



Special Topics Report on Pregnancy-Related
Deaths Due to Sepsis in Ohio, 2008-2016

Ohio Department of Health 2020



Department
of Health

Table of Contents

Overview	2
Background on Sepsis in Pregnancy	2
PAMR Findings	3
Cause of Death	3
Demographics	5
Contributing Factors and Preventability	8
Vignette	10
Committee Recommendations	12
PAMR Initiatives	12
Summary	13
References	14

Overview

The Ohio Department of Health (ODH) established the Ohio Pregnancy-Associated Mortality Review (PAMR) to identify and review pregnancy-associated deaths with the goal of developing interventions to reduce maternal mortality, particularly for pregnancy-related deaths.

A pregnancy-related death is the death of a woman while pregnant or within one year of pregnancy from any cause related to or aggravated by the pregnancy or management, excluding accidental or incidental causes. A pregnancy-associated death is the broader category and includes the death of a woman while pregnant or anytime within one year of pregnancy regardless of cause.

The purpose of this PAMR special topics data brief is to supplement the comprehensive report, [A Report on Pregnancy-Associated Deaths in Ohio 2008-2016](#), with additional information on leading causes of pregnancy-related deaths.

Background on Sepsis in Pregnancy

Sepsis occurs when an infection causes an extreme reaction in the body to fight the infection, which can lead to tissue damage, organ failure, and death (Centers for Disease Control and Prevention (CDC), 2018). In the case of maternal sepsis, the infection may be related to the pregnancy (e.g. cesarean section) or may not be related (e.g. pneumonia) (Sepsis Alliance, 2017).

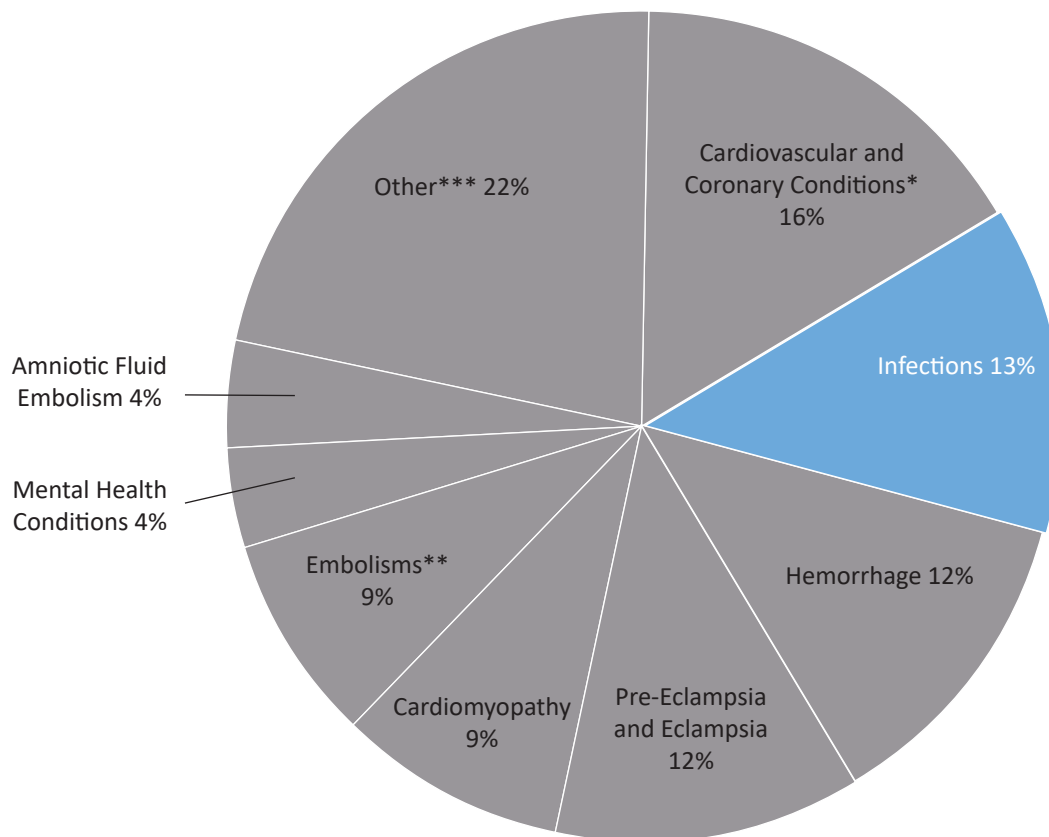
Maternal sepsis is a significant cause of maternal morbidity and mortality. Historically, in times prior to the discovery and use of antibiotics, nearly one half of all maternal deaths were due to infection (Society for Maternal-Fetal Medicine (SMFM), 2019). In Ohio, sepsis is the second-leading cause of pregnancy-related deaths. Sepsis, as a contributor to maternal mortality, is a leading cause both nationally (Hensley, 2019) and in other states such as California (Gibbs, 2020) and Michigan (Bauer, 2015). This a potentially preventable cause of death. However a key determinant for successful treatment of sepsis is timely identification and initiation of treatment (Kendle, 2019). The delay in these things most common occurs on the obstetric unit (SMFM, 2019).

PAMR Findings

Cause of Death

Figure 1 displays the underlying causes of 2008-2016 pregnancy-related deaths. Infections, which include sepsis, are the second-leading causes of death (n=25).

Figure 1: Underlying Causes of Pregnancy-Related Deaths by Leading Causes, Ohio 2008-2016



*Not including cardiomyopathy.

**Not including amniotic fluid embolism.

***Includes cerebrovascular accident, homicide, and others.

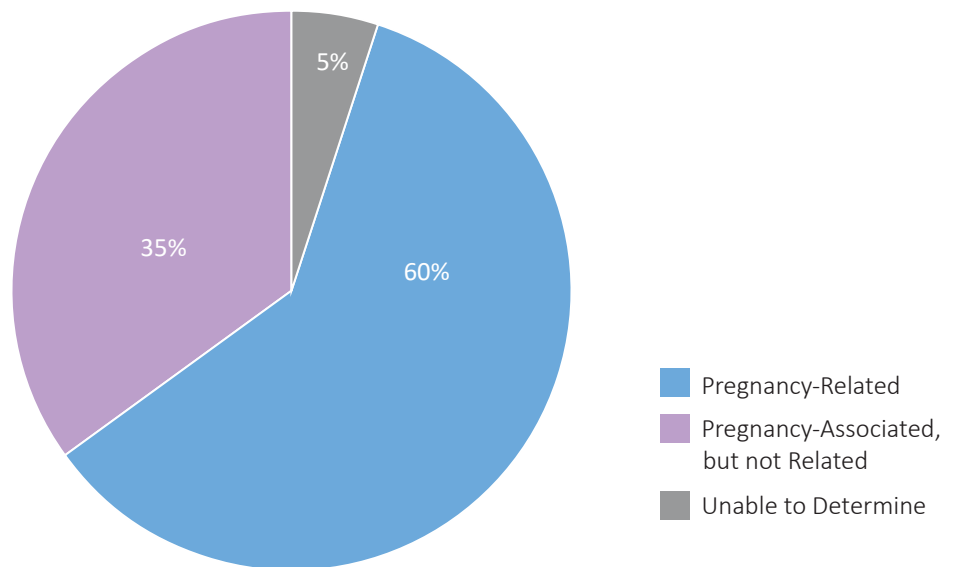
As highlighted in Table 1, among pregnancy-associated deaths due to infections, broken down by specific Pregnancy Mortality Surveillance System (PMSS)¹ cause of death, sepsis accounted for 20 deaths.

Table 1: Pregnancy-Associated Deaths Due to Infection by Specific Pregnancy Mortality Surveillance System (PMSS)¹ Cause of Death and Relatedness, Ohio 2008-2016

PMSS Cause of Death	Pregnancy-Related	Pregnancy-Associated, but not Related	Unable to Determine	Pregnancy-Associated (Total)
20.1 Postpartum Genital Tract (e.g. of the Uterus/Pelvis/Perineum/ Necrotizing Fasciitis)	2	0	0	2
20.2 Sepsis/Septic Shock	12	7	1	20
20.5 Non-Pelvic Infections (e.g. Pneumonia, TB, Meningitis, HIV)	8	6	1	15
20.9 Other Infections/NOS	3	1	0	4
Total	25	16	2	41

From 2008-2016 there were 20 pregnancy-associated deaths with underlying cause of death, sepsis, of which 12 (60%) were pregnancy-related as shown in Figure 2.

Figure 2: Pregnancy-Associated Deaths Due to Sepsis by Pregnancy-Relatedness, Ohio 2008-2016



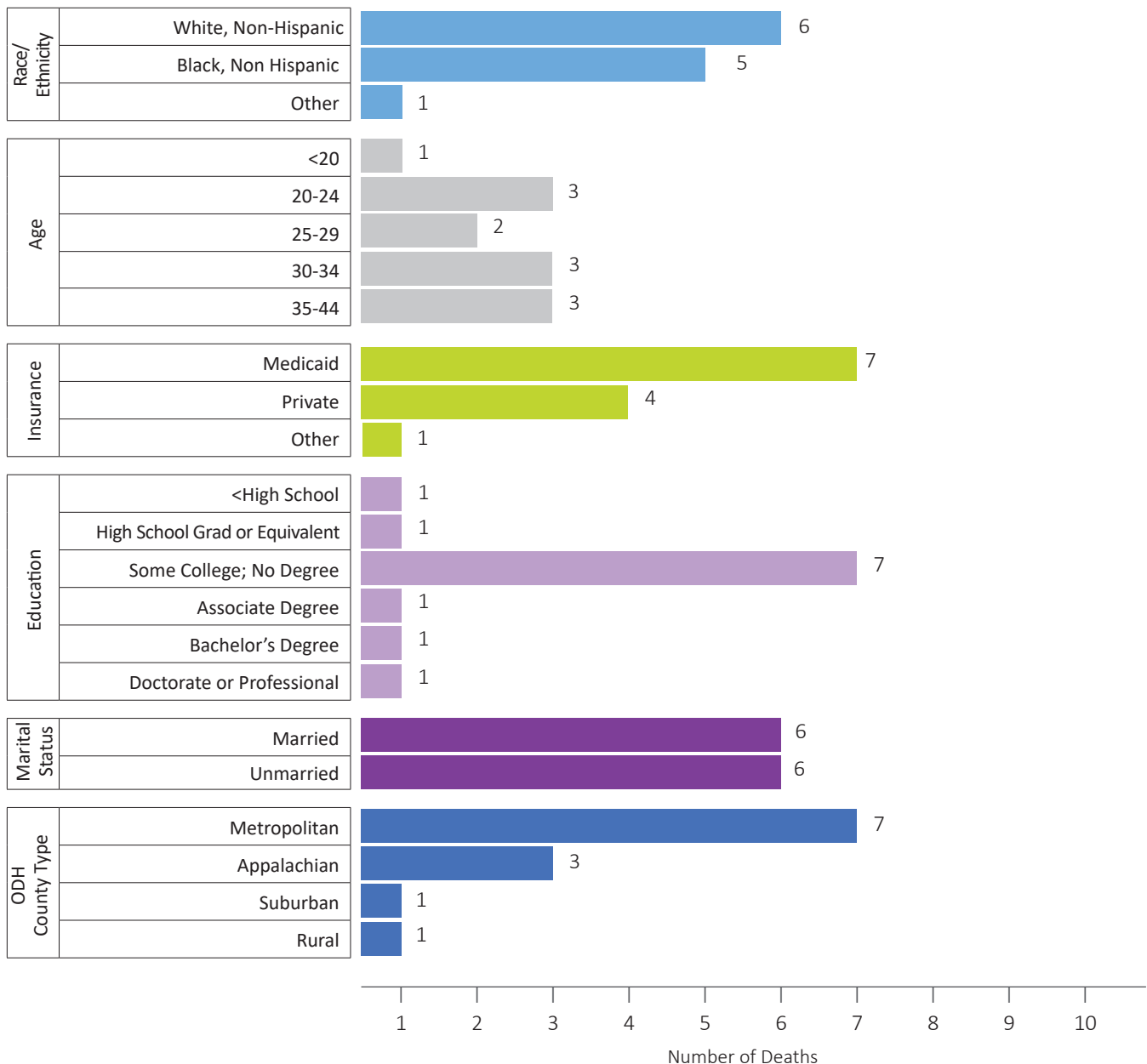
The data presented throughout the remainder of the report are restricted to the 12 deaths due to sepsis determined to be pregnancy-related.

¹ The Centers for Disease Control and Prevention (CDC) Pregnancy Mortality Surveillance System (PMSS) established underlying cause of death codes, which are a standard approach for classifying pregnancy-related deaths in a clinically meaningful way. The PAMR committee assigns a PMSS cause of death as part of the review. CDC PMSS: <https://www.cdc.gov/reproductivehealth/maternalinfanthealth/pregnancy-mortality-surveillance-system.htm>

Demographics

Figure 3 describes the demographic characteristics of the 12 women who died of pregnancy-related sepsis. Most deaths occurred among women with a high school diploma (or equivalent) and who lived in metropolitan counties. While slightly more deaths occurred to white, non-Hispanic women, there was a disproportionate number of deaths among non-Hispanic Black women, compared to the overall population.

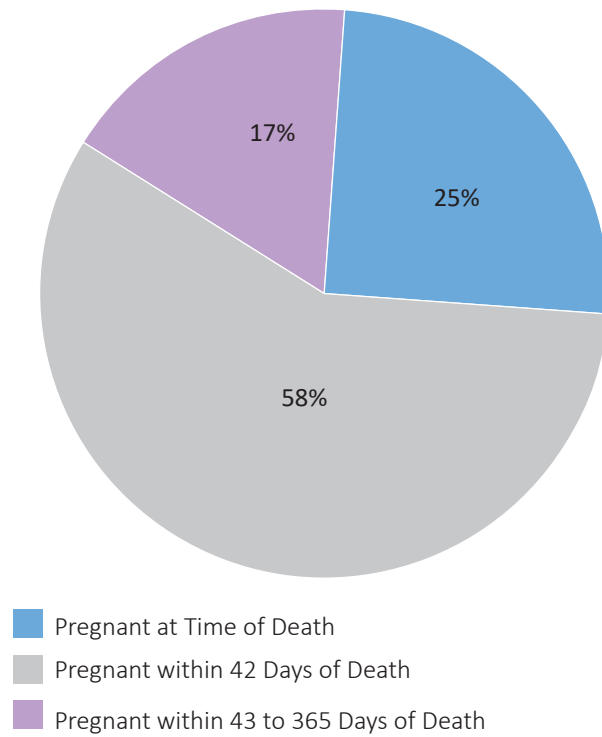
Figure 3: Number of Pregnancy-Related Deaths Due to Sepsis by Maternal Demographics, Ohio 2008-2016



Data interpretation example: The row for women aged 20-24 means that three of the 12 women who died of pregnancy-related sepsis occurred among women aged 20 through 24 years from 2008-2016.

As shown in Figure 4, pregnancy-related deaths due to sepsis occurred most frequently within 42 days of pregnancy (58%).

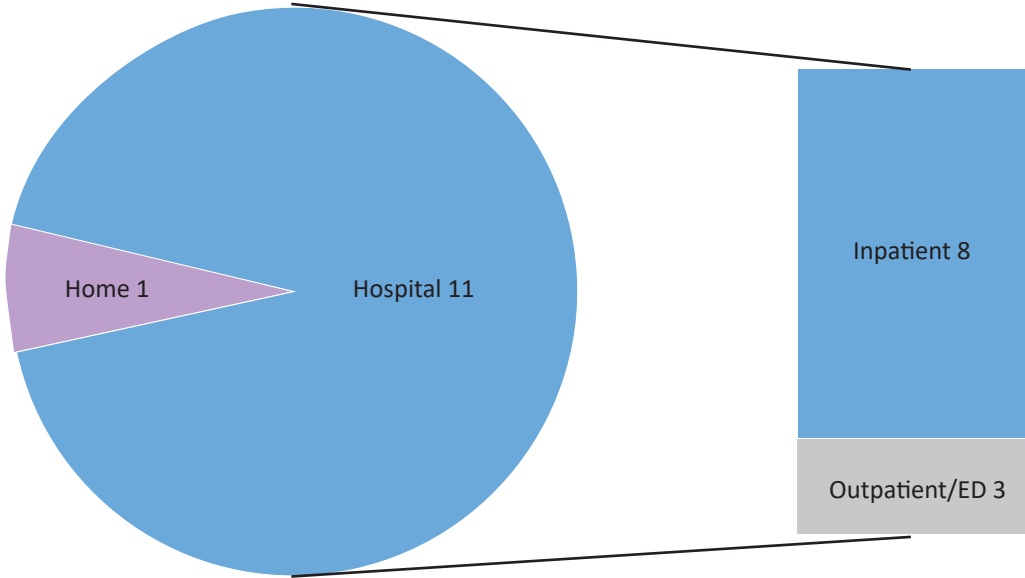
Figure 4: Timing of Death in Relation to Pregnancy, Among Pregnancy-Related Deaths due to Sepsis, Ohio 2008-2016



Note: The pregnant at time of death classification includes deaths that occurred the day of delivery.

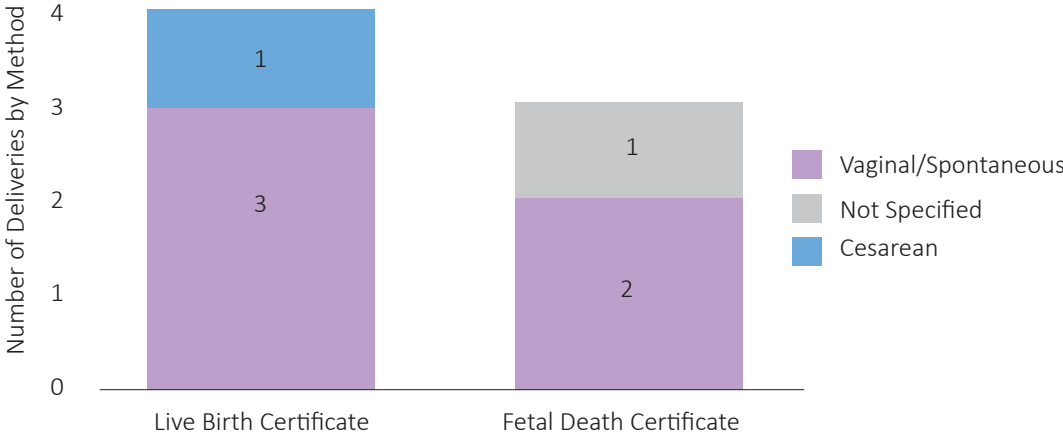
The majority of pregnancy-related deaths due to sepsis occurred in the hospital (92%). Figure 5 describes the place of death and specifies hospital location.

Figure 5: Pregnancy-Related Deaths Due to Sepsis by Place of Death, Ohio 2008-2016



In cases where the fetus is less than 20 weeks gestation or not extracted, the completion of a fetal death certificate is not required. Figure 6 describes the delivery methods by certificate type.

Figure 6: Pregnancy-Related Deaths Due to Sepsis with Linked Birth or Fetal Death Certificates by Certificate Type and Method of Delivery, Ohio 2008-2016



Contributing Factors and Preventability

For each case, the review committee identifies factors that contributed to the death. These factors include steps along the way that, if altered, may have prevented the woman’s death. The committee considers factors that operate at the following levels: *patient/family*, *health care provider*, *facilities* (where the woman sought care), and *systems* (that influence the lifestyle, care, and health services for the woman). Contributing factors are further broken down into classes, and dominant, representative themes.

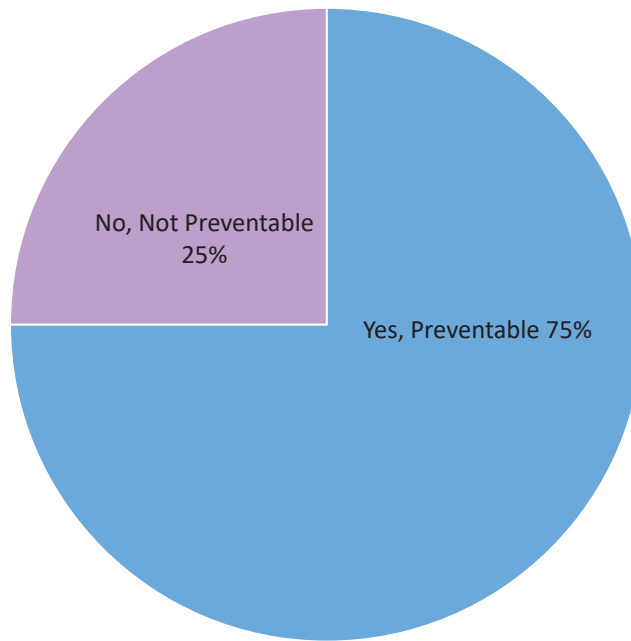
Table 2: Contributing Factors of Pregnancy-Related Deaths Due to Sepsis, Ohio 2008-2016

Patient/Family		
Factor Class	Count	Representative Themes
Chronic Disease	7	Hypertension, obesity
Adherence	2	Non-compliance
Mental Health Conditions	2	Anxiety and depression
Substance Use Disorder- Alcohol, Illicit/Prescription Drugs	2	Pre-existing substance use disorder
Environmental	1	Lack of financial resources
Delay	1	Delay or failure to seek care
Other	1	Cognitive impairment
Unstable Housing	1	Lack of stable housing
Provider		
Factor Class	Count	Representative Themes
Assessment	4	Failure to screen/inadequate assessment of risk
Knowledge	3	Use of ineffective treatment
Delay	2	Delay in or lack of diagnosis, treatment, or follow-up
Clinical Skill/Quality of Care	1	Inadequately trained or unavailable personnel
Outreach	1	Inadequate patient education
Referral	1	Failure to refer or seek consultation
System		
Factor Class	Count	Representative Themes
Clinical Skill/Quality of Care	2	Inadequately trained/unavailable personnel or services
Equipment/Technology	1	Inadequate or unavailable equipment/technology
Other	1	Unavailable or inadequate response by EMS

Note: No contributing factors related to facilities were identified among pregnancy-related deaths due to sepsis.

Prior to 2012, the committee did not consistently determine preventability, therefore Figure 7 displays preventability determination of 2012 through 2016 deaths. A death was considered preventable if the committee determines that there was at least some chance of the death being averted. Approximately 75% of pregnancy-related deaths due to sepsis were deemed preventable.

Figure 7: Preventability of Pregnancy-Related Deaths Due to Sepsis, Ohio 2012-2016



Vignette

Erica's Story — Overwhelming Infection in Pregnancy

“Erica” was a 25-year-old woman who had been pregnant four times resulting in three children and a miscarriage. She self-identified as non-Hispanic, Black. Her medical history was significant for morbid obesity (BMI=56.5).

Prenatal Period: Erica began prenatal care early at nine weeks gestation and had 12 prenatal visits.

Delivery Hospitalization: At 38 weeks and two days gestation, her water broke. Ten hours later, Erica delivered vaginally with no obstetric complications for herself or her infant. She was discharged home on the second postpartum day.

Postpartum Period: The next day (third day post-delivery) Erica felt ill and 911 was called. Although she had no fever, her blood pressure was low and heart rate was high. She weighed 350 pounds and required extra personnel and 43 minutes to ready her for transport. A large cuff was not available, which compromised evaluation of her blood pressure. She presented to the hospital nine minutes later. Erica was initially evaluated for hemorrhage since she was bleeding vaginally; there was a delay of several hours in identifying sepsis (damage to multiple organs caused by her body's attempt to fight an overwhelming infection) and beginning antibiotics. She died 18 hours after admission.

The death certificate cause of death was Group A Streptococcus sepsis and disseminated intra-vascular coagulation (excessive bleeding that uses up clotting factors). The manner was natural. The autopsy was done by a hospital pathologist.

Key Questions Answered by the Review Committee

Was the Death Pregnancy-Related?

Yes. Group A Streptococcal infection is a virulent cause of endometritis (uterine infection) related to child birth. Compared to women who aren't pregnant, pregnant and postpartum women are 20 times more likely to have severe Group A Streptococcal infection.

What was the Cause of Death?

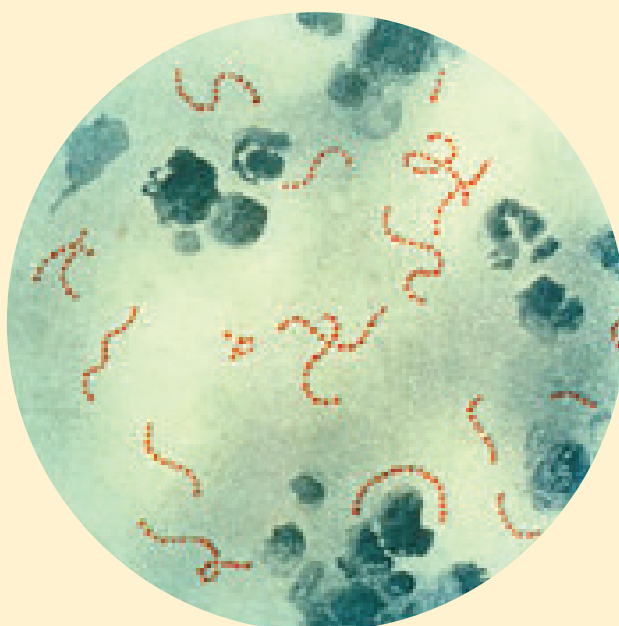
Infection. Approximately 85% of pregnancy-related Group A Strep infections occur in the postpartum period. These patients are likely to have had an upper respiratory tract infection prior to the infection in the reproductive tract. Contact with young children is a risk factor. Infection is the fourth-leading most common cause of pregnancy-related death in Ohio and the most common cause of death within 42 days after the end of pregnancy.

Was there Some Opportunity to Alter the Outcome?

Yes. Although the mortality rate for pregnant and postpartum women from this kind of infection is high (30-50%), had she received prompt treatment and supportive care, she might not have died.

What were the Factors that Contributed to this Death?	What are the Recommendations and Actions that Address those Contributing Factors?
Delay in Diagnosis (Systems Level)	Educate providers and patients on recognition, treatment, and prevention of sepsis: <ul style="list-style-type: none"> • All maternity units (includes operating room / recovery room / postpartum / emergency department) should adopt specific management plan for sepsis that includes: <ul style="list-style-type: none"> o Readiness (e.g. checklists, drills, huddles, and post event debriefings) o Recognition of at-risk patients o Institution of prevention strategies o Escalation of care, if needed o Monitoring of outcomes • Provide discharge education to patients on signs and symptoms that require attention • Partner with the Ohio Hospital Association Sepsis Network for prevention and management strategies
Use of Ineffective Treatment (Provider Level)	Encourage the use of known standards of care
Inadequate Emergency Medical Services (EMS) Response (Systems Level)	EMS should have equipment for and protocols for management of obese patients

Case is fictitious but based on real events



Committee Recommendations

As part of the review of each death, the committee identifies recommendations (including strategies and action steps) that may address factors that contributed to the death. Those recommendations were grouped into categories and themes.

Table 3: Committee Recommendations of Reviewed Pregnancy-Related Deaths Due to Sepsis, Ohio 2008-2016

Category	Themes
Quality of Care	Improve early pregnancy counseling and communicate risks.
	Perform sepsis screening according to sepsis protocol.
	Ensure emergency departments are equipped with necessary medications.
Protocols and Procedures	Improve communication between provider and coroner.
	Mandate facility review of all pregnancy-associated deaths.
	Create and follow a policy regarding EMS transport of pregnant women to an emergency department without OB care.
Provider Training	Equipment and transport simulation training with morbidly obese patients.
	Educate providers and patients on recognition, treatment, and prevention of sepsis.

PAMR Initiatives

ODH is implementing Urgent Maternal Warning Signs education in public health settings (e.g., WIC clinics, ODH Home Visiting sites, Healthy Start locations). This education focuses on teaching moms about severe symptoms that can occur during pregnancy or in the postpartum period and when to seek immediate care or schedule a follow-up appointment with their doctor. This work is aligned with the recently released campaign from the Council on Patient Safety (<https://safehealthcareforeverywoman.org/urgentmaternalwarningsigns/>). This project will be completed over a five-year period (2019 to 2024).

Emergency medicine staff and first responders are often the experts women turn to when they are experiencing acute distress during and after pregnancy. However, a survey of Ohio’s delivery hospitals found that only 30% of obstetric emergency simulations involve emergency department staff. A report from the ODH PAMR program also revealed that 23% of pregnancy-related deaths in Ohio from 2008-2016 occurred in an emergency department or in an outpatient setting. ODH, in conjunction with the Clinical Skills Education and Assessment Center at the Ohio State University Wexner Medical Center, will be conducting simulation training for emergency medicine providers. These trainings will be completed over the next five years (2019-2023) and will provide educational opportunities to increase knowledge and preparedness for obstetric emergencies and ultimately reduce preventable maternal morbidity & mortality in Ohio.

In quarter 3 of 2015, the Ohio Hospital Association (OHA) launched its statewide sepsis initiative in response to the OHA Board directed goal of a 30% reduction in statewide sepsis mortality. As a component of the 2019-2021 OHA Strategic Plan, the statewide sepsis initiative continues its efforts to reduce sepsis mortality to a rate of 14.9% by the end of 2021.

The statewide initiative utilizes the strategies of:

- Early recognition
- Early, appropriate intervention

Key tactics within this initiative include, but are not limited to:

- Collect, analyze, monitor, and report sepsis mortality-related data, including incidence, mortality (present-on-admission (POA) and not present-on-admission (non-POA)), admission sources, length of stay, readmission, progression, and three-hour bundle compliance.
- Design and provide pertinent monthly, evidence-based continuing education programs addressing current trends in sepsis care leveraging regional, state, and national subject matter experts.
- Collaborate with provider groups and other state and national quality initiatives.
- Assess and address health care provider needs related to the timeliness and accuracy of diagnosing sepsis.
- Target efforts toward early and appropriate treatment of non-POA sepsis.

OHA has collaborated with partners and stakeholders throughout the continuum of care to address sepsis-related issues, including maternal sepsis. For example, the following maternal sepsis educational program was facilitated:

Obstetric Sepsis and Simulation Training on April 20, 2016 from 11:30am-12:30pm

Panelists: Cynthia S. Shellhaas, MD, MPH- The Ohio State University Wexner Medical Center and Stephen F. Thung, MD- The Ohio State University Wexner Medical Center

Slides may be accessed [here](#). Webcast Recording may be accessed [here](#).

If you have any questions related to the statewide sepsis mortality reduction initiative, please contact James Guliano, MSN, RN, NPD-BC, FACHE – Vice President, Quality Programs at the Ohio Hospital Association at james.guliano@ohiohospitals.org.

You are encouraged to visit the OHA Sepsis website to access a repository of enduring resources including educational webcasts and corresponding slides, toolkits, and articles of interest.

Summary

Initiating and sustaining a robust maternal mortality review committee is the key to improving surveillance of maternal deaths by understanding trends, causes, contributing factors, and preventive steps for maternal mortality. PAMR continues to comprehensively review deaths with the goal of developing recommendations and strategies to prevent these tragic events moving forward.

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