



# Special Topics Report on Pregnancy-Related Deaths Due to Pre-eclampsia and Eclampsia in Ohio, 2008-2016

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Department  
of Health

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## 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 Pre-eclampsia and Eclampsia

As defined by the American College of Obstetricians and Gynecologists (ACOG), “pre-eclampsia is a syndrome that chiefly includes the development of new-onset hypertension in the second half of pregnancy”; “eclampsia is the presence of new-onset grand mal seizures in a woman with pre-eclampsia” (ACOG, 2013). Pre-eclampsia affects at least 5 to 8% of pregnancies, and proper prenatal care is essential for diagnosis and management (Preeclampsia Foundation, 2019).



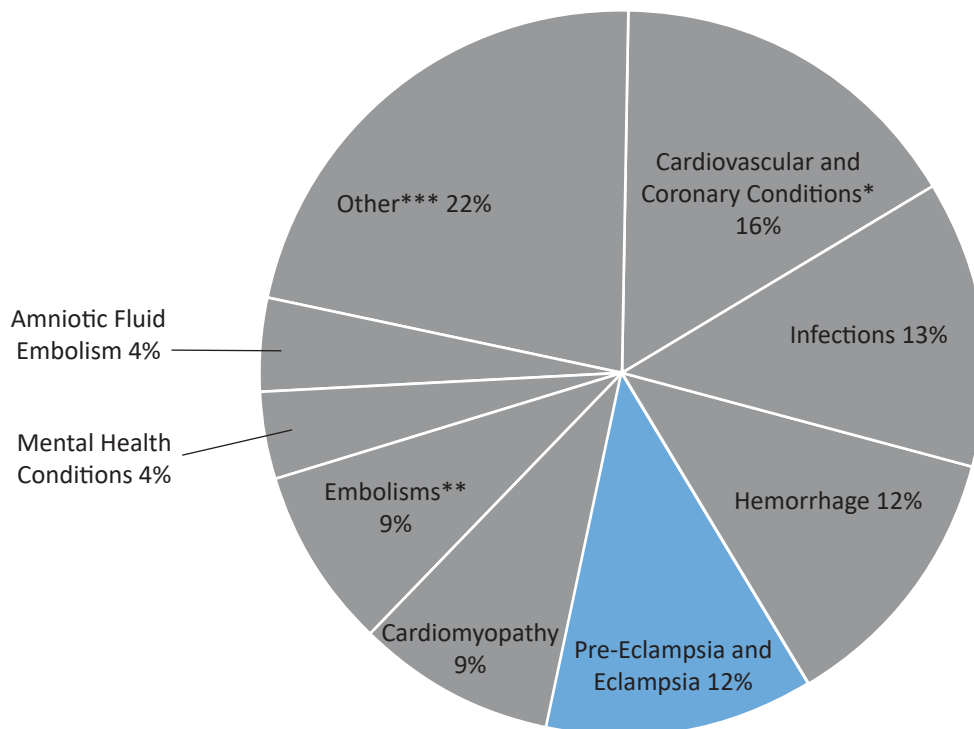
## PAMR Findings

### Cause of Death

Figure 1 displays the underlying causes of 2008-2016 pregnancy-related deaths. Pre-eclampsia and eclampsia and hemorrhage were tied for the third leading single causes of death (n=22).

From 2008-2016 there were 22 pregnancy-associated deaths with Pregnancy Mortality Surveillance System (PMSS)<sup>1</sup> cause of death, pre-eclampsia or eclampsia, of which 100% were pregnancy-related.

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

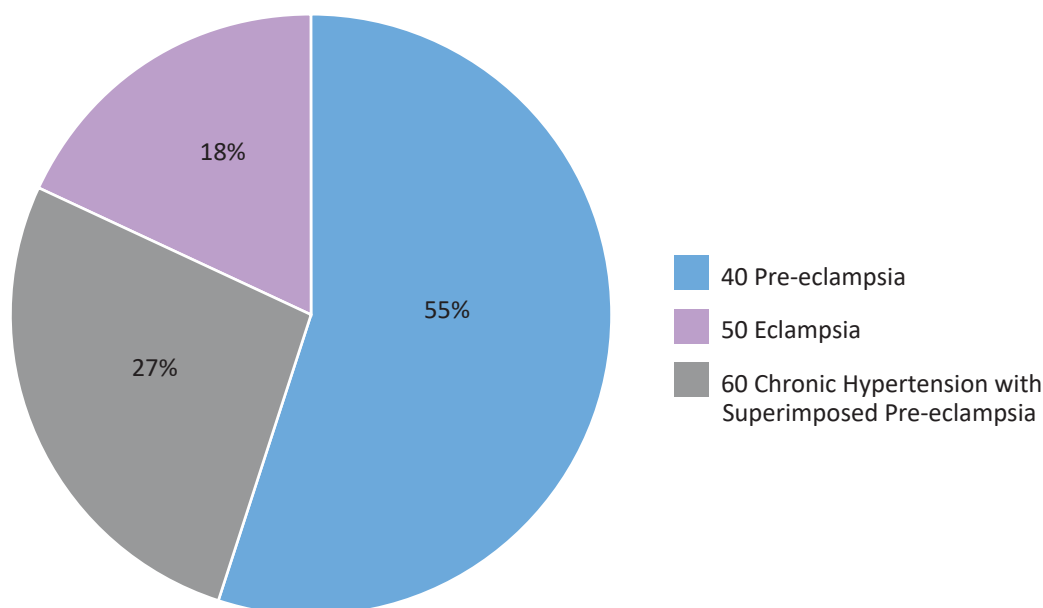
<sup>1</sup> The Centers for Disease Control and Prevention (CDC) Pregnancy Mortality Surveillance System (PMSS) established underlying cause of death codes, which are a standard approach for classifying pregnancy-related deaths in a clinically meaningful way. The PAMR committee assigns a PMSS cause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

Table 1: Pregnancy-Associated Deaths Due to Pre-eclampsia or Eclampsia by Specific Pregnancy Mortality Surveillance System (PMSS) 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)
40 Pre-eclampsia	12	0	0	12
50 Eclampsia	6	0	0	6
60 Chronic Hypertension with Superimposed Pre-eclampsia	4	0	0	4
Total	22	0	0	22

Among pregnancy-related pre-eclampsia and eclampsia deaths, broken down by specific Pregnancy Mortality Surveillance System (PMSS) cause of death, pre-eclampsia was the most common at 55%, followed by eclampsia (27%), and chronic hypertension with superimposed pre-eclampsia (18%).

Figure 2: Pregnancy-Related Deaths due to Pre-eclampsia or Eclampsia by Pregnancy Mortality Surveillance System (PMSS) Cause of Death, Ohio 2008-2016

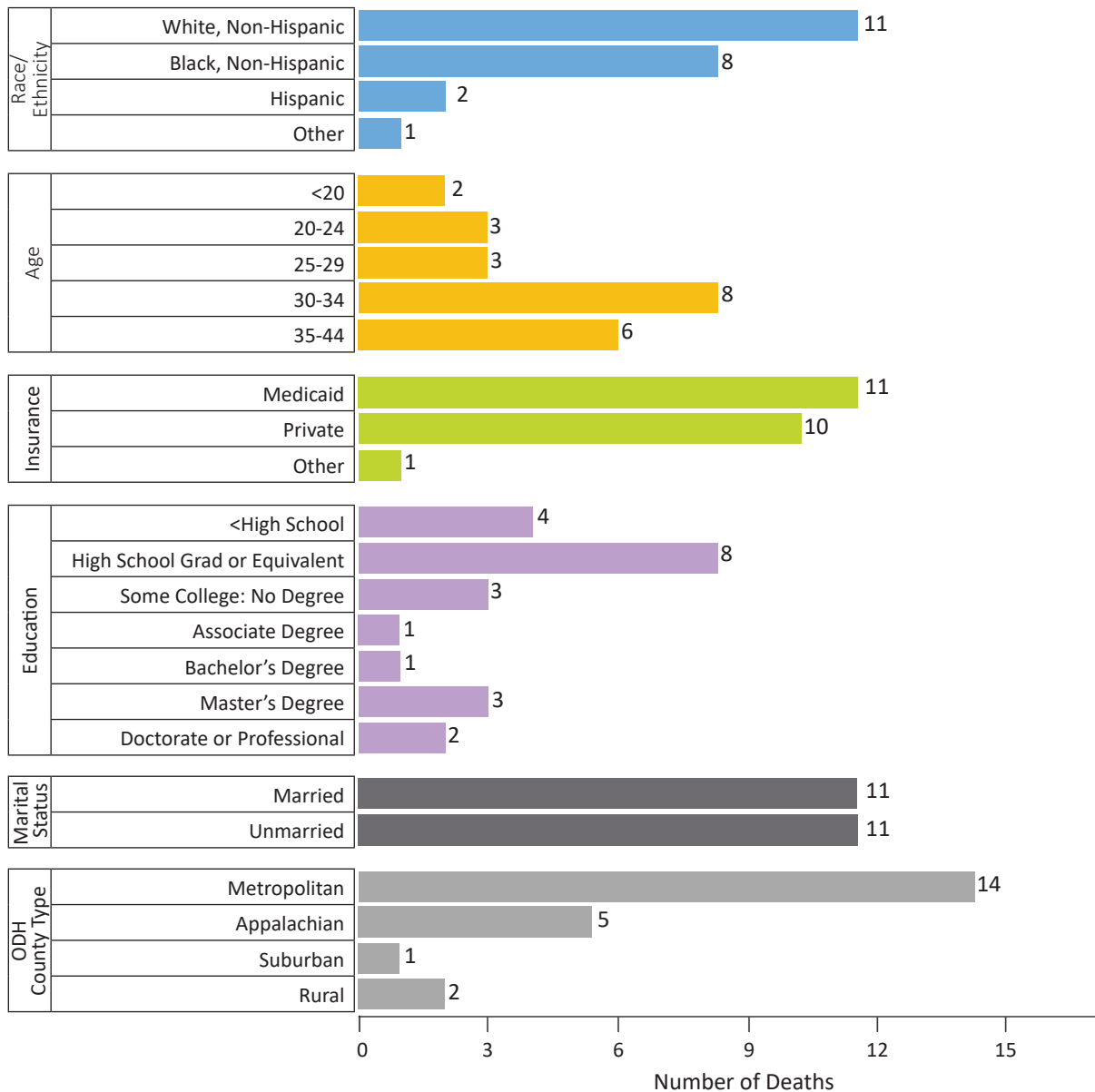


The pregnancy-related mortality ratio (PRMR) is defined as the number of pregnancy-related deaths per 100,000 live births. Given the 22 pregnancy-related deaths due to pre-eclampsia and eclampsia from 2008-2016, the PRMR is 1.7, meaning Ohio women experienced pregnancy-related deaths due to pre-eclampsia and eclampsia at a rate of 1.7 deaths per 100,000 live births.

## Demographics

Figure 3 describes the demographic characteristics of the 22 women who died of pregnancy-related pre-eclampsia or eclampsia. Most deaths occurred among women aged 30 to 34, with a high school diploma (or equivalent), who were non-Hispanic white, and who lived in metropolitan counties. While most deaths were among non-Hispanic white women, there is a disproportionate number of deaths among non-Hispanic black women, compared to the overall population.

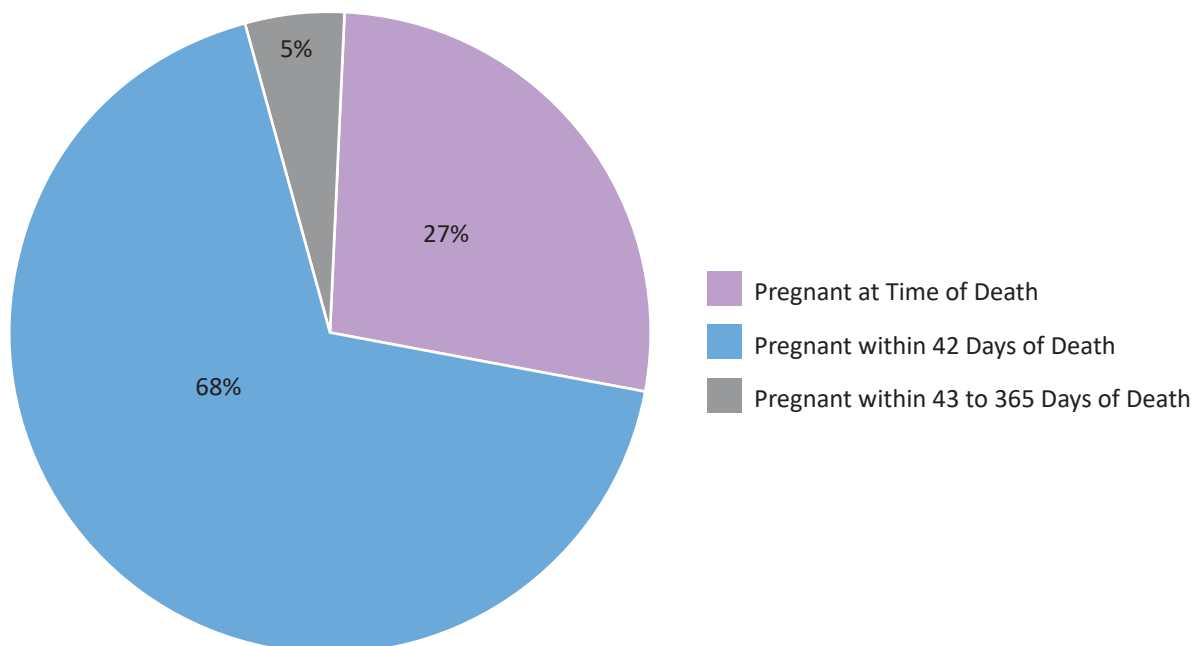
**Figure 3: Pregnancy-Related Deaths Due to Pre-eclampsia and Eclampsia by Maternal Demographics, Ohio 2008-2016**



Data interpretation example: The row for metropolitan means that 14 of the 22 women who died of pregnancy-related pre-eclampsia and eclampsia occurred among women residing in metropolitan counties, by ODH county type, from 2008-2016.

As shown in Figure 4, pregnancy-related deaths due to pre-eclampsia and eclampsia varies by timing with the majority pregnant within 42 days of death (68%).

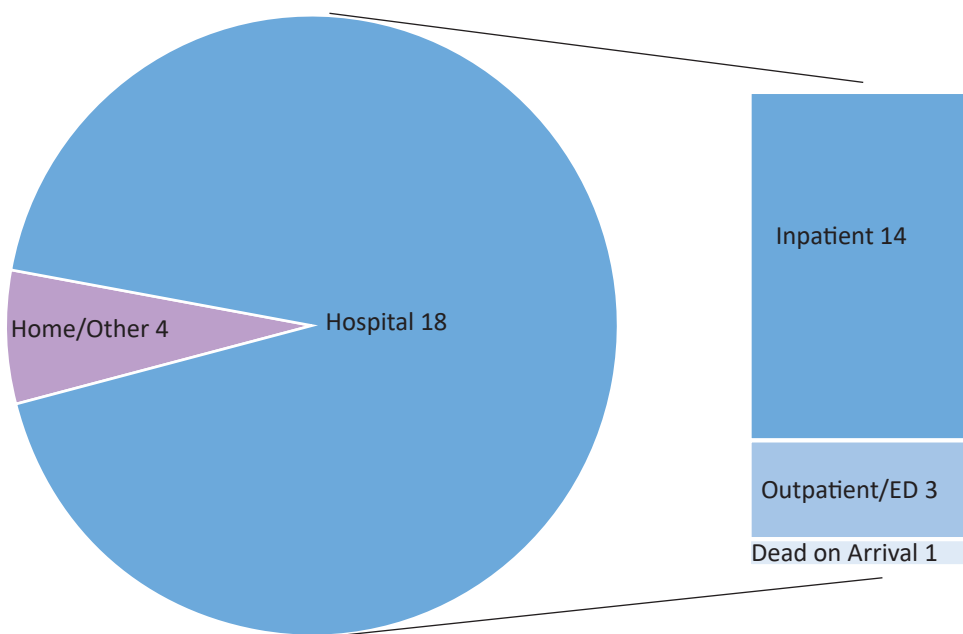
**Figure 4: Pregnancy-Related Deaths due to Pre-eclampsia and Eclampsia by Timing of Death in Relation to Pregnancy, Ohio 2008-2016**



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

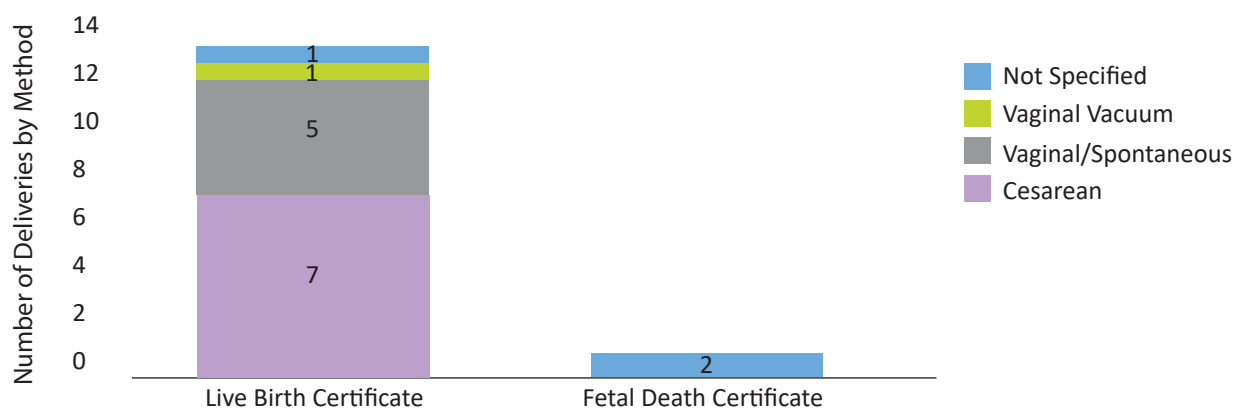
The majority of pregnancy-related deaths due to pre-eclampsia and eclampsia occurred in the hospital (82%). Figure 5 describes the place of death and specifies hospital location.

**Figure 5: Pregnancy-Related Deaths Due to Pre-eclampsia and Eclampsia by Place of Death, Ohio 2008-2016**



Among the 22 pregnancy-related deaths due to pre-eclampsia and eclampsia, 13 linked live birth certificates and one linked fetal death certificates were obtained, which document method of delivery. 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 Pre-eclampsia and Eclampsia 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 Pre-eclampsia and Eclampsia, Ohio 2008-2016**

Patient/Family		
Factor Class	Count	Representative Themes
Chronic Disease	9	Obesity, other chronic medical conditions.
Knowledge	7	Lack of knowledge of treatment or follow up, lack of knowledge regarding importance of event.
Adherence	4	Non-adherence with medical recommendations.
Delay	4	Delay or failure to seek care, delay or failure to seek prenatal care.
Social Support/Isolation	1	
Substance Use Disorder - Alcohol, Illicit/ Prescription Drugs	1	Alcohol use.
Tobacco Use	2	
Provider		
Factor Class	Count	Representative Themes
Delay	10	Delay in or lack of diagnosis, treatment, or follow up.
Assessment	7	Failure to screen, inadequate assessment for risk, use of ineffective treatment.
Knowledge	6	Use of ineffective treatment, delay in or lack of diagnosis, treatment, or follow up, failure to refer or seek consultation.
Referral	5	Failure to refer or seek consultation.
Clinical Skill/Quality of Care	4	Use of ineffective treatment, inadequate preconception counseling.
Continuity of Care/Care Coordination	3	
Other	3	Use of ineffective treatment, misdiagnosis.
Communication	2	Lack of communication between providers.

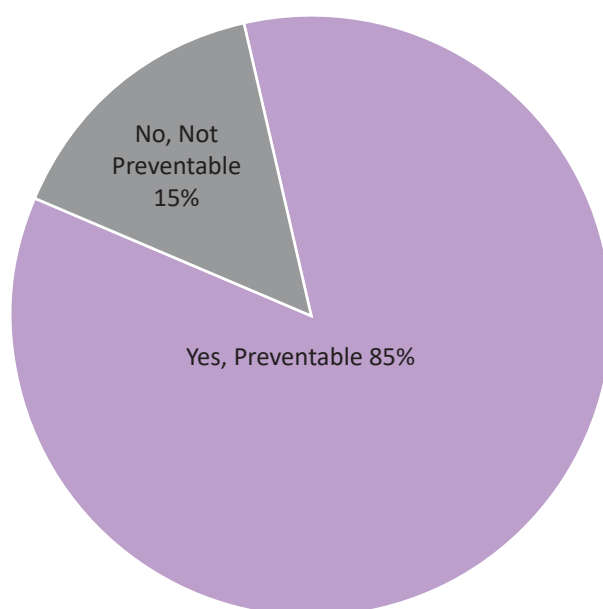


Table 2: Contributing Factors of Pregnancy-Related Deaths Due to Pre-eclampsia and Eclampsia, Ohio 2008-2016 (continued)

System		
Factor Class	Count	Representative Themes
Continuity of Care/Care Coordination	5	Case coordination/management.
Access/Financial	4	Barriers to accessing care: insurance, provider shortage, transportation, and inadequate facilities.
Clinical Skill/Quality of Care	1	Inadequately trained/unavailable personnel or services.
Communication	1	
Equipment/Technology	1	Inadequate or unavailable equipment/technology.
Knowledge	1	Inadequately trained personnel.
Personnel	1	Inadequately trained personnel.
Policies/Procedures	1	

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. Among all causes of death, preventability was highest among pre-eclampsia and eclampsia deaths, with 85% determined preventable.

Figure 7: Preventability of Pregnancy-Related Deaths Due to Pre-eclampsia and Eclampsia, Ohio 2012-2016



### Jennifer's Story - Hypertension in Pregnancy

*Jennifer* was a 32- year-old woman in her second pregnancy. She was a healthy woman who started prenatal care early and had regular visits. Her first pregnancy ended in a miscarriage.

**Delivery Hospitalization:** At 36 weeks pregnant, she went to her prenatal care visit and was found to have high blood pressure. She was sent to her local, small hospital for further evaluation. When she arrived at Labor and Delivery, it was very busy and she sat in the waiting area for over an hour. The hospital did not receive a message from her doctor's office about why she was sent to the hospital.

On evaluation, she complained of a severe headache. Her first blood pressure was markedly elevated at 195/122. She did not receive medication to treat her high blood pressure for another two hours. Bloodwork was done and was consistent with a diagnosis of pre-eclampsia. She continued to have dangerously high blood pressures. During the hours after she arrived at the hospital, she went from knowing where she was and why she was in the hospital to not knowing either of these. She underwent an emergency cesarean section about five hours after arrival at the hospital. The baby did well.

**Postpartum Period:** Immediately after delivery she had a CT scan of the head that showed bleeding in the brain. She was transferred to another hospital with a higher level of care, where she underwent two surgeries to relieve pressure in the brain and remove the blood which was now a clot. Her condition continued to worsen. She died three days after delivery.

### Key Questions Answered by the Review Committee

#### *Was the Death Pregnancy-Related?*

Yes. Pre-eclampsia only occurs during pregnancy.

#### *What was the Cause of Death?*

Pre-eclampsia which complicates 2 to 8% of pregnancies globally (ACOG, 2019). Pre-eclampsia is not only one of the leading causes of maternal and perinatal mortality worldwide but is the third leading cause of pregnancy-related deaths in Ohio.

#### *Was there Some Opportunity to Alter Outcome?*

Yes; the review team evaluated the opportunity as strong. The reason to treat severe high blood pressure is to prevent maternal problems such as heart failure, heart attack, kidney damage, and stroke that may include a brain bleed. Drugs to treat severe high blood pressure should be administered quickly, within 30 to 60 minutes (ACOG, 2019).

What were the Factors that Contributed to this Death?	What are the Recommendations and Actions that Address those Contributing Factors?
Delay in, or lack of, diagnosis, treatment or follow up.	<p>Facilities should implement the AIM Hypertension Bundle and utilize quality improvement principles to optimize use.</p> <p>Facilities should adhere to state mandated guidance on prenatal transfer of patients to the appropriate maternal level of care (ACOG SMFM, 2015).</p>
Use of ineffective treatment.	Providers should participate in regular multi-disciplinary simulation training for obstetric emergencies.
Lack of communication between providers.	Facilities should have policies in place for clinical handoffs—between in-patient and out-patient providers as well as providers of different services.



## 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 Pre-eclampsia and Eclampsia, Ohio 2008-2016**

Category	Themes
Patient Education	Optimize preconception planning.
	Opportunity for reproductive planning.
Protocols and Procedures	Follow hypertension policy guidelines.
	Create and follow a protocol to transfer to a tertiary care center.
	Utilize urgent alerts to healthcare providers.
	Perform pre-eclampsia and eclampsia screening according to pre-eclampsia and eclampsia protocol.
	Improve discharge instructions using AWHONN's Post-Birth Warning Signs Education Program.
Provider Training	Simulation trainings for pre-eclampsia and eclampsia emergencies.
	Education regarding pre-eclampsia.
	Training for prenatal care and inpatient blood pressure management.
	Educate providers on recognition, treatment, and prevention of obstetric complications by encouraging the adoption of corresponding patient safety bundles.
	Improve education regarding super imposed pre-eclampsia versus chronic hypertension exacerbation.
Quality of Care	Improve early pregnancy counseling and communicate risks to patients.
	Optimize care for mental health issues. Restructure mental health systems and increase funding.
	Prenatal providers should intervene when pre-eclamptic signs/symptoms start and take appropriate action.
	Optimization of preconception planning.
Treatment	More aggressive management of symptoms.
	More timely follow up with primary care provider.
	Need for intensive alcohol abuse treatment.
	Optimize care for mental health issues.

## What is the Anticipated Impact of those Actions if Implemented?

Statewide quality improvement projects in California (Gupta, et al., 2018) and Illinois have demonstrated the ability to standardize and implement early treatment of hypertensive urgency to great maternal benefit. California developed its own toolkit and Illinois (King, et al., 2018) utilized the Alliance for Innovation on Maternal Health (AIM) Hypertension bundle.



## PAMR Initiatives

ODH and PAMR support Ohio hospitals in implementing the best practices recommended by the Alliance for Innovation on Maternal Health (AIM). Starting in 2019, PAMR contracted with The Ohio State University (OSU) to pilot implementation of the Alliance in Innovation in Maternal Health (AIM) hypertension bundle in one urban and two rural delivery hospitals. The pilot will be ongoing through 2021. Concurrently, PAMR expanded this pilot program to implement the AIM hypertension bundle statewide, with an emphasis on hospitals that see a high proportion of minority patients.

This project will be done over a five-year period (2019-2023). PAMR is raising awareness of Urgent Maternal Warning Signs through public health providers. Warning signs education can help new mothers recognize signs of postpartum complications of hypertensive disorders of pregnancy. They are then able to seek medical advice early and be treated immediately. This project will be done over a five-year period (2019-2023).

Finally, PAMR will expand previously completed (2014-2017) simulation training to low resource hospitals to prepare for obstetric emergencies. The new emergency simulation training will be completed over the next five years (2019-2023) among emergency medicine providers and will include emergency scenarios for pre-eclampsia. The trainings will focus on areas with high proportions of women who are black, living in Appalachia, or insured by Medicaid.

## 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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