidelines for* treatment options (link)*. If vancomycin is started for MRSA coverage, obtain cultures/nasal PCR to allow de-escalation or confirmation of need for continued therapy. In patients with prior respiratory isolation of Pseudomonas aeruginosa or recent hospitalization and parenteral antibiotic receipt, add coverage for Pseudomonas and obtain cultures to allow de-escalation or confirmation of need for continued therapy.*[10]

Appendix M: Antibiotic Considerations for Serious Infections by Source in Obstetric Patients

See footnotes for further explanation

Source of Infection	Preferred Regimen[a]	Type I Penicillin Allergy[b]	Type I Allergy to cephalosporins or Type II-IV Allergy to Penicillin[b]	Bacterial Resistance & Virulence Factors[c]	Duration
Septic Abortion or Retained Products of Conception[d]	Piperacillin-tazobactam 4.5 g IV q8h, 4-h infusion[e] **May add** Doxycycline 100 mg IV/PO q12h	Cefepime 2 g IV q8h[f] **AND** Metronidazole 500 mg IV/PO q8h **May add** Doxycycline 100 mg IV/PO q12h	Meropenem 1 g IV q8h[g,h] **May add** Doxycycline 100 mg IV/PO q12h **OR** Levofloxacin 750 mg IV/PO q24h **AND** Metronidazole 500 mg IV/PO q8h **May add** Doxycycline 100 mg IV/PO q12h	**ESBL:** Meropenem 1 g IV q8h[g,h] **MRSA:** **ADD** Vancomycin[i,j] **STSS:** **ADD** Clindamycin 900 mg IV q8h	48h IV and afebrile with clinical improvement and source control; followed by an oral agent to complete 10-14 days
Urosepsis[k]	Ceftriaxone 2 g IV q24h **May add** Aminoglycoside[l]		Meropenem 1 g q8h [g,h] **OR** Levofloxacin 750 mg IV/PO q24h		IV antibiotics should be given until significant clinical improvement, then followed by an appropriate oral agent to complete 7-14 days total antibiotic therapy. There may be no oral option in patients with multi-drug resistant organism (MDRO) infections.

Appendix M: Antibiotic Considerations for Serious Infections by Source in Obstetric Patients (Continued)

Hospital-Associated Intra-abdominal Infection[l]	Piperacillin-tazobactam 4.5 g IV q8h, 4-hour infusion[e]	Cefepime 2 g IV q8h[6] **AND** Metronidazole 500 mg IV/PO q8h	Meropenem 1 g q8h [g,h] **OR** Aztreonam 2 g IV q8h **AND** Metronidazole 500 mg IV/PO q8h	**ESBL:** Meropenem [g,h] **MRSA:** **ADD** Vancomycin [i,j] **VRE:** Daptomycin 8-10 mg/kg IV q24h OR Linezolid 600 mg IV/PO q12h	4-7 days following complete source control (See section on Source Control)
Pelvic Abscess[m]	Intra-abdominal Source: see Hospital-Associated Intra-abdominal Infection Genitourinary Source: see Septic Abortion/ Retained Products of Conception/ Tubo-Ovarian Abscess				48h IV and afebrile with clinical improvement and source control; followed- an oral agent to complete 10-14 days. See Source Control section.
Necrotizing Skin and Soft Tissue Infection or Necrotizing Fasciitis or Gas Gangrene[n]	Piperacillin-tazobactam 4.5 g IV q8h, 4-h infusion[e] **AND** Vancomycin[l,j] **AND** Clindamycin 900 mg IV q8h	Cefepime 2 g IV q8h[f] **AND** Vancomycin [i,j] **AND** Clindamycin 900 mg IV q8h **AND** Metronidazole 500 mg IV q8h	Meropenem 1 g q8h[g,h] **AND** Vancomycin[i,j] **AND** Clindamycin 900 mg IV q8h		7-14 days following source control
Monomicrobial Necrotizing Skin and Soft Tissue Infection due to: *S. pyogenes* (GAS) OR Clostridium spp. *(C. perfringens or C. sordellii)*	Penicillin G (aqueous) 4 million units IV q4h **AND** Clindamycin 900 mg IV q8h	Cefazolin 2 g IV q8h[o] **AND** Clindamycin 900 mg IV q8h	Vancomycin[i,j] **AND** Clindamycin 900 mg IV q8h	N/A	

Appendix M: Antibiotic Considerations for Serious Infections by Source in Obstetric Patients (Continued)

Community-acquired Pneumonia[p]	**Non-Pregnant:** Ceftriaxone 2 g IV q24h **AND** Doxycycline 100 mg IV/PO q12h **Pregnant:** Ceftriaxone 2 g IV q24h **AND** Azithromycin 500 mg IV/PO q24h	**Non-Pregnant:** Levofloxacin 750 mg IV/PO q24h **Pregnant:** Meropenem 1 g q8h[g,h] **AND** Azithromycin 500 mg IV/PO q24h	**MRSA:** **AND** Vancomycin[i,j] **Pseudomonas Risk:** Cefepime 2 g IV q8h[f] **AND** Doxycycline 100 mg IV/PO q12h **May add** Aminoglycoside if septic shock	5 days Patient should be afebrile x 48-72 hrs without supplemental oxygen dependence prior to stopping antibiotics.

Abbreviations: ESBL: extended spectrum beta-lactamase producing organism; MDRO: multi-drug-resistant organism; MRSA: methicillin resistant Staphylococcus aureus; STSS: Streptococcal Toxic Shock Syndrome; VRE: Vancomycin Resistant Enterococcus, GAS: Group A Streptococcus.

Notes:

a. ***Empiric antibiotic recommendations*** *are based on known or strongly suspected source of infection. Recommendations should be tailored to local antibiotic resistance patterns and local microbiological epidemiologic patterns. Antibiotic selection and duration should be adjusted when the pathogens and source(s) are known and controlled and based on patient's clinical response. Antibiotic dosing recommendations are based upon normal renal and hepatic function.*

b. Refer to the following antibiotic allergy section *for further discussion on antibiotic allergy definitions and management strategies.*

c. ***MDRO: Multi-drug-resistant organisms (MDRO)*** *may include ESBL producing Enterobacterales, MRSA, and VRE. Risk factors for MDRO organisms include prior history or present colonization/infection with these organisms.*

d. ***Septic Abortion or Retained Product of Conception:*** *Doxycycline should be considered when there is a need for coverage of atypical pathogens (i.e. Mycoplasma genitalium, Ureaplasma urealyticum). Consider atypical organism coverage for patients with (1) early (< 22 weeks gestational age) spontaneous abortion who undergo surgical uterine aspiration, (2) induced surgical abortion at any gestational age, or (3) lack of clinical improvement. Refer to CDC guidelines (link) for treatment recommendations for patients testing positive for M. genitalium. Clindamycin for STSS is usually provided for 48-72 hours or 24 hours of clinical and hemodynamic stability (whichever is longer). Clindamycin for STSS can replace metronidazole in metronidazole containing regimens based upon local anaerobic resistance trends. The option to use levofloxacin containing regimen should only be in institutions with low gram-negative resistance trends.*

e. ***Piperacillin-tazobactam*** *should be started with a 4.5 g IVPB loading (bolus) dose infused over 30 minutes with maintenance dose of 4.5 g IV q8h started 4 hours following the maintenance dose and administered as an extended infusion over 4 hours.*[5,6,7] *If patient does not have access to allow for extended infusion, administration of piperacillin-tazobactam 4.5 g IV q6h given as a 30-minute intermittent infusion is recommended.*

f. *Administer* ***cefepime*** *as an extended infusion when available; administer cefepime 2 g IV infused over 30 minutes (loading/bolus) with maintenance dose of 2 g IV over 4 hours starting 8 hours after the bolus.*

g. *Administer* ***meropenem*** *as an extended infusion when available, either 1 g IV infused over 30 minutes (loading/bolus dose) with maintenance dose of 1 g IV infused over 3 hours to start 8 hours after bolus dose or 500 mg IV q6h with a 30-minute infusion based upon institution practice.*[8]

h. ***Imipenem-cilastatin,*** *dosed at 500 mg imipenem component IV Q6h, may be considered as an alternative to meropenem. Ertapenem 1 g IV q24h may also be considered as an alternative to meropenem if Enterococcus spp., Pseudomonas aeruginosa, and Acinetobacter spp. are not frequent pathogens based on local epidemiology.*

RESPONSE

i. ***Vancomycin**, when used for sepsis or critically ill patients, is typically started with a loading dose of 25-30 mg/kg. Loading doses greater than 2 g must be divided. Usual maintenance dosing range is 15-20 mg/kg IVPBq8h-q12h and should be adjusted based on TDM and renal function. Monitor serum creatinine and vancomycin serum concentrations closely in patients with sepsis and end-organ injury. Typical target vancomycin 24-hour area under the curve (AUC24) is 400-600 for most indications or ≥ 500 and/or a goal trough of greater than 10 mcg/mL in MRSA bacteremia or critically ill patients. Literature suggests that the risk of AKI increases with AUC > 650 and trough > 15 mcg/mL. Pharmacists trained in pharmacokinetic dosing of vancomycin are recommended to assist with dosing and monitoring of vancomycin. Consider discontinuing vancomycin if no MRSA risk factors are present or when MRSA has not been identified. Testing for MRSA colonization in nares swab, when negative, can provide a strong negative predictive value for MRSA pneumonia. However, a negative predictive value for other sources in sepsis is not clearly identified in the literature. Some experts may recommend swabbing 2-3 locations such as nares, throat, and perineum, to help with early de-escalation and discontinuation of vancomycin in a clinically improving patient in the absence of an MRSA culture result from the suspected source.*

j. *For patients with **vancomycin infusion reaction** (formerly "red man syndrome"), characterized as maculopapular rash appearing on the face, neck, trunk, and/or upper extremities during vancomycin infusion, decrease the infusion rate to 1.5 - 2 hours per gram and consider premedication with an antihistamine (e.g. **cetirizine, diphenhydramine**). For patients with true allergic reactions (excluding aforementioned infusion rate-induced reaction) to vancomycin or a history of vancomycin resistant enterococcus (VRE), substitute vancomycin with daptomycin 8-10 mg/kg IV q24h. Note daptomycin is inactivated by pulmonary surfactant and is not acceptable for treatment of pneumonia. For infections involving the respiratory tract substitute vancomycin with linezolid 600 mg IV/PO q12h.*

k. ***Urosepsis**[9]: Levofloxacin can be considered in pregnancy and lactation with careful evaluation of the risks to the fetus or breastfed newborn. Aminoglycosides: Gentamicin or tobramycin may be administered as high-dose extended interval or conventional dosing strategy. Dosing and monitoring provided here is for high-dose extended interval regimens: gentamicin or tobramycin 5-7 mg/kg IV q24h. Therapeutic drug monitoring (TDM) should be performed for all patients. TDM target: Cmax: 15 – 30 mcg/mL, trough: < 0.3 mcg/mL. Pharmacists trained in pharmacokinetic dosing of aminoglycosides are recommended to assist with dosing and monitoring of these drugs. Preference and use of gentamicin or tobramycin should be guided by institutional policy and local antibiogram.*

l. ***Intra-abdominal Infection (IAB):** a complicated IAB signifies an infection that extends beyond the hollow viscus of origin into the peritoneal space and is associated with either abscess formation or peritonitis. A hospital-associated complicated IAB typically occurs after a surgical procedure or bowel perforation in a currently or recently hospitalized patient. Drainage (percutaneous or surgical) is key to management of IAB; early consultation of interventional radiology is mandatory. See section on Source Control. Empiric MRSA coverage is not routinely recommended; MRSA coverage should be considered in patients with MRSA colonization or with MRSA risk factors risk factor which include, but are not limited to prior treatment failure and significant antibiotic exposure. MRSA coverage should be discontinued at 48h if MRSA is not identified in cultures associated with the source of infection. Piperacillin-tazobactam may provide adequate empiric coverage of Enterococcus faecalis but should be confirmed with local antibiogram and susceptibility results if organism is identified in cultures. Consider VRE coverage in septic or severely ill patients with known prior colonization. Initial empiric management of Candida is not recommended in most circumstances.*

m. *Pelvic Abscess: Can be an infectious complication of surgery (i.e. hysterectomy, cesarean, induced abortion) or the result of infectious processes (i.e., pelvic inflammatory disease +/- tubo-ovarian abscess, inflammatory bowel disease, diverticulitis). Early imaging and surgical or interventional radiology consultation for source control is essential for managing pelvic abscesses with the goal to reduce risk on future fertility.*

n. ***Necrotizing Skin and Soft Tissue Infection, Necrotizing Fasciitis, or Gas Gangrene:** Source control along with early surgical consultation is mandatory in any patient with concern for necrotizing skin and soft tissue infection. Add clindamycin or linezolid for anti-toxin effect for at least 48-72 hours or until patient is clinically and hemodynamically stable (whichever is later).*

o. ***Cefazolin:** If measured bodyweight is >120 kg, consider dosing 2 g IV q6h*

p. ***Community-acquired Pneumonia:** CDC respiratory virus guidance is updated annually and are available through the CDC website (link). In California, the influenza season typically occurs October through March (but seasonality may differ by year). Obstetric patients infected with influenza should be treated with oseltamivir 75 mg PO BID x 5 days. There are several treatment options available for COVID-19 positive hospitalized patients. Recommendations for preferred treatment options vary by disease severity and patient comorbidities. Refer to IDSA guidelines for treatment options (link). If vancomycin is started for MRSA coverage, obtain cultures/nasal PCR to allow de-escalation or confirmation of need for continued therapy. In patients with prior respiratory isolation of Pseudomonas aeruginosa or recent hospitalization and parenteral antibiotic receipt, add coverage for Pseudomonas and obtain cultures to allow de-escalation or confirmation of need for continued therapy.[10]*

Appendix N: Lactation Safety of Antimicrobials Used for Treatment of Sepsis

CMQCC acknowledges Philip O. Anderson, Pharm.D., from UC San Diego and author of LactMed for his review and comments of the content of this appendix document.

For detailed information on the safety and use of antibiotics during pregnancy, we recommend the publicly accessible database LactMed or the smartphone app LactRx. https://www.ncbi.nlm.nih.gov/books/NBK501922/

With use of many antibiotics, there can occasionally be disruption of the infant's gastrointestinal and oral flora, resulting in diarrhea or thrush (candidiasis).

Medication	Breastfeeding Category	Comments
Ampicillin	Acceptable	
Ampicillin-sulbactam	Acceptable	Limited information. In general, beta-lactams have very low levels in milk and are acceptable.
Azithromycin	Acceptable	
Aztreonam	Acceptable	Limited information. In general, beta-lactams have very low levels in milk and are acceptable.
Caspofungin	No information	Caspofungin is poorly absorbed orally, so it is not likely to reach the bloodstream of the infant or cause any adverse effects in breastfed infants. It can be given IV directly to infants 3 months and older.
Cefazolin	Acceptable	
Cefepime	Acceptable	Limited information. In general, beta-lactams have very low levels in milk and are acceptable.
Cefoxitin	Acceptable	
Ceftriaxone	Acceptable	Limited information. In general, beta-lactams have very low levels in milk and are acceptable.
Clindamycin	Concern	More likely than other antibiotics to cause gastrointestinal symptoms, including GI bleeding. Other antibiotics are preferred.
Daptomycin	Acceptable	Limited information, but unlikely to be absorbed orally by the infant.
Doxycycline	Acceptable for short courses	Avoid long or repeated courses of therapy while breastfeeding.
Ertapenem	Acceptable	Limited Information. In general, beta-lactams have very low levels in milk and are acceptable.
Gentamicin	Acceptable	Gentamicin is poorly excreted into breastmilk and poorly absorbed by infants, except in newborns who may absorb small amounts.

Appendix N: Lactation Safety of Antimicrobials Used for Treatment of Sepsis (Continued)

Medication	Breastfeeding Category	Comments
Imipenem	Acceptable	Limited Information. In general, beta-lactams have very low levels in milk and are acceptable.
Levofloxacin	Acceptable	No information is available on the clinical use of levofloxacin during breastfeeding. However, amounts in breastmilk appear to be far lower than the infant dose and would not be expected to cause any adverse effects in breastfed infants.
Linezolid	Probably acceptable	Amounts in milk <10% of an infant dose.
Meropenem	No information	In general, beta-lactams have very low levels in milk and are acceptable.
Metronidazole	Acceptable	While older laboratory experiments showed a potential risk of mutagenesis in bacteria, subsequently no evidence of mutagenicity has been found in humans including a large study of maternal use in the 1st trimester. Metronidazole is a recommended choice by ACOG and SMFM for chorioamnionitis with cesarean delivery, endometritis, and sepsis. CDC recommends the use of metronidazole for the treatment of bacterial vaginosis during pregnancy. The National Health System UK Medicines Information Service notes: "The balance of current evidence and clinical experience, and the consensus of specialist opinion, is that there is no established mutagenic or carcinogenic risk to infants breastfeeding from mothers receiving routine short-course treatment with metronidazole by any route." Currently, metronidazole is used for maternal treatment in the postpartum period, without restrictions on breastfeeding, by multiple large centers in California.
Oseltamivir	Acceptable	Limited information
Penicillin G	Acceptable	
Piperacillin/ tazobactam	Acceptable	Limited information. In general, beta-lactams have very low levels in milk and are acceptable.
Tobramycin	Acceptable	Tobramycin is poorly excreted into breastmilk and poorly absorbed by infants, except in newborns who may absorb small amounts.
Vancomycin	Acceptable	Poorly absorbed orally.

Appendix O: Antibiotic IV Compatibility Chart for Use in Co-Administration of Antibiotics in Initial Management of Severe Infections and Sepsis

Broad Spectrum Antibiotic (Start antibiotic in this column FIRST!)	Additional Antibiotics	Y-site Compatibility
Ampicillin-sulbactam	Gentamicin or Tobramycin	NO
Cefepime	Doxycycline	NO
	Metronidazole	YES
	Vancomycin	YES
Ceftriaxone (Compatible with NS, not compatible with LR)	Azithromycin	NO
	Doxycycline	YES
	Gentamicin	YES
	Metronidazole	YES
	Tobramycin	NO
	Vancomycin	NO
Levofloxacin	Clindamycin	YES
	Metronidazole	YES
	Vancomycin	YES
Meropenem or Ertapenem	Vancomycin	YES
Piperacillin-tazobactam (Compatible with NS, most products not compatible with LR)	Clindamycin	YES
	Doxycycline	NO
	Vancomycin	YES* (concentration dependent)

**Note: piperacillin-tazobactam and vancomycin are compatible via Y-adaptor depending on drug concentrations. Y-site compatibility for co-infusion of piperacillin-tazobactam and vancomycin is considered acceptable due to published compatibility data when piperacillin-tazobactam concentration range is 18-112.5 mg/mL and vancomycin concentration range is 2-5 mg/ml.*

Appendix P: Sample: Miller Sepsis/Chorio Order Sets

MEWT MATERNAL INFECTION (LBM/MCH) [3402]

Maternal Early Warning Trigger (MEWT) Reference Diagram **URL:** http://docs.memnet.org/Xpedio/groups/public/documents/order_sets/093690.pdf

SEVERE SEPSIS or END ORGAN INVOLVEMENT

For MAP Less than 65, Respiratory Rate Greater than 24 , or Altered Mental Status [202585]

Check the box to open orders for MAP Less than 65, Respiratory Rate Greater than 24 , or Altered Mental Status

Note: This is a SAMPLE developed for a particular facility as an example to work from. You may need to adjust based on the individual circumstances of your facility.

☐ Severe Sepsis / End Organ Involvement [202586]	
☐ Lactic Acid [LAB000427]	STAT, ONCE, Starting today For 1 Occurrences
☐ Comprehensive Metabolic Panel [LAB000213]	STAT, ONCE, Starting today For 1 Occurrences
☐ XR Chest 1 View Portable [IXR000036]	STAT, ONCE, Starting today For 1 Occurrences Indication: Is patient pregnant? Discharge pending test results?
☐ normal saline (BOLUS) 0.9 % injection Solution [500295]	for 3 Hours, Intravenous, STAT For 1 Doses Consult with MD every hour regarding need for rate adjustment based on current MAP and Lactic Acid results.
☐ Nursing to Apply and Monitor Pulse Oximetry [PCS001052]	Routine, EFFECTIVE NOW, Starting today For 1 Occurrences
☐ I & O, Strict [PCS001656]	Routine, EFFECTIVE NOW, Starting today For 1 Occurrences
☐ Foley Catheter: Insert &/or Maintain [PCS001372]	Routine, EFFECTIVE NOW Foley Placement Indication: .Urine output monitoring in critically ill patients Remove Foley when indications for monitoring urine output in critically ill patients no longer exist.
☐ Consult to: Maternal Fetal Medicine [PCS002241]	Referral for 1 visits (expires on 10/18/20) What is the reason for the consult: Consult with specialty: Other (Specify)
☐ Notify MD (Specify Reason) [PCS001552]	Routine, EFFECTIVE NOW, Starting today For 1 Occurrences, Consult with MD every hour regarding need for Normal Saline Bolus rate adjustment based on current MAP and Lactic Acid Result.

ANTI-INFECTIVES FOR PYELONEPHRITIS

Anti-Infectives for Less Than 20 Weeks Gestational Age for No or Mild Beta-Lactam Allergy [193532]

☐ ceFAZolin (ANCEF, KEFZOL) IV [900690] — 2 g, Intravenous, Every 8 Hours

Anti-infectives for Greater Than 20 Weeks Gestational Age for No or Mild Beta-Lactam Allergy [193533]

☐ ceFAZolin/Gentamicin [193543]

☐ ceFAZolin (ANCEF, KEFZOL) IV [900690]	2 g, Intravenous, Every 8 Hours
☐ gentamicin dosing per pharmacy [500048]	Indication: Suspected Infection Source of Infection (Select all that apply): Urinary Tract Expected Duration of Therapy:

Anti-Infectives for Severe Beta-Lactam Allergy [193534]

☐ gentamicin dosing per pharmacy [500048] — Indication: Suspected Infection; Source of Infection (Select all that apply): Urinary Tract; Expected Duration of Therapy:

ANTI-INFECTIVES FOR ENDOMETRITIS

Anti Infectives for Endometritis (Single Response) [193535]

BEST PRACTICE ELEMENT

Appendix P: Sample: Miller Sepsis/Chorio Order Sets (Continued)

- NO Beta Lactam Allergy Panel [193544]
  - ampicillin (POLYCILLIN, OMNIPEN) IVPB [900781] — 2 g, Intravenous, Every 6 Hours
  - gentamicin dosing per pharmacy [500048] — Indication: Suspected Infection; Source of Infection (Select all that apply): OB/GYN; Expected Duration of Therapy:
  - clindamycin (CLEOCIN) infusion [801453] — 900 mg, Intravenous, Every 8 Hours; Indication: Suspected Infection; Source of Infection (Select all that apply): OB/GYN
- MILD or SEVERE Beta Lactam Allergy Panel [193545]
  - vancomycin dosing per pharmacy [500056] — Indication: Suspected Infection; Source of Infection (Select all that apply): OB/GYN; Expected Duration of Therapy:; Justification for Vancomycin Use: Beta-lactam allergy
  - gentamicin dosing per pharmacy [500048] — Indication: Suspected Infection; Source of Infection (Select all that apply): OB/GYN; Expected Duration of Therapy:
  - clindamycin (CLEOCIN) infusion [801453] — 900 mg, Intravenous, Every 8 Hours; Indication: Suspected Infection; Source of Infection (Select all that apply): OB/GYN

ANTI-INFECTIVES FOR SUSPECTED INFLUENZA

Suspected Influenza [193530]

BEST PRACTICE ELEMENT

- Tamiflu/Nasal Swab [193542]
  - oseltamivir (TAMIFLU) capsule [12448] — 75 mg, Oral, 2 Times a Day For 5 Days
  - Flu with RSV by PCR [LAB006358] — Routine, ONCE, Starting today

ANTI-INFECTIVES FOR COMMUNITY-ACQUIRED PNEUMONIA

Community-Acquired Pneumonia (Single Response) [303120]

Patient is classified as having **SEVERE** pneumonia if patient is in either:

- Septic shock with need for vasopressors and/or respiratory failure requiring mechanical ventilation
  OR
- Meets at least 3 of the following criteria:
  - RR ≥ 30 breaths/min
  - Confusion/disorientation
  - Platelets < 100,000
  - $Pa_{O2}/Fi_{O2} \leq 250$
  - Hypotensive requiring aggressive fluid resuscitation
  - Core temperature < 36□C
  - Multilobar infiltrates
  - Non-chemotherapy induced leukopenia (WBC < 4000)
  - BUN ≥ 20

CAP guidelines — **URL:** https://www.idsociety.org/practice-guideline/community-acquired-pneumonia-cap-in-adults/

- Standard regimen for NONSEVERE pneumonia (no Pseudomonas or MRSA risk factors) (Single Response) [193527]
  - No or mild beta-lactam allergy [193541]
    - cefTRIAXone (ROCEPHIN) IVPB [600488] — 2 g, Intravenous, Every 24 Hours For 5 Days, for 30 Minutes
      Give First Dose STAT.
      Start this antibiotic first if other antibiotics are ordered.
      Do not infuse through the same IV line as calcium-containing IV solutions (including LR and TPN)

Appendix P: Sample: Miller Sepsis/Chorio Order Sets (Continued)

- azithromycin (ZITHROMAX) 500 mg in NS 250 mL IVPB [601247] — 500 mg, Intravenous, Every 24 Hours For 5 Days, for 1 Hours
- Severe beta-lactam allergy [215092]
  - levoFLOXacin (LEVAQUIN) IVPB [510026] — 750 mg, Intravenous, Every 24 Hours For 5 Days
    Give first dose STAT.
    Indication: Suspected Infection
    Source of Infection (Select all that apply): Respiratory
- Standard regimen for SEVERE pneumonia (no Pseudomonas or MRSA risk factors) [193528]
  - Anti-Infectives (Single Response) [193529]
    - No or mild beta-lactam allergy [303117]
      - cefTRIAXone (ROCEPHIN) IVPB [600488] — 2 g, Intravenous, Every 24 Hours For 5 Days, for 30 Minutes
        Give First Dose STAT.
        Start this antibiotic first if other antibiotics are ordered.
        Do not infuse through the same IV line as calcium-containing IV solutions (including LR and TPN)
      - azithromycin (ZITHROMAX) 500 mg in NS 250 mL IVPB [601247] — 500 mg, Intravenous, Every 24 Hours For 5 Days, for 1 Hours
    - Severe beta-lactam allergy [303116]
      - LEVOFLOXACIN IVPB ORDERABLE [510026] — 750 mg, Intravenous, Every 24 Hours For 5 Days
        Give First Dose STAT.
        Indication: Suspected Infection
        Source of Infection (Select all that apply): Respiratory
  - Culture, Respiratory W/ Gram Stain [LAB000665] — ASAP, ONCE, Starting today
  - Culture, MRSA / ORSA Screen [LAB000577] — ASAP, ONCE, Starting today
  - Streptoccus pneumoniae Antigen (Urine) [LAB001361] — ASAP, ONCE, Starting today
- Other Types of Community-Acquired Pneumonia associated with Pseudomonas, MRSA or Aspiration [303119]
  Contact Pharmacy for guidance with antibiotic selection recommendations for patients with Community-Acquired Pneumonia associated with Pseudomonas or MRSA cultures within the last year, and/or with aspiration.
  - Respiratory Culture if SEVERE Pneumonia [LAB000665] — ASAP, ONCE, Starting today
  - Streptoccus pneumoniae Antigen (Urine) [LAB001361] — ASAP, ONCE, Starting today

ANTI-INFECTIVES FOR HOSPITAL-ACQUIRED PNEUMONIA

Hospital-Acquired Pneumona [193531]

Definition of Hospital-Acquired Pneumonia: Pneumonia not incubating at time of hospital admission and occurring 48 hours after admission.
Contact Pharmacy for guidance with antibiotic selection recommendations for patients with Hospital-Acquired Pneumonia.

IV FLUIDS

IV Fluids [193536]

- Insert and Maintain Saline Lock (Adult) [75762]
  - SALINE LOCK, INSERT / MAINTAIN [PCS001053] — Routine, EFFECTIVE NOW
  - SALINE LOCK FLUSH (ADULT) [500090] — 3 mL, Intravenous, Daily

DIAGNOSTIC TESTING

Diagnostic Testing [193537]

Appendix P: Sample: Miller Sepsis/Chorio Order Sets (Continued)

☑ Creatinine [LAB000232]	STAT, ONCE, Starting today For 1 Occurrences, May run as add-on test if OB panel drawn.
☐ CBC with Auto Differential, Reflex Manual Differential if Indicated [LAB000699]	STAT, ONCE, Starting today For 1 Occurrences
☐ Culture, Blood X2 [98719]	
☐ Culture, Blood #1 [LAB000143]	STAT, ONCE, Starting today For 1 Occurrences, #1
☐ Culture, Blood #2 [LAB000143]	STAT, ONCE, Starting today For 1 Occurrences, #2
☐ Culture, Respiratory W/ Gram Stain [LAB000665]	STAT, ONCE, Starting today For 1 Occurrences
☐ Urine Culture with UA [193540]	
☐ Urinalysis With Reflex Microscopic & Culture, If Indicated [LAB000633]	STAT, ONCE, Starting today For 1 Occurrences, If UTI suspected and patient is pregnant, < 2 years old, has ANC < 500, or will have urologic procedure with anticipated mucosal trauma, UA with urine culture is recommended.
☐ Culture, Urine [LAB000635]	STAT, ONCE, Starting today For 1 Occurrences

Appendix Q: Empiric Management of Chorioamnionitis/ Endomyometritis

Setting	Preferred Regimens	Type I Allergy to Penicillin (immediate hypersensitivity-hives, wheezing, anaphylaxis)	Type I Allergy to Cephalosporins OR Type II-IV Allergy to Penicillin[4]
Uncomplicated Chorioamnionitis/ Endomyometritis	Ampicillin 2g IV q6h **AND** Aminoglycoside[a] **IF having a cesarean, ADD** Metronidazole 500mg PO/IV q8h)[b] **OR** Clindamycin 900mg IV q8h	Ceftriaxone 2g IV q24h **AND** Metronidazole 500mg PO/IV q8h	Ertapenem 1g IV q24 hours[e] **OR** Meropenem 1g IV q8 hours[f]
	OR Piperacillin-tazobactam 4.5g IV q8h, 4-h infusion[c]		
	OR Ceftriaxone 2g IV q24h **AND** Metronidazole 500mg PO/IV q8h		
	OR Ampicillin-sulbactam 3g IV q6h **AND** Aminoglycoside[a]		
Serious Illness (signs of end-organ injury) **(If different from the routine chorioamnionitis regimen above, replace with one of these regimens)**	Piperacillin-tazobactam 4.5g IV q8h, 4-h infusion[c]	Ceftriaxone 2g IV q24h **AND** Metronidazole 500mg PO/IV q8h	Meropenem 1g IV q8 hours[f]
	OR Ceftriaxone 2g IV q24h **AND** Metronidazole 500mg PO/IV q8h		
Critical Illness (requiring broad spectrum coverage)	Refer to Appendix L: Antibiotic Considerations for Sepsis of Unknown Source or Septic Shock		

Appendix Q (Continued)

a. ***Aminoglycosides:*** *Gentamicin or tobramycin may be administered as high dose extended interval or conventional dosing strategy. Dosing and monitoring provided here is for high dose extended interval regimens; gentamicin or tobramycin 5-7 mg/kg IV q24h. Therapeutic drug monitoring (TDM) should be performed for all patients. TDM target: C_{max}: 15 – 30 mcg/mL, trough: < 0.3 - 0.5 mcg/mL. Pharmacists trained in pharmacokinetic dosing of aminoglycosides are recommended to assist with dosing and monitoring. Preference and use of gentamicin or tobramycin should be guided by institutional policy and local antibiogram.*
b. ***Metronidazole*** *has 100% bioavailability and can be given IV or PO in those who have normal gut absorption.*
c. ***Piperacillin-tazobactam,*** *when used for sepsis, should be started with a 4.5 g IVPB loading (bolus) dose infused over 30 minutes with maintenance dose of 4.5 g IV q8h which is started 4 hours following the maintenance dose and administered as an extended infusion over 4 hours. If patient does not have access to allow for extended infusion, administration of piperacillin-tazobactam 4.5 g IV q6h given as a 30-minute intermittent infusion is recommended.*
d. ***For patients allergic to penicillin****, cephalosporins, AND carbapenems: Clindamycin 900 mg IV q8h (or Metronidazole 500 mg IV/PO q8h) + Vancomycin + Aminoglycoside[a] is an option for the management of chorioamnionitis/endomyometritis.*
e. ***Ertapenem*** *is a broad-spectrum antibiotic, but compared to meropenem, it lacks coverage of Enterococcus spp., Pseudomonas aeruginosa, and Acinetobacter spp. These pathogens are less commonly encountered in routine chorioamnionitis; the exceptions could be patients failing to respond or occasionally in post-surgical endomyometritis. In this situation, escalation to meropenem can be considered.*
f. ***Meropenem*** *dosing may be different based on institutional guidelines. Meropenem may be administered as an extended infusion over 3 hours and given every 8 hours or provided as a 30-minute infusion and given every 6 hours.*

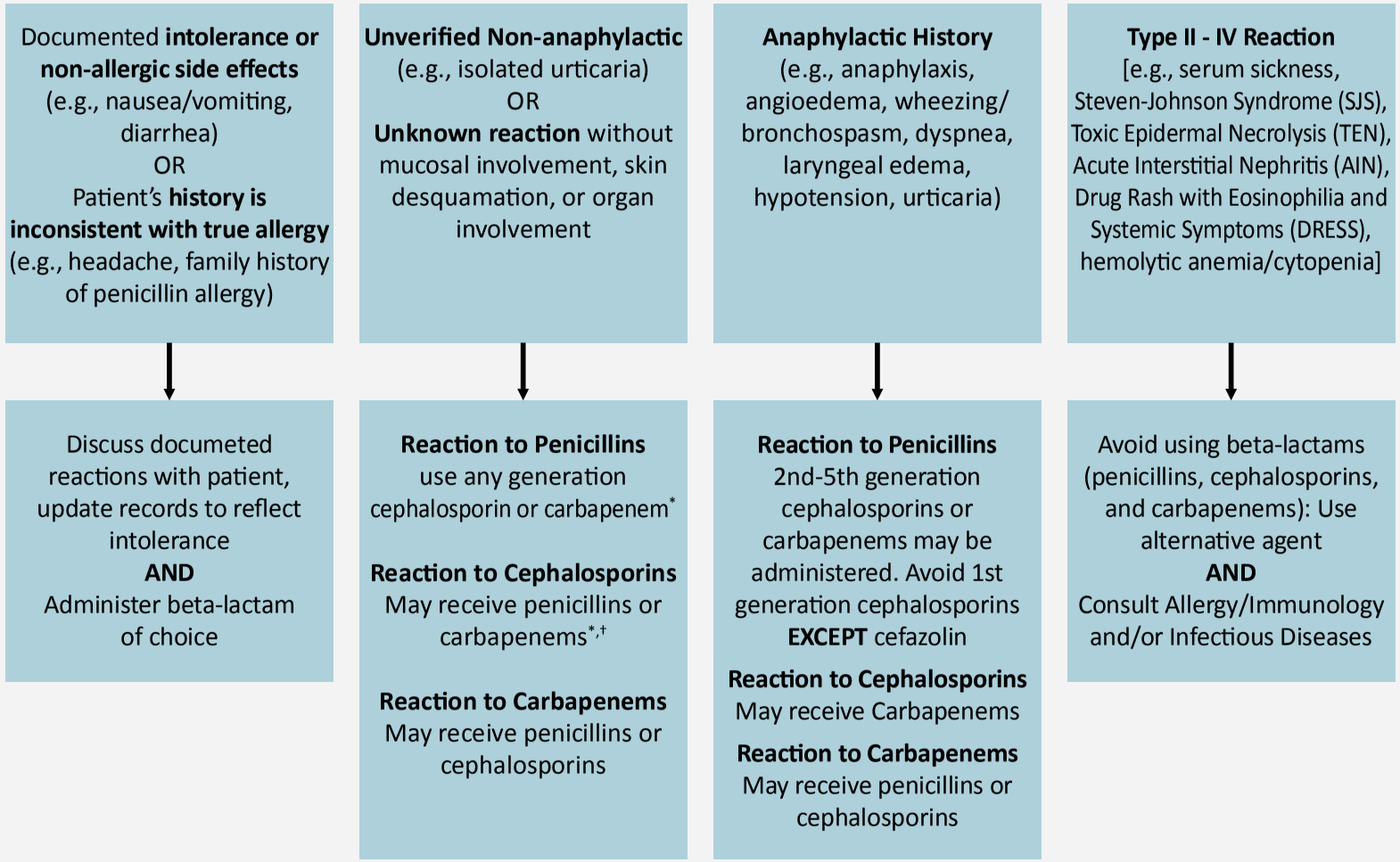
Appendix R

Table 2. Medications for Management of Allergy-related Reactions

Medication*	Dose
Diphenhydramine	25-50 mg IV push (over 5 minutes) every 4-6 hours PRN for any allergic reaction. For mild to moderate cutaneous reactions (e.g, pruritius): 25 mg PO every 4-6 hours PRN
Cetirizine	10 mg IV or PO as single dose. If used for management of anaphylaxis should be adjunct to epinephrine.
Epinephrine (1 mg/mL)	0.3 or 0.5 mg (use 0.5 mg in patients >50 kg if available) IM; may repeat every 5 - 15 minutes (or sooner if clinically indicated) if patient does not respond adequately. Note: Physician should be at bedside and there should be immediate access to telemetry monitoring or as per institutional guidelines for use.
Famotidine	20 mg IV push every 12 hours PRN in combination with H1 antihistamine (e.g., cetirizine, diphenhydramine)
Albuterol MDI (with or without spacer)	Inhale 2 puffs every 4 hours PRN shortness of breath, or Inhale 4 puffs every 20 minutes PRN for anaphylaxis (use facemask if needed), up to 8 hours

**Do NOT pretreat with these medications as they may mask early signs of a hypersensitivity reaction*

Appendix S: Beta-lactam Allergy Pathway



**Amoxicillin and ampicillin have cross reactivity with 1st generation cephalosporins (e.g., cephalexin, cefadroxil, cefaclor, cefprozil) EXEPT cefazolin. †Clinically stable patients with a history of non-anaphylactic reaction to cephalosporins where cephalosporin use is desired may be eligible to receive an oral drug challenge. Consult Allergy/Immunology for further evaluation and recommendations.*

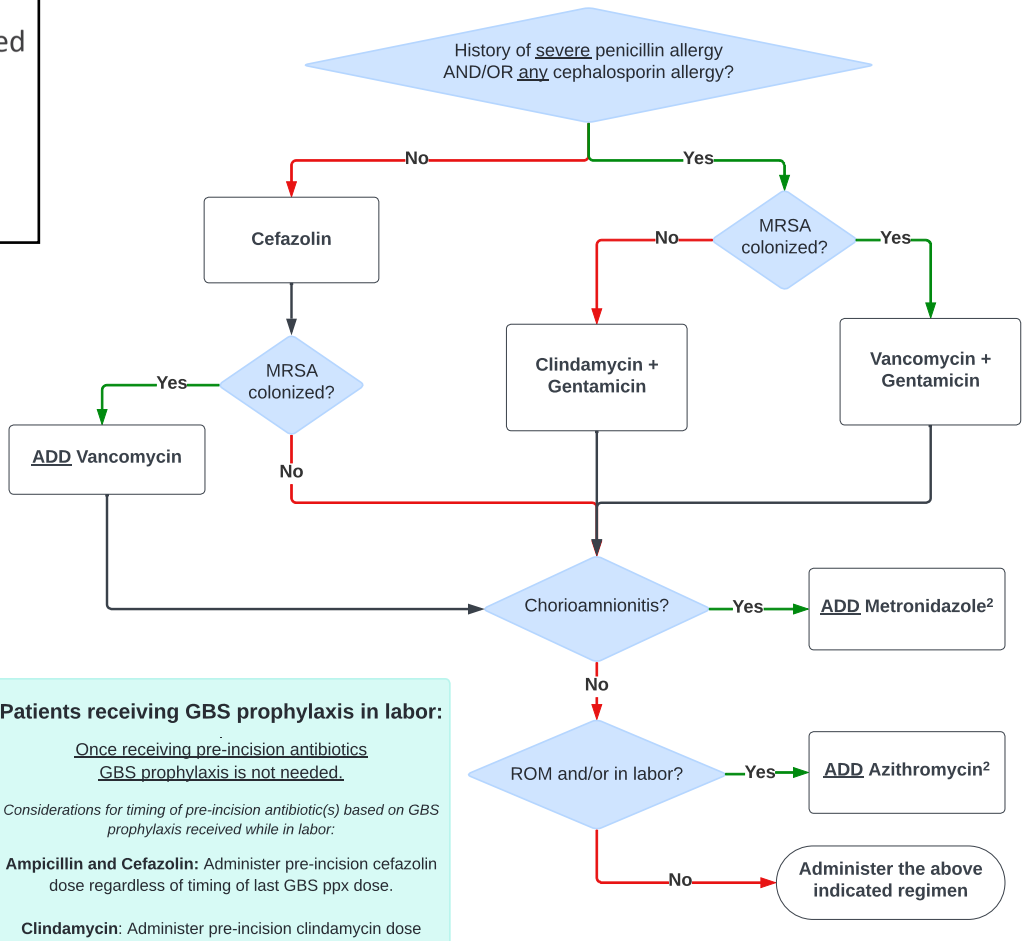
Appendix T: Example Flow Chart For Prophylactic Antibiotics At Cesarean Delivery

Note: This is a SAMPLE developed for a particular facility as an example to work from. You may need to adjust based on the individual circumstances of your facility.

Pre-Incision Antibiotics for Cesarean Delivery Algorithm

Stanford MEDICINE Children's Health

For **scheduled cases**, antibiotics administered via a bolus should be administered prior to skin incision, and antibiotics administered via an infusion should be initiated (and ideally completed) prior to skin incision. For **urgent/emergent cases**, administer antibiotics as soon as is safe to do so in the course of clinical care.



Antibiotic Dosing		Infusion Time
Azithromycin	500 mg IV	60 min
Cefazolin	< 120 kg: 2 g IV ≥ 120 kg: 3 g IV	3 – 5 min
Clindamycin	900 mg IV	30 min
Gentamicin	< 120 kg: 240 mg IV ≥ 120 kg: 360 mg IV	30 min
Metronidazole	500 mg IV	30 min
Vancomycin	< 80 kg: 1 g IV 80 – 99 kg: 1.25 g IV 100 – 199 kg: 1.5 g IV ≥ 120 kg: 2 g IV	60 min/ 1 g

Antibiotic Redosing

REDOSE **cefazolin** q4h intra-op or if QBL > 1500 mL
REDOSE **clindamycin** q6h intra-op or if QBL > 1500 mL
REDOSE antibiotics if due for chorio treatment while intra-op
Azithromycin, metronidazole, and vancomycin (for pre-incision ppx) do NOT require redosing

Patients receiving GBS prophylaxis in labor:

Once receiving pre-incision antibiotics GBS prophylaxis is not needed.

Considerations for timing of pre-incision antibiotic(s) based on GBS prophylaxis received while in labor:

Ampicillin and Cefazolin: Administer pre-incision cefazolin dose regardless of timing of last GBS ppx dose.

Clindamycin: Administer pre-incision clindamycin dose 6 hours after last dose. Other pre-incision antibiotics (e.g., gentamicin) can be administered regardless of timing of last GBS ppx dose.

Vancomycin: Administer pre-incision antibiotics regardless of timing of last GBS ppx dose.

Footnotes

[1] Cephalosporins can safely be used in patients with an allergic reaction to penicillins that is **not** an IgE-mediated reaction (e.g., anaphylaxis, urticaria, bronchospasm) or exfoliative dermatitis (Stevens-Johnson syndrome, toxic epidermal necrolysis).

[2] Azithromycin is not indicated if metronidazole is administered for chorioamnionitis.

Link to Redcap Decision Support Tool

Last Updated 2/25/25, T.Ng, N.Aziz, K.Fedoruk, G.Abir, D.Lyell, Y.El-Sayed, L.Puckett

Appendix U: Comparison of Sep-1 to CMQCC Criteria

SEP-1 Specifications Manual		CMQCC Obstetric Serious Infection Evaluation Flow Chart
Non-Pregnant Patients*	**Pregnant 20 weeks through Day 3 Post-delivery Patients**	**Pregnant 20 weeks through Day 3 Post-delivery Patients**
Hypotension: SBP <90 mmHg or MAP <65mmHg or SBP decrease >40 mmHg **Respiratory:** New mechanical or non-invasive ventilation (e.g. CPAP, BiPAP)	**Hypotension:** SBP <85 mmHg or MAP <65mmHg or SBP decrease >40 mmHg **Respiratory:** New mechanical or non-invasive ventilation (e.g. CPAP, BiPAP)	**Hypotension:** SBP <85 mmHg or MAP <65mmHg or SBP decrease >40 mmHg **Respiratory:** New mechanical or non-invasive ventilation (e.g. CPAP, BiPAP, or O2 sat <92%, or O2 requirement)
Renal: Creatinine >2.0 mg/dL or Urine Output <0.5ml/kg/hour for two consecutive hours **Liver:** Total Bilirubin >2 mg/dL **Coagulation:** Platelet count <100,000, or INR >1.5, or aPTT >60 sec **Lactate:** >2mmol/L	**Renal:** Creatinine >1.2 mg/dL or Urine Output <0.5ml/kg/hour for two consecutive hours **Liver:** Total Bilirubin >2 mg/dL **Coagulation:** Platelet count <100,000, or INR >1.5, or aPTT >60 sec **Lactate:** >2mmol/L (NOTE: Do not use lactate obtained during active labor through delivery)	**Renal:** Creatinine >1.2 mg/dL or Urine Output <60ml for two consecutive hours **Liver:** Total Bilirubin >2 mg/dL **Coagulation:** Platelet count <100,000, or INR >1.5, or aPTT >60 sec (PT and aPTT may not be routinely collected in obstetrics) **Lactate:** >2mmol/L (NOTE: Do not use lactate obtained during active labor through one hour postpartum). In Sepsis-3, Lactate is a measure of severity rather than an indicator of end-organ injury.

**Includes pregnant patients <20 weeks and after 3 days post-delivery*

Appendix V: Sample: Maternal Sepsis Debriefing Form

Maternal Sepsis Debriefing			
Person Completing Form:		Date/Time:	
Patient's demographic label:		Team members present:	
Team Attendance	**Yes**	**No**	**Comments**
Notified charge appropriately			
Notified OB team appropriately			
Notified RRT team appropriately			
Notified code blue pharmacist			
Adequate help present			
Clear roles/stayed in roles			
Intervention	**Yes**	**No**	**Comments**
Order set 601 by RN for sepsis			
Order set 600 by MD for sepsis			
RRT to bedside for sepsis			
Lactic acid			
CBC			
BMP			
Blood cultures			
Central venous access			
Medication	**Yes**	**No**	**Comments**
Fluids bolus			
Broad spectrum antibiotics			
Additional Comments:			
What went well:			**What Needs improvement?**
Teamwork			Teamwork
Communication			Communication
Leadership			Leadership
Other			Other
Patient	Remained on D3/T3		Return completed form to organizer on L&D. If topics pertain to safety issues that need to be immediately addressed, return directly to:
	ICU transfer		

CONFIDENTIAL: Protected by Attorney-Client Privilege and California Evidence Code Sections 1156 and 1157

Appendix W: Sample: UC Davis Health Maternal Sepsis Drill Scenario

Note: This is a SAMPLE developed for a particular facility as an example to work from. You may need to adjust based on the individual circumstances of your facility.

UC DAVIS HEALTH

OB MATERNAL SEPSIS SCENARIO

Preparation:

- ✓ **Mannequin, delivered with baby skin to skin Patient name DEBRA HULAHOOP**
- ✓ **Add patient band on mannequin with MRN/DOB/name**
- ✓ **Labor in bed broken down for delivery/repair**
- ✓ **Del table set up- repair in progress**
- ✓ **IV LR w Pitocin infusing, Magnesium infusing**
- ✓ **2 extra Pumps available for IV Tylenol and Abx**
- ✓ **Tylenol IV labeled in Pyxis drawer**
- ✓ **MD to start in room at start of scenario**
- ✓ **WOW at Bedside for practice if EMR component**
- ✓ **For order set 601 use "NURSE Order set"**
- ✓ **For order set 600 use "MD Order set"**
- ✓ **Have Sepsis Kits readily avail/ discuss before SIM**

Scenario #1:

34 yo G1 P1 s/p vaginal delivery
Was admitted for Induction of labor for postdates
developed preeclampsia with severe features(mild BPs, inc Cr & AST), treated with magnesium sulfate, continues with MAG running at start of scenario, She was AROM @ 0000, 2nd stage of labor 3 hrs
Delivers @ 11:05 am , and has a complex 4th degree laceration, She is being repaired at the start of the scenario
Her QBL was 705ml , She also had Uterine atony and was treated with SL **misoprostol** 400 mcg
It is 11:45am at the start of scenario and the Physician is still repairing the patient

Time	Scenario Flow	Actions by team	Reactions by mannequin/simulationist
0:00	Shaking after delivery	Continue repair Anesthesia -> Demerol	Shaking, "I really don't feel well" Not able to get vital signs
0:05	Shaking improved	MD continues repairing	T 38.6 temp oral, 40 axillary HR 124, BP 147/68, RR 26
0:05-0:15	SIRS alert- **TIME ZERO**	Notify MD	The MD says "it's because of the sublingual misoprostol that her temp is high"
PAUSE	**SIRS ALERT** **Talk through the criteria that triggered the alert**	**LEAD THEM TO ORDER SET 601-RN order set** ***complete PAUSE if they have not performed these steps** • Draw labs (CBC, BMP, lactic acid)	

Appendix W: Sample: UC Davis Health Maternal Sepsis Drill Scenario (Continued)

Note: This is a SAMPLE developed for a particular facility as an example to work from. You may need to adjust based on the individual circumstances of your facility.

UC DAVIS HEALTH

OB MATERNAL SEPSIS SCENARIO

Time	Scenario Flow	Actions by team	Reactions by mannequin/simulationist
	Pt starts to shake again	MD continues with repair	"I really don't feel well"
0:25 Facilitator reports 10 minutes from Labs sent	Labs returned Labs: WBC 23.8, Hgb 12.5, Hct 38, plts 167; lactic acid 5.8 RRT NOT in room although notified of lactic acid >4	**MD to enter order set 600-MD order set** Rapid response called/Sepsis RN IV fluid bolus (30 ml/kg over 3 hours) Blood cultures	T 38.6 temp oral, 40 axillary, HR 124, BP 123/57, RR 26
PAUSE	**LAB RESULTS**	**LEAD MDs TO ORDER SET 600 .Initialsepsisdoc** ***complete pause if they have not performed these steps** • **Is RRT at BS** • **Has CHG RN been notified**	
PAUSE	What if you weren't able to get blood cultures within 45 min of **TIME ZERO** what do you do?	Blood cultures **(unable to get blood cultures after attempting for >45 minutes)** Antibiotics ordered **(start abx after attempting blood cultures for 45 minutes, then continue to attempt blood cultures)**	
0:45	Pharmacy technician delivers Antibiotics	Hang Antibiotics Reassure Patient and family regarding patient status and baby status	"What's going on? Where is my baby?"
1:10		Consider transfer to ICU, pressors, central venous access	Patient confused (change in AMS) T 38.2 temp oral, 40 axillary, HR 132, BP 85/53, RR 28

Debrief using tool to ensure all elements are discussed

Appendix X

The Importance of The Pre-discharge Care Discussion

Initiating Healing After a Severe Maternal Event (SME)

What is birth trauma?

Birth trauma is any experience related to birth that overwhelms the nervous system's ability to cope. Up to 45% of pregnant patients report feeling traumatized by their birth experience[1]. Feeling traumatized by a birth experience is not a choice, but an automatic response of the nervous system to protect the patient from a perceived threat. Birth trauma is caused by a wide range of experiences and is subjective in nature. An event that is traumatic for one patient, may not be experienced as traumatic by another. A life-threatening experience or perceived life-threatening experience during birth leaves patients at an increased risk for birth trauma.

Why is birth trauma important in the context of a Severe Maternal Event?

Research indicates that experiencing a SME increases the risk for developing PTSD as well as other mental health conditions postpartum.[2,3] A patient's expected outcome for their birth often lies in stark contrast to the experience of almost dying, making this reality difficult for most to comprehend. Many patients report leaving the hospital with no clear understanding about the events of their birth, which can lead to further confusion and feelings of isolation, compounding symptoms of trauma.

How can you help mitigate trauma and improve mental health outcomes?

Not all trauma within the context of severe maternal events can be prevented, but it can be mitigated through compassion, acknowledgement, and detailed care discussions. Pre-discharge care discussions play a crucial role in trauma-informed care for patients following a severe maternal event. One of the most common concerns from patients after experiencing a traumatic birth is that they do not fully understand what happened during their birth. Health care providers should take the time to meet with patients who have experienced a severe maternal event to ensure a thorough understanding of what occurred, address any questions or concerns, and plan ongoing care. By offering a care discussion, patients gain a clearer understanding of their treatment and have the opportunity to ask questions. Care discussions not only offer information, but for many patients, they provide a starting point for their physical and emotional healing after an SME.

This discussion, ideally involving familiar faces such as the senior physician, a known nurse, and a social worker, helps initiate the process of closure and provides emotional support. Providers must use clear, empathetic language, avoid assigning blame, and facilitate an open dialogue to support the patient's recovery and future health. This careful approach helps in creating a supportive environment for the patient and her family, ensuring they feel heard and understood, and preparing them for the next steps in their care journey.

---

[1] Beck CT, Watson S, Gable RK. Traumatic Childbirth and Its Aftermath: Is There Anything Positive? J Perinat Educ. 2018 Jun;27(3):175-184. doi: 10.1891/1058-1243.27.3.175.

[2] Lewkowitz AK, Rosenbloom JI, Keller M, López JD, Macones GA, Olsen MA, Cahill AG. Association Between Severe Maternal Morbidity and Psychiatric Illness Within 1 Year of Hospital Discharge After Delivery. Obstet Gynecol. 2019 Oct;134(4):695-707. doi: 10.1097/AOG.0000000000003434.

[3] Duval CJ, Youssefzadeh AC, Sweeney HE, McGough AM, Mandelbaum RS, Ouzounian JG, Matsuo K. Association of severe maternal morbidity and post-traumatic stress disorder. AJOG Glob Rep. 2022 Sep 28;2(4):100111. doi: 10.1016/j.xagr.2022.100111.

CMQCC California Maternal Quality Care Collaborative

Stanford MEDICINE Dunlevie Maternal-Fetal Medicine Center for Discovery, Innovation and Clinical Impact

MiAIM MICHIGAN ALLIANCE FOR INNOVATION ON MATERNAL HEALTH

Appendix Y

Supportive Communication After a Severe Maternal Event:
What Not to Say and Why

Your words matter after a severe maternal event. Patients are in an incredibly vulnerable state given what they've just experienced. The words you use and the statements you make have the potential to stick with patients for the rest of their lives, for better or worse. Providers have the power to mitigate further trauma and start patients on the path toward healing after a severe maternal event.

Phrases To Avoid After a Severe Maternal Event:

Instead of: "You almost died, but we were able to save you"
Try: "You were quite sick, but your body is tough and resilient."
Why: No matter how hard the team may have worked, this comment is self-aggrandizing and takes away from the patient's strength and agency which will be needed to the patient to recover.

Instead of: "All that matters is a healthy mom and healthy baby."
Try: "I know this wasn't the birth experience you expected. It's okay to have feelings about that."
Why: A healthy mom and baby matter, but so does the patient's experience of their birth. This statement dismisses any feelings they might be having about almost dying.

Instead of: "I can't believe you're alive" or "You are very lucky to be alive" or "Thank God, you're OK".
Try: Provide a brief overview of what happened to the patient and the interventions used.
Why: After a Severe Maternal Event, most patients feel unsafe in the world. They wonder when the next time the rug will be pulled out from underneath of them, and they will almost die again. When someone on their medical team expresses disbelief at their survival, it further compounds this lack of safety and dismisses the on-going trauma.

Instead of: "Everything happens for a reason."
Try: "This wasn't your fault. Here's what we know about why this may have happened to you."
Why: This phrase is a platitude that attempts to put a positive spin on what is often a devastating experience. It is dismissive of the grief and trauma the patient has experienced.

Instead of: Anything that begins with "at least"
Try: "You've been through a lot. You are probably going to feel many complicated and conflicting emotions. That's normal after an event like this."
Why: The term "at least" uses comparison to dismiss a patient's experience. Something can always be worse, but that doesn't mean it's not traumatic.

Instead of: "You should be so grateful."
Try: "I know this might be scary and a lot to process. What questions can I help you answer?"
Why: There is nothing wrong with expressing gratitude, but forced gratitude is unhelpful, particularly after a severe maternal event. The provider's experience of this event often differs greatly from the patient's. For most patients, they walked into the hospital to have a baby and go home, instead they and/or their baby almost lost their lives. They are likely grateful to be alive, but they also need the space and permission to feel sad, angry, and devastated that this happened to them.

Summary For Why Not To Use These Phrases:
These statements are said with the intention to improve patient outcomes by helping patients move past the experience. Unfortunately, the impact can be the opposite, and these statements often dismiss or minimize a patient's experience. When a patient feels dismissed after trauma, especially by someone in a position of authority, they feel their experience of the birth and the emotions that come with it are not valid. This often leads to ignoring or suppressing emotions and inevitably delaying psychological recovery. When a patient is instead offered validation and empathy, the door is opened to access support and treatment for their experience, leading to better outcomes postpartum and longer term.

Appendix Z

Guide For Pre-Discharge Care Discussion (aka Patient Debrief) After a Severe Maternal Event

- **Purpose**: to review what happened, answer questions, and plan on-going care with the patient and whoever the patient chooses to invite.
- **This document** is an informal checklist to help guide the discussion. The discussion would ideally include a senior physician and a nurse known to the patient, and a social worker. Known faces are important for support and starting the process of healing and closure.
- **Timing** should be after the patient is fully aware and near to discharge. This is not to replace earlier shorter care updates provided to the patient and family.

Step 1: Assess Patient Understanding

- ❑ "Now that you have had a few days to process, can you recap in your own words what you understand about what you experienced." "In a moment we will go through your story in detail."
  - Do not stop the patient to correct information
- ❑ "What are your biggest concerns about what happened?

Step 2: Provide an overarching description of the condition

- ❑ Define (in lay terms) the condition that they experienced, including how common
- ❑ Briefly review risk factors and in general the diagnosis and treatment approaches

Step 3: What happened with this specific patient

- ❑ Review in lay terms, how the patient presented and how the diagnosis was made
- ❑ What specific consultations and treatments were made
- ❑ How the patient responded to the treatments
- ❑ If and why they were transferred to a higher level of care (such as an ICU) and what happened there
- ❑ What has happened in the recovery phase
- ❑ Provide the summary document of the key elements of the diagnosis and care for her to share with her follow-up providers (see CMQCC Sepsis Toolkit for an example)
- ❑ Stress that this was not her fault

Step 4: Pause for questions

- ❑ "I have just given you a lot of information
  What questions do you have? What are your concerns going forward?"

Step 5: Review what to expect next

- ❑ Review plans for discharge, including who and when to see for follow up (ideal to identify an "anchor" provider)
  - The Discharge Follow-up Checklist is very useful
  - Early follow-up is almost always required
- ❑ Discuss return precautions and "what to watch for", involving the patient's family and/or those who may be helping support them
  - Emphasize the need for support from providers, family, and others
- ❑ Broadly review how this event may affect future health and future pregnancies, if relevant
- ❑ Emphasize the importance of continuing discussions
- ❑ Give opportunity for more questions

CMQCC California Maternal Quality Care Collaborative

Stanford MEDICINE Dunlevie Maternal-Fetal Medicine Center for Discovery, Innovation and Clinical Impact

MiAIM MICHIGAN ALLIANCE FOR INNOVATION ON MATERNAL HEALTH

Appendix AA

Patient Summary: Severe Maternal Event				
Patient Name				
Event Type & Date				
Attending Provider			**Office Phone**	
Other Key Provider			**Office Phone**	
Other Key Provider			**Office Phone**	
Follow-Up	☐ Subspecialist_____ ☐ Subspecialist_____ ☐ Support Group / Social Worker_____ ☐ Other: _____			
Clinical Summary				
Surgeries / Procedures	*Date* *Type*	*Date* *Type*	*Date* *Type*	*Date* *Type*
	Type	*Type*	*Type*	*Type*
Blood Transfusion	*Type and Number of Units of Blood Products*			
	Red Blood Cells _____ units	Platelets _____ units	Plasma _____ units	Fibrinogen/Cryo ____ units
ICU Admission	☐ No ☐ Yes Dates_____ *Notes:* _____			
Key Medications				
Patient Friendly Brief Narrative Summary (e.g., What happened?, Why did I need these interventions?, What was the final diagnosis? Anything else of importance?)				
Coordinating Resource Person			**Phone**	
This is a **person designated to be a point of contact for the patient after discharge. This individual may provide resources, answer questions, and help the patient in navigating and processing their experience.*				

Appendix BB

Guide for Post-Discharge Care After a Severe Maternal Event

Follow-Up Visits Arranged

- ❑ Follow up within 1-2 weeks of hospital discharge with obstetric care provider (OB)
- ❑ Identify key contact for immediate care and support as needed
- ❑ Arrange follow-up with primary care provider (PCP) or specialist(s) as appropriate
  - Many patients will need ongoing care up to 1 year to assess on going needs (especially mental health)
- ❑ Send Discharge Summary/Summary of Hospital Course to OB, PCP, and specialists
- ❑ Give Summary of Hospital Course to patient (see CMQCC Sepsis Toolkit for example)

Referrals (in-hospital or as outpatients)

- ❑ All patients with a Severe Maternal Event should have a referral to postpartum support group(s), either general or diagnosis specific (see resource list)
- ❑ Social Work—Medicaid or disability enrollment and transportation support as needed
- ❑ Lactation Consult—For support or suppression after major maternal illness or loss
- ❑ All patients with critical illness/ICU admission (for example: intubated, experiencing weakness) should have the following outpatient referrals placed on discharge[1]
  - Occupational Therapy and Physical Therapy
  - Speech/Swallow evaluation (usually done post-extubation refer if ongoing difficulties)

Specialized Postpartum Care (beyond standard services)

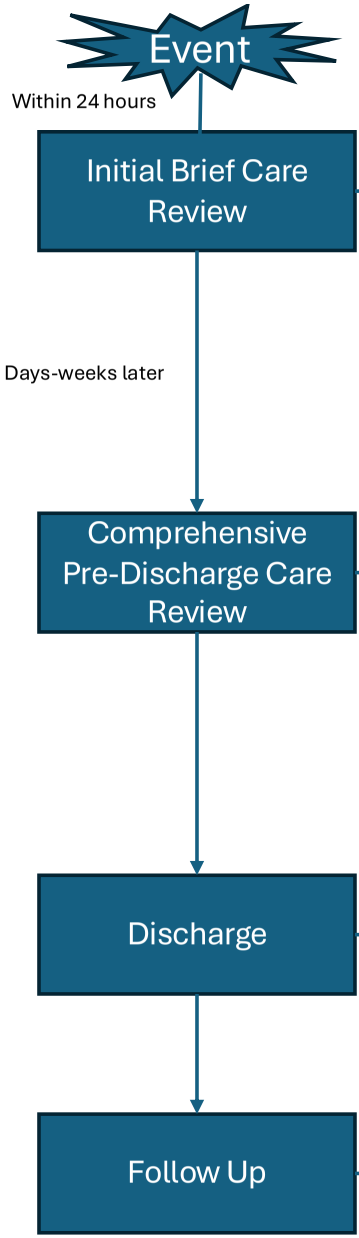
- Note: Postpartum visits for complications may be billed outside of the global Obstetric fee.[2]
  - ❑ Serial mental health assessments recommended for one year. Patients can experience continuing or new symptoms over the course of a year. There may be overlap between PTSD symptoms, trauma-related postpartum depression, postpartum anxiety and ICU-related trauma; additionally, cognitive challenges (sleep, memory and concentration disorders) may complicate/compound the postpartum mental health course. Examples of validated tools are provided below. All 3 areas are important to evaluate.
    - **Depression**
      PHQ-9[3] (Patient Health Questionnaire, a 9-question depression assessment)
      EPDS (Edinburgh Postnatal Depression Scale, a 10-question assessment)
    - **Anxiety**
      GAD-7[3] (Generalized Anxiety Disorder 7-item assessment)
    - **Post-Traumatic Stress Disorder (PTSD)**
      PCL-5 [4](PTSD Checklist for DSM-5, a 20-item assessment of PTSD symptoms)
  - ❑ Contraception needs, in the context of medical conditions[5]
  - ❑ Mobilize a support system of family, community social services and/or Doula services

---

[1] Prescott HC, Angus DC. Post Sepsis Morbidity. JAMA. 2018;319(1):91. doi:10.1001/jama.2017.19809
[2] Optimizing Postpartum Care. Accessed April 10, 2024. https://www.acog.org/clinical/clinical-guidance/committee-opinion/articles/2018/05/optimizing-postpartum-care
[3] Screening and Diagnosis of Mental Health Conditions During Pregnancy and Postpartum. Accessed April 10, 2024. https://www.acog.org/clinical/clinical-guidance/clinical-practice-guideline/articles/2023/06/screening-and-diagnosis-of-mental-health-conditions-during-pregnancy-and-postpartum
[4] Arora IH, Woscoboinik GG, Mokhtar S, et al. Establishing the validity of a diagnostic questionnaire for childbirth-related posttraumatic stress disorder. Am J Obstet Gynecol. 2023;0(0). doi:10.1016/j.ajog.2023.11.1229
[5] CDC Summary Chart of Medical Eligibility Criteria for Contraceptive Use (2024). https://www.cdc.gov/contraception/media/pdfs/2024/07/us-mec-summary-chart-color-508.pdf

CMQCC Stanford Medicine MI-AIM

Appendix CC: Trauma Care Flow Chart



Step 1. Assess patient understanding. Ask to recap in their own words what they understand about what happened. What is their biggest concern?
Step 2. Define the condition. Review general risk factors and whether this patient had any of them.
Step 3. What happened to this specific patient.
1. How the patient presented and what/when we identified that the event was occurring.
2. What steps we took.
3. If and why they were transferred to a higher level of care (such as an ICU or another hospital).
4. What has happened since the event.

Step 4. Pause for questions.
Step 5. Review what to expect next.
1. Review plans for the next 24 hours, which may include frequent checks by nurses or other healthcare providers, labs, imaging.
2. Acknowledge that we take things day by day, and that if things change we will readdress the next steps.
3. Emphasize care and safety while in the hospital, as well as close follow up once discharged as an outpatient.
4. Give opportunities for more questions

Step 1. Assess patient understanding.
1. Now that they have had a few days to process, ask to recap in their own words what they understand about what they experienced. Do not stop the patient to correct information. Note the topic and cover it in the "What happened" section.
2. What is their biggest concern about what happened?

Step 2. Provide an over-arching description of the event, in general.
1. Define (in lay terms) the condition that they experienced, including how common it is. Review what the risk factors are for the condition (in general).
2. Discuss how we usually screen for these risk factors. Did this patient have any of these risk factors?
3. In general, how are we prepared to manage the condition?

Step 3. What happened to this specific patient.
1. Review in lay terms:
    a. How the patient presented and what/when we identified that the event was occurring
    b. What steps we took
        i. Calling for help/consultation
        ii. Treatments administered, and acknowledging how these treatments feel for the patient. What the treatment(s) that the patient received typically do to help.
        iii. How the patient responded to the treatment(s)
        iv. Transfer to a higher level of care (such as the ICU or another hospital). Reason for transfer, how long they were there.
2. How has the patient has done in the time since the event occurred?
3. Acknowledge that this wasn't their fault

Step 4. Pause for questions.
Step 5. Review what to expect next.
1. Review plans for discharge, including who and when to see for follow up.
2. Discuss return precautions and "what to watch for", involving the patient's family and/or those who may be helping support them at home.
3. Broadly review how this event may affect future pregnancies, if relevant. Give opportunities for more questions

All patients should have the following:
1. Discharge summary/summary of hospital course sent to obstetrician/CNM and PCP
2. Plan for where to go if there's a need to come back to the hospital. If they were transferred during their course, which hospital should they present to? Bring information about your hospitalization to the ED if you need to go.
3. Follow up within 1-2 weeks of hospital discharge with obstetric care provider
4. Mental health assessment; below are examples of validated tools:
    -PHQ-9[1] (Patient Health Questionnaire, a 9-question depression assessment)
    - GAD-7[1] (Generalized Anxiety Disorder 7-item assessment)
    -PCL-5[2] (PTSD Checklist for DSM-5, a 20-item assessment of PTSD symptoms)
    -EPDS (Edinburgh Postpartum Depression Scale, a 10-question depression and anxiety assessment)
5. All patients with critical illness/ICU admission (for example; intubated, weakness) should have the following outpatient referrals placed on discharge[3]: Occupational therapy, physical therapy, speech evaluation (if trouble swallowing)

At the postpartum follow up visits, the following should be assessed:
- Hospital discharge medication lists should be reconciled
- Contraception needs, in the context of serious adverse obstetric event[4]
- Offer Referral for mental health services [needs a introduction as to benefit]; esp if mental health screening positive
- Lactation/baby feeding needs
- Referral to postpartum support, including doula care, where available
- Important to mobilize a support system of family and/or community social services

Continue follow-up up to 1 year to assess for the following and make appropriate referrals as needed:
- Ongoing or later onset mental health needs. There may be overlap between PTSD symptoms, trauma-related PPD and PP anxiety, ICU-related trauma; additionally, cognitive challenges (sleep, memory and concentration disorders) may make some of the PP issues worse
- Follow-up testing at 1-2 moths after discharge: Sexual function[6], Urinary symptoms[6]

Post Severe Maternal Event: Overview of Support, Care Discussions, and Follow-up

Ongoing Care Discussions

Ongoing Updates with Patient and Family/Support Persons
- Identify a staff liaison to provide updates with partner/family during a surgical case
- Ensure that there is a daily opportunity for updates and questions with patient and supports persons
- Give advance notice for a more comprehensive Care Discussion prior to discharge

Comprehensive Pre-Discharge Care Discussion

Review: Guide for Pre-Discharge Care Discussion
Step 1. Assess patient understanding, what are your biggest concerns?
Step 2. Provide an over-arching description of the condition
Step 3. What happened to this specific patient.
Step 4. Pause for questions
Step 5. Review what to expect next

By Discharge

Review: Guide for Post-Discharge Care After a Severe Maternal Event
- Summary of Hospital Course (review example summary) given to patient and sent to OB, PCP, and specialists as appropriate.
- Schedule follow-up care within 1-2 weeks with OB, with others as needed. Identify key contact for immediate care if needed.
- Refer to a Postpartum/Trauma Support Group
- Referrals as needed for OT and PT care

Specific Post-Discharge Follow Up

Review: Guide for Post-Discharge Care After a Severe Maternal Event
- Note overlap with PTSD symptoms, trauma related depression, postpartum anxiety and ICU related trauma.
- Serial mental health assessments recommended for one year for depression, anxiety and PTSD with referral as needed
- Contraception needs, in the context of serious adverse obstetric event
- Mobilize a support system of family, community social services and/or Doula services

Appendix DD

Life after Experiencing Sepsis

Use this tool to learn what to expect and to identify topics you would like more information on.

Key points about Sepsis

- Sepsis is caused by an infection that can occur anywhere in your body. Sepsis can cause your body to respond to the infection in a way that can damage many different organs.
- The most common types of infection during pregnancy and postpartum are:
  - Infections of the uterus
  - Infections of the urinary tract
  - Wound infections including in the vagina
  - Pneumonia
- Sepsis can lead to disability or even death if untreated. Serious infections occur in 3-4 of every hundred pregnant women and sepsis occurs in 1-2 in every thousand pregnant or postpartum women and is the #2 cause of maternal death.
- A diagnosis of sepsis is an emergency and should be dealt with in a timely manner to prevent injury or death. Antibiotics, Intravenous fluids and medications are standard treatments for sepsis.

Physical Recovery

- Most birthing people recover from a sepsis without any effects. But some with sever sepsis may have long lasting issues such as kidney failure, breathing issues, complications of treatments and depression or anxiety.
- Continue to take any prescribed antibiotics, even if you are feeling better.

Bonding and feeding your newborn

- Because of the need to provide you with more intensive care, you may have been separated from your newborn while your condition was being stabilized. You may have missed out on skin-to-skin time and initial breastfeeding. However, you will still be able to bond with their baby and it's common for it to take time after a severe maternal event.
- Due to the physiologic and metabolic stress that your body has experienced, establishing breast feeding can be very difficult after a severe obstetric illness.
- If you are still hoping to breastfeed here is what you can do:
  - Talk to your healthcare team about being able to have your baby brought to you for skin to skin and bonding time.
  - Ask to meet with a Lactation Consultant to assist you with your unique breastfeeding needs. These services are also often available after discharge.
  - Request a breast pump with a demonstration so that you can establish your milk supply.
  - If your baby is in the Neonatal Intensive Care Unit, request that you receive daily updates on your newborn's condition and for photographs of your newborn be provided to you.

Appendix DD: Life After Experiencing Sepsis (Continued)

Emotional Recovery

- Up to 50% of sepsis survivors are left with a condition called Post-Sepsis Syndrome which includes:
  - Insomnia, difficulty getting to sleep or staying asleep
  - Nightmares, hallucinations and panic attacks
  - Muscle and joint pains
  - Overwhelming tiredness
  - Trouble concentrating
  - Decreased mental functioning
  - Loss of self-esteem and self-belief
- The "baby blues" and postpartum depression and anxiety can affect anyone. You may be more likely to have postpartum depression, anxiety or even post-traumatic stress disorder (PTSD) after a diagnosis of sepsis.
- Some symptoms of postpartum depression, anxiety and PTSD include:
  - Feeling low (depressed mood) or angry most days
  - Loss of interest in activities that you used to enjoy
  - Having trouble concentrating
  - Having trouble falling asleep or staying asleep
  - Anxiety or excessive worry
  - Loss of confidence or self esteem
  - Loss of appetite or overeating
  - Recurrent thoughts of suicide or death
  - Reliving the event
- If you have any of the symptoms listed above, contact your healthcare provider right away.

Call your healthcare provider

- If you have an incision (on your abdomen or vagina) that is not healing
- If you have increasing pain at the incision site or pain doesn't get better with prescribed pain medication
- If you have increased redness, drainage, or puss from any incision site
- If you have foul smelling bleeding from your vagina or incision site
- If you are urinating less than usual, or not at all.
- If you are breathing faster than normal, or your heart is beating faster than
- If you feel like something is wrong and you just don't feel right
- If you have questions or concerns about your condition or care
- If you become confused, sleepy or lethargic
- If your heart feels like it's racing or pounding
- If you are suddenly short of breath and feel lightheaded or have trouble breathing
- If you have sudden chest pain
- If you have thoughts of injuring yourself or your newborn

Some patients find it helpful to speak with their healthcare provider about the events surrounding their sepsis experience after they have had time to heal. Having this opportunity after you leave the hospital can help you fill in gaps of time you don't remember and allow for answers to questions that didn't come up until after you spent some time at home. If you would like an opportunity to meet with your healthcare provider, we encourage you to call his or her office to schedule an appointment when the time feels right to you. Be sure to let the scheduler or your provider's nurse know what information you would like to receive during the appointment, so that your healthcare provider can come prepared to answer your questions.

Appendix EE

Resources for Severe Maternal Event Survivors

These sites have a wealth of educational resources. We have included some very good sites from the UK and Australia for their educational value understanding that their referral sites are not relevant.

After Trauma: http://www.aftertrauma.org/

This site is meant to provide a community for survivors of traumatic injury and their families to support and connect with one another. Information and resources are also provided to help survivors and families on the recovery journey.

Birth Trauma Association: http://www.birthtraumaassociation.org.uk/

Resources on this site are meant to support women who have suffered difficult births by offering information, advice and peer support to all women who are finding it hard to cope with their childbirth experience.

Australian Birth Trauma Association: https://birthtrauma.org.au/downloadable-guides/

PDF resource guides for caregivers and families of survivors.

What is Birth Trauma?: https://birthtrauma.org.au/what-is-birth-trauma/

Clear definitions of the different types of birth trauma people can experience.

Postpartum Support International: http://www.postpartum.net/

The site provides links to information about perinatal mood and anxiety disorders, including risk factors, symptoms and treatments. Visitors to the site are able to identify local resources, chat with an expert or join an online support group. Highlights include resources for special groups such as military families, women of color, fathers, and more.

Prevention and Treatment of Traumatic Childbirth (PATTCh): http://pattch.org/

Information on this site helps explain the components of traumatic birth and describes the symptoms, risk factors, treatment and prevention of traumatic birth.

Make Birth Better: https://www.makebirthbetter.org/birth-trauma-support-for-parents

Resources on this UK site provide education and support for those who have experienced birth trauma.

Amniotic Fluid Embolism (AFE)

Amniotic Fluid Embolism Foundation: http://afesupport.org/

This site includes resources for family members (caregivers), survivors, and those who have experienced a loss related to Amniotic Fluid Embolism (AFE). Guides and resources help survivors and families from the crucial moments after AFE, through the hours, days and weeks following.

Appendix EE: Resources for Severe Maternal Event Survivors (Continued)

Preeclampsia/Eclampsia

Preeclampsia Foundation: https://www.preeclampsia.org/get-support

This site includes multiple resources on preeclampsia and other hypertensive disorders of pregnancy. Visitors can link with health experts for advice and connect with other preeclampsia survivors through the Community Forum or Share Your Story thread.

Hemorrhage

National Accreta Foundation: https://www.preventaccreta.org/accreta-resources

National Accreta Foundation helps connect placenta accreta, increta and percreta patients & families with resources and content of value to help navigate an accreta experience.

Sepsis

Begin Again Foundation: https://www.beginagainfoundation.com/

This site includes education and awareness resources for sepsis survivors and caregivers, financial assistance resources, and sepsis survivor stories.

End Sepsis, The Legacy of Rory Staunton: https://www.endsepsis.org/

END SEPSIS is primarily led by sepsis survivors and community members, providing templates for chapters to adopt nationally. This organization focuses on implementing national public health policies, public awareness campaigns and initiatives that improve the rapid identification and treatment of sepsis and increase public recognition of sepsis as a medical emergency.

Sepsis Alliance: https://www.sepsis.org/education/patients-family/

This site provides information and resources to help you better understand your or your loved one's sepsis diagnosis.

The UK Sepsis Trust: https://sepsistrust.org/get-support/support/

Lots of good information but referral resources are for residents of the United Kingdom (England).

Local Resources:

Please modify to include local birth trauma support groups or feel free to skip this section if not applicable.

Appendix FF: Guide to Recognizing Acute Stress Disorder in the Hospital Setting

Introduction

The Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition (APA, 2013) outlines the criteria for Acute Stress Disorder, beginning with the first criterion that a person must be exposed to actual or threatened death or serious injury; for many women, giving birth fits this standard. While some women can experience normal childbirth as traumatic, women who experience birth traumas such as postpartum hemorrhage and other complications are at an even greater risk of having a traumatic stress response following childbirth. In order to give postpartum women the services and support they need, it is imperative that healthcare professionals recognize the signs of Acute Stress Disorder, **note them accurately in the patient's chart**, and enlist the help of a mental health professional immediately. Because women who have experienced birth trauma must temporarily remain in the setting in which the trauma occurred (i.e., the hospital), it is vital that professionals recognize signs of traumatic stress early and provide necessary support.

Signs of Acute Stress Disorder

Symptom	Behavioral Signs	Support Needed
Intrusion Symptoms (Memories, dreams, flashbacks)	A woman can re-experience the birth trauma by having *involuntary* recurrent images, thoughts, illusions, dreams/ nightmares, and/or flashbacks related to the event. Intrusive symptoms can be a cause of sleep difficulty and can exacerbate symptoms of anxiety and depression (such as poor concentration, hyper vigilance, exaggerated startle response, and negative mood). Signs can include agitation upon waking and fitful sleep.	**Do:** If you suspect your patient is experiencing intrusive symptoms, consult with a mental health professional. Ask sensitive, open-ended questions about her current state, such as "I noticed you tossed and turned in your sleep last night. How was your sleep?" **Avoid:** Being insensitive, dismissive, or judgmental. Do not say things such as "it's over, just don't think about it," or "try to think happy thoughts before you fall asleep."

Continued on next page...

Appendix FF: Guide to Recognizing Acute Stress Disorder in the Hospital Setting (Continued)

Symptom	Behavioral Signs	Support Needed
Distress with Exposure to Stimuli	While still in the hospital, a postpartum woman who has experienced birth trauma will be surrounded by stimuli related to the event. Signs of distress can be physical (accelerated heart rate, perspiration) or can manifest as irritability, fear, or unwillingness to comply with requests; an exaggerated startle response to stimuli can be seen. Stimuli that can trigger distress include alarms/beeping or other sounds, medical instruments, medical professionals who were present during the trauma, bright lights, smells, and procedures.	**Do:** Recognize that your patient has experienced a jarring medical event and that it could have been traumatic for her. Many aspects of the hospital environment were present during her traumatic event, and she is still in this environment. Be sensitive and use a warm voice when providing instructions, etc. Do not force any intervention. If patient shows signs of significant distress, contact a mental health professional. **Avoid:** Forcing any procedure or saying things like "You just need to comply – it's for your own (or your baby's) good."
Negative Mood	Inability to experience positive emotions. The woman may show little to no joy during time with her baby or family. She may be detached or seem numb to the events happening around her; aloof; withdrawn. Women who have experienced birth trauma can feel a flood of different and sometimes conflicting emotions, including: Fear, sadness, terror, guilt, disappointment, happiness, anger, elation, joy, sorrow, embarrassment, and confusion. She may express these different emotions at times, or be overwhelmed by them and express nothing, seeming numb, cold, or detached.	**Do:** Gently "check in" with your patient, inquiring about how she is feeling (not only physically, but emotionally). Ask her if she would like to speak to someone about her feelings and try to normalize this for her (sometimes a woman might refuse because she feels a stigma for talking to a counselor). A woman can benefit from verbalizing her thoughts, feelings, and experiences about the trauma – if she feels safe in doing so. **Avoid:** Do not say things like: "Cheer up!" "Put on a happy face!" or "You should be glad or grateful that you survived/your baby survived/that the bad part is over." These only minimize the patient's feelings and could shame her into staying silent about her inner experiences.

Continued on next page...

Appendix FF: Guide to Recognizing Acute Stress Disorder in the Hospital Setting (Continued)

Symptom	Behavioral Signs	Support Needed
Dissociative Symptoms (altered sense of reality or disturbance in memory)	When dissociation occurs, it can seem like your patient is "out of it" or spacey, dazed, robotic, or confused about basic facts or her surroundings. Sometimes people lose concept of time (which can easily happen in the hospital setting). Some women might speak of an "out-of-body" experience, like floating above one's own body or seeing the procedures happening to them. When patients experience flashbacks, they may have significant distress after seeing images, reacting as if the event were actually occurring.	**Do:** Be calm and clear with your communication and be accurate when entering psychosocial comments in her records. Pay attention to her behaviors and document them appropriately. Dissociative symptoms exist on a continuum: your patient can seem a little dazed, or at the extreme, she can lose complete awareness of her surroundings. It is important to consult with a mental health professional immediately if you see signs of dissociation. **Avoid:** Minimizing or ignoring these symptoms or trying to distract your patient from these experience by suggesting she "just watch TV to get her mind off of it." Do not mistake dissociation for normal, compliant, or agreeable behavior. These are serious symptoms that need to be addressed by a mental health professional.
Avoidance Symptoms (Avoiding distressing memories/ thoughts/ feelings or external reminders of the event)	Women who have experienced birth trauma may attempt to avoid any memories or discussion about the birth experience or may try to avoid reminders of the experience. She may refuse certain procedures, parts of the hospital, people who were present during the trauma – and at the extreme – she may want to avoid spending time with the baby.	**Do:** Be sensitive to your patient's feelings, recognizing her current context. Stay focused on providing excellent care and be calm and direct when requesting compliance. While it is important to be supportive, it may also be necessary to challenge your patient to follow her plan of care. You may need to consult with a mental health professional. **Avoid:** Forcing your patient to comply, or to "face her fears" regarding specific reminders of the trauma. Statements such as "There is nothing to be afraid of!" or "You just have to do it!" are not supportive of your patient.

Continued on next page...

Appendix FF: Guide to Recognizing Acute Stress Disorder in the Hospital Setting (Continued)

Symptom	Behavioral Signs	Support Needed
Arousal Symptoms		
Sleep Disturbance	Insomnia is common following a trauma. Signs of high arousal following a birth trauma can include fitful sleep or inability to go to sleep, which can indicate nightmares or an overly-active sympathetic nervous system.	**Do:** Ask her how she slept, and if she is having any problems with both the amount and the quality of her sleep. **Avoid:** Assuming that because her eyes are closed, she is asleep. After a birth trauma, your patient may often need to lie quietly with her eyes closed – with little stimulation.
Poor concentration	Because of the intense stimulation and activation of the sympathetic nervous system that occurs during a birth trauma, a woman may have difficulty concentrating on cognitive tasks or stimuli. She may ask you to repeat information or instructions several times or seem aloof with medical professionals or family/friends.	**Do:** Be patient if you need to repeat information or instructions, recognizing her current emotional state. Ask her if she is having any difficulty concentrating, and if there is anything you can do to help. **Avoid:** Taking it personally or getting agitated/impatient if you have to alter your communication to meet her current needs.
Hyper vigilance and Exaggerated Startle Response	Because of a birth trauma, a woman can become hypersensitive to stimuli around her. As a result, her behaviors can become exaggerated in an attempt to detect threats in the environment. Her sympathetic nervous system was likely activated for an extended period of time during the trauma, and her instinct is to protect herself at signs of threat. A traumatized individual can react instantly to stimuli that might not bother others, such as sudden noises or movements. Signs of exaggerated startle response include jumping, flinching, shaking, and accelerated heart rate in response to stimuli such as sudden speech or movements by others, noises from hallway, alarms or beeping, and physical connection.	**Do:** Keep your movements careful. If you notice hyper vigilance and an exaggerated startle response in your patient, you should slow down your pace and be mindful of noise, bright lights, and effects of physical touch. Ask her about preferences and make accommodations if possible. This may include turning down alarms/monitors or dimming the lights. If you notice these symptoms, consult a mental health professional. **Avoid:** Doing "business as usual" when your patient is clearly negatively impacted by stimulation. Do not make off-hand remarks such as "Wow! Aren't you jumpy today!" or any other statement that would minimize her current state.

Continued on next page...

Appendix FF: Guide to Recognizing Acute Stress Disorder in the Hospital Setting (Continued)

General Suggestions

If your patient has experienced a birth trauma, she has been through a difficult, painful, and scary experience. If she experienced a postpartum hemorrhage or other serious complication, she may have felt close to her own death and feared for the wellbeing of her newborn. *While these situations require the help and guidance of a mental health professional*, there are ways that medical professionals can help support the healing of women who have experienced birth traumas.

A few general guidelines include:

- Maintain empathy. Remain cognizant of your patient's experience and of the many intense emotions she may be feeling;
- Communicate with warmth and patience;
- Stay focused on her treatment. Avoid engaging in sidebar conversations with other staff members;
- Minimize discomforts and harsh stimuli;
- Ask her how she is feeling – *emotionally*. Ask her if she would like to speak with someone; and
- Know the signs of Acute Stress Disorder and enlist the help of a mental health professional.

This appendix was adapted from the Improving Health Care Response Obstetric Hemorrhage: A California Quality Improvement Toolkit, funded by the California Department of Public Health, 2015; supported by Title V funds.

(Used with permission of Michelle Flaum, EdD, LPCC-S, Xavier University)

Appendix GG

Tell us if you
ARE PREGNANT *or*
HAVE BEEN PREGNANT
within the past 6 weeks

Come to the front of the line if you have:

- Persistent headache
- Visual change (floaters, spots)
- History of preeclampsia
- Shortness of breath
- History of high blood pressure
- Chest pain
- Heavy bleeding
- Weakness
- Severe abdominal pain
- Confusion
- Seizures
- Fevers or chills
- Swelling in hands or face

Improving Health Care Response to Obstetric Hemorrhage, a CMQCC Quality Improvement Toolkit, 2022