

Maternal Safety: Best Practices in Hypertension



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Executive Summary

Between 2008 and 2016, Ohio women died from pregnancy-related causes at a rate of 14.7 per 100,000 live births.¹ In addition, severe maternal morbidity (SMM) affects women at a much higher rate, occurring in 143 per 10,000 deliveries in 2013.² The Ohio Department of Health's (ODH) Pregnancy-Associated Mortality Review (PAMR) indicates that 57% of pregnancy-related deaths are preventable.¹ Preeclampsia and eclampsia were the leading cause of maternal death in 12% of pregnancy-related deaths during this period, a mortality ratio of 1.7 per 100,000 live births, with preventability for hypertensive disorders of pregnancy determined to be 85%.¹

Health Disparities

There are significant disparities in SMM and mortality in Ohio. From 2008 to 2016, the pregnancy related-mortality ratio (PRMR) was 29.5 for Black women and 11.5 for white women. Black women also experienced SMM at a higher rate, 210 per 10,000 deliveries, when compared to white women, 124 per 10,000 deliveries.¹ In addition, mothers covered by Medicaid were over two times more likely to die from a pregnancy-related death than mothers covered by private insurance. From 2008 to 2016, mothers with Medicaid coverage had a PRMR of 22.2 and mothers with private insurance had a PRMR of 9.4.¹

About the Ohio Maternal Safety Quality Improvement Project

To address the issues of severe maternal morbidity and mortality due to hypertensive disorders of pregnancy and their contributing factors, the Ohio Department of Health, in collaboration with The Ohio State University Wexner Medical Center, University Hospitals Cleveland Medical Center, MetroHealth Medical Center, Ohio Hospital Association (OHA), the Ohio Perinatal Quality Collaborative (OPQC) and the Ohio Colleges of Medicine Government Resource Center (GRC), has initiated the Maternal Safety Quality Improvement Project (QIP), funded by the Health Resources and Services Administration (HRSA). The project aims to reduce the rate of hypertension-related maternal morbidity and mortality in Ohio for pregnant and postpartum women. The SMART aims for the work are:

1. Reduce the rate of severe maternal morbidity (SMM) across Ohio in pregnant and postpartum women related to HTN* by 20% by September 2024.
2. Reduce the rate of maternal mortality in pregnant and postpartum women with HTN* across Ohio from X% to X% by September 2024.
3. Reduce disparities in maternal morbidity and mortality with HTN* across Ohio by 25% by September 2024.

** Includes chronic HTN, gestational HTN, preeclampsia, eclampsia, or preeclampsia superimposed on pre-existing HTN*

The Maternal Safety QIP utilizes quality improvement science to achieve the SMART aims and reduce maternal morbidity and mortality throughout the project implementation period. Utilizing a modified version of the Institute for Healthcare Improvement (IHI) Model for Improvement³ participating sites will form a project team and develop rapid feedback Plan-Do-Study-Act cycles to test interventions designed to equip providers with best clinical practices to provide care to pregnant and postpartum mothers.

This toolkit was developed by the project team, based on the Alliance for Innovation on Maternal Health's Severe Hypertension in Pregnancy patient safety bundle, to inform best clinical practices.

Introduction to the Model for Improvement and PDSAs

The Model for Improvement is a powerful tool for accelerating improvement. The model is not meant to replace change models that organizations may already be using, but rather to accelerate improvement. The model has three fundamental questions. The third question relates to the Plan-Do-Study-Act (PDSA) cycle, which tests changes in real work settings. The PDSA cycle guides the test of a change to determine if the change is an improvement.

Step 1: Form a Project Team

Having the right people on a quality improvement team is essential. Teams can vary in size and composition based on the organization and the complexity of the improvement effort. An effective team includes a Project Champion, someone in a leadership position who can get buy-in from staff members required for change to occur. The Project Champion may represent the following:

- Organizational Leadership
- Program Expertise
- Day-to-Day Leadership

Step 2: Set Aims

“What are we trying to accomplish?”

For example: The SMART aims for the Maternal Safety QIP are to:

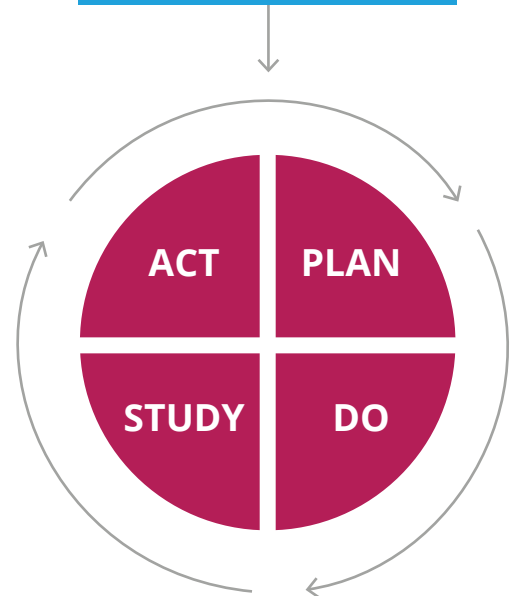
1. Reduce the rate of severe maternal morbidity (SMM) across Ohio in pregnant and postpartum women related to HTN by 20% by September 2024.
2. Reduce the rate of maternal mortality in pregnant and postpartum women with HTN across Ohio from X% to X% by September 2024.
3. Reduce disparities in maternal morbidity and mortality with HTN across Ohio by 25% by September 2024.

Once you know your organization’s data, these aims can be adapted for your setting.

What are we trying to accomplish?
(AIM)

How do we know the change is an improvement?
(Measures)

What changes can we make that will result in improvement?
(PDSA Results)



Step 3: Establish Measures

“How will we know that a change is an improvement?”

Process Measures	
<ul style="list-style-type: none">• Timely Blood Pressure Treatment• Appropriate Medical Management• Discharge Education Materials	<ul style="list-style-type: none">• Follow-up Appointment Scheduled• Follow-up for Patient with Rx• Postpartum Bundle Implementation
Balancing Measures	
<ul style="list-style-type: none">• Mean Arterial Pressure (MAP) Decrease• Fetal Heart Rate (FHR) Deterioration – MAP Decrease	<ul style="list-style-type: none">• Fetal Heart Rate (FHR) Deterioration
Outcome Measures	
<ul style="list-style-type: none">• HTN-related and cardiovascular-related Severe Maternal Morbidity (SMM) (hospital)• Postpartum Hospital Readmission Rate• Maternal Mortality<ul style="list-style-type: none">• Maternal Mortality by Race/Ethnicity	<ul style="list-style-type: none">• SMM (state)<ul style="list-style-type: none">• SMM (state) by Race/Ethnicity• SMM (hospital)<ul style="list-style-type: none">• SMM (hospital) by Race/Ethnicity

Step #4: Select Changes

“What changes can we make that will result in improvement?”

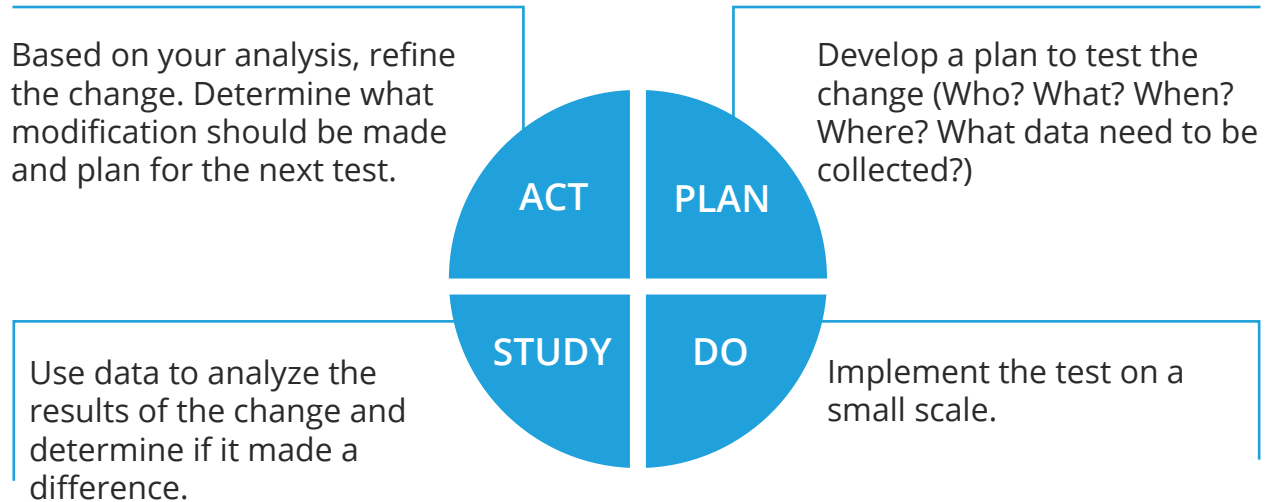
Changes are necessary to make improvements. Rather than completely reconfiguring your current process, develop, test, and implement changes on a small scale. What are the low-hanging fruits? Your team can also use previously gathered observations to determine the changes. Examples:

- Ensure appropriate blood pressure measurement protocol
- Utilize care checklists for care of hypertensive disorders of pregnancy

Step #5: Test Changes

Start testing the selected changes! By testing these strategies on a small scale, you will learn what will work in your setting. Your team can start testing changes in order to figure out what strategies are appropriate for your practice setting.

Follow the Plan-Do-Study-Act (PDSA) cycle:



Step #6: Implement Changes

After several PDSA cycles, your changes can be tested on a broader scale. Implementation is a permanent change to the current process. It may affect documentation, written policies, hiring, training, compensation, and organizational infrastructure. Implementation also requires following the PDSA cycle for continuous testing and monitoring.

Step #7: Spread Changes

After successful tests, your changes can be spread and implemented to other parts of your organization .



Readiness

The Readiness Domain ensures that hospital units are prepared to treat and address hypertensive emergencies. This is accomplished through the implementation of best clinical practices to prevent delays in treatment and to prepare for optimal management of severe hypertension, preeclampsia, and eclampsia. The five key elements of the Readiness domain are¹:

1. Standards for early warning signs, diagnostic criteria, monitoring and treatment of severe preeclampsia/eclampsia (include order sets and algorithms).
2. Unit education on protocols, unit-based drills (with post-drill debriefs).
3. Process for timely triage and evaluation of pregnant and postpartum women with hypertension including ED and outpatient areas.
4. Rapid access to medications used for severe hypertension/eclampsia: Medications should be stocked and immediately available on labor and delivery and in areas where patients may be treated. Include brief guide for administration and dosage.
5. System plan for escalation, obtaining appropriate consultation, and maternal transport, as needed.

Standards for Early Warning Signs

Units

- Labor & Delivery
- Antepartum
- Emergency Department
- Triage
- Postpartum
- Non-OB inpatient units

Expectation

- Treatment with appropriate therapy within 60 minutes of diagnosis of hypertensive emergency
- System plan for escalation, obtaining appropriate consultation, and maternal transport, as needed

Table 1. Stages of HTN Emergency	
Stage 1	<ul style="list-style-type: none">• Initial treatment and therapy escalation• Protocol activation and bedside care by primary nurse or primary provider• Notify charge nurse or lead nurse for nursing staff
Stage 2	<ul style="list-style-type: none">• Continued therapy escalation if needed with alternative agent• Bedside care by primary nurse and additional support nurse or obstetrical provider if available• Notification of charge nurse, anesthesia staff, intensivist staff if need for additional assistance
Stage 3	<ul style="list-style-type: none">• Continued therapy escalation and transfer to intensive care unit if:<ul style="list-style-type: none">a) Transfer arrangements have not been madeb) Patient remains unstable for transport• Bedside care with primary nurse and additional support nurse, obstetrical provider, anesthesia staff, intensivist staff• Notification of charge nurse, anesthesia staff, intensivist staff• If planning to potentially emergently deliver, consider notification of pediatrics staff for resuscitation and neonatal care

Consultation Consideration

- Any instances of Stage 1, 2, or 3 HTN
- Other signs, symptoms, findings, or clinical conditions of concern to the primary assessment care team or the items listed below in Table 2

Laboratory

Stat laboratory analysis for:

- Complete blood count (CBC)
- Comprehensive metabolic profile (CMP)
- Lactate dehydrogenase (LDH)
- Coagulation panel (PT/INR, PTT, Fibrinogen)
- Random urine protein to creatinine ratio

Table 2. Consulting Service		
Pulmonary/ Fluids	<ul style="list-style-type: none"> • Pulmonary edema • Fluid overload • Leaky membrane • Low colloid oncotic pressure 	<ul style="list-style-type: none"> • Unresponsive to diuretics • Shortness of breath • Unresponsive asthmatic therapy
Cardiac	<ul style="list-style-type: none"> • Cardiac pump failure (such as peripartum cardiomyopathy) • Arrhythmia • Hypoxia 	<ul style="list-style-type: none"> • Chest trauma • Allergic reaction • Magnesium toxicity
Neurologic	<ul style="list-style-type: none"> • Seizures (eclampsia) • Unresponsive seizures to typical therapy (magnesium followed by anti-epileptics) 	<ul style="list-style-type: none"> • Altered mental status • Cerebrovascular accident
Hematologic	<ul style="list-style-type: none"> • Disseminated intravascular coagulation • Thrombocytopenia (platelet < 50,000) 	<ul style="list-style-type: none"> • Coagulopathy • Obstetrical hemorrhage • Anticoagulation use

Pharmacy

Readily available agents and appropriate dosages for initial emergent hypertension therapy including:

- IV labetalol: 20 mg, 40 mg, and 80 mg
- IV Hydralazine: 5 mg and 10 mg
- PO Nifedipine immediate release: 10 mg and 20 mg
- Calcium gluconate: 1g IV in 10% solution (10 mL)
- Magnesium sulfate
 - a) IV – 6 g bolus and 2 g continuous infusion with 10% solution
 - b) IM – 5 g injections with 50% solution with two initial injections and one injection every 4 hours thereafter

Second-line agents to be considered in an ICU setting where appropriate (but do not need to be readily available in obstetrical units).

- Nicardipine infusion initially at 5 mg/hr with a maximum dose of 15 mg/hr
- Esmolol infusion
 - a) Immediate: 1000 mcg/kg over 30 sec followed by 150 mcg/kg/min infusion with maximum of 300 mcg/kg/min
 - b) Gradual: 500 mcg/kg over 1 min followed by 50 mcg/kg/min over 4 min with either continuing the 50 mcg/kg/min rate thereafter or titrating up 50 mc/kg/min over 4 min up to a maximum of 300 mcg/kg/min

Radiology

- Stat portable chest X-ray availability

Equipment

- The following should be available to monitor the patient’s status:
 - Maternal pulse oximetry
 - Supplemental oxygen
 - Bag-mask ventilation
 - Suction
 - Padding for the patient’s bed
 - Continuous external fetal monitoring

Unit Education on Protocols, Unit-based Drills

Health Equity Education

It is important to understand the implications of health equity and disparities on outcomes of maternal hypertension, particularly when considering the differences in outcomes for African American mothers, who experience maternal mortality at a rate greater than 2.5 times that of white women.² As such, several resources may be utilized to educate an organization’s providers and staff on the concepts of health equity.

Table 3. Training Opportunities	
Managing Implicit Bias and Maternal Health³	https://odh.ohio.gov/wps/portal/gov/odh/know-our-programs/pregnancy-associated-mortality-review/Webinars/
Addressing Black Maternal Mortality Rates Starts with Listening to Black Women⁴	https://www.nichq.org/insight/addressing-black-maternal-mortality-rates-starts-listening-black-women

Unit Education

Organizations may utilize the following resources to conduct unit-based drills for their units and staff.

Table 4. Unit-based Drills	
Eclampsia: Simulation Scenario Overview #1⁵	https://www.acog.org/-/media/project/acog/acogorg/files/forms/districts/smi-hypertension-bundle-eclampsia-simulation-scenario.pdf
Eclampsia: Clinical Scenario #2⁶	https://www.acog.org/-/media/project/acog/acogorg/files/forms/districts/smi-hypertension-bundle-eclampsia-simulation-scenario.pdf
Eclampsia: Drill Assessment Tool⁷	https://www.acog.org/-/media/project/acog/acogorg/files/forms/districts/smi-hypertension-bundle-eclampsia-drill-assessment.pdf

Process for Timely Triage and Evaluation of Pregnant and Postpartum Women with Hypertension

These checklists may be utilized when evaluating and triaging patients.

Table 5. Triage Resources	
Inpatient Areas: Hypertensive Emergency Checklist ACOG District II⁸	https://www.acog.org/-/media/project/acog/acogorg/files/forms/districts/smi-hypertension-bundle-emergency-checklist.pdf
Emergency Department: Postpartum Preeclampsia Checklist ACOG District II⁹	https://www.acog.org/-/media/project/acog/acogorg/files/forms/districts/smi-hypertension-bundle-postpartum-preeclampsia-checklist.pdf

Rapid Access to Medications

Medications should be stocked and immediately available on L&D and in other areas where patients may be treated. See Table 6.¹⁰

Table 6. Sample L&D Severe Preeclampsia & Eclampsia Box – Content and Dose Guideline

Magnesium 20 grams/500 ml bag	<p>IV (Use Magnesium Sulfate Continuous Infusion under L&D protocol in Alaris Pump Library): <i>Initial (Loading Dose):</i> 4-6 g (100 ml – 150 ml) over 20-30 minutes <i>Maintenance Dose:</i> 1-2 g/hour (25 ml/hr – 50 ml/hr) continuous infusion</p> <p>Intramuscular Injection (in case of difficulty establishing venous access): <i>Initial (Loading Dose):</i> 10 g (20 ml) <i>Maintenance Dose:</i> 5 g (10 ml) q 4 hours</p>
Labetalol 100 mg/20 ml vial	<p>Initial: Draw 4 ml from the vial 10–20 mg (2 ml - 4ml) IV, then 20–80 mg (4ml - 16ml) every 10–30 minutes to a maximum cumulative dosage of 300 mg (60 ml); or constant infusion 1-2 mg/min IV</p>
Hydralazine 20 mg/ml vial	<p>Initial: Draw 0.25 ml from the vial 5 mg IV or IM, then 5–10 mg IV every 20–40 minutes to a maximum cumulative dosage of 20 mg; or constant infusion of 0.5–10 mg/hr</p>
Nifedipine 10 mg PO	<p>10–20 mg orally, repeat in 20 minutes if needed; then 10–20 mg every 2–6 hours; maximum daily dose is 180 mg</p>
Calcium gluconate 1000 mg/10 ml vial	<p>10% solution, 10 ml IV over 3 minutes</p>
Supply contents	<p>3 ml, 10 ml, and 20 ml syringes, appropriate needles and appropriate tubing sets</p>
Esmolol 100 mg/10 ml vial (By Anesthesiologists ONLY)	<p>Requires coordination with Anesthesiologist</p>
Propofol 10 mg/ml, 20 ml vial (By Anesthesiologists ONLY)	<p>Requires coordination with Anesthesiologist</p>

System Plan for Escalation

Please see Appendix B for a sample form that may be used as a tool to aid in communication when transferring pregnant patients to a higher level of care.¹¹



Recognition

The Hypertension Maternal Safety Bundle Recognition and Prevention Domain is intended to ensure that hospital units are prepared to identify and assess every patient for hypertensive emergency. This is accomplished through the implementation of standards for patient assessment, early warning signs, and patient education. There are three key elements in the Recognition and Prevention domain.¹

1. Establishing a standard protocol for measurement and assessment of BP and urine protein for all pregnant and postpartum women.
2. Standard response to maternal early warning signs including listening to and investigating patient symptoms and assessment of key laboratory values.
3. Facility-wide standards for educating prenatal and postpartum women on signs and symptoms of hypertension and preeclampsia.

Standard Protocol for Measurement and Assessment Blood Pressure Measurement

The graphic below from the American Heart Association² may be used as a guide for clinicians and providers regarding appropriate and accurate blood pressure measurement. Additional information regarding blood pressure measurement may be found in Appendix C.

STEPS FOR ACCURATE BP MEASUREMENT

- 1** SEAT PATIENT WITH FEET FLAT ON THE FLOOR, RELAXED AND QUIET FOR 5 MIN. HAVE PATIENT EMPTY BLADDER AND AVOID CAFFEINE, EXERCISE AND SMOKING FOR 30 MINUTES. REMOVE CLOTHING FROM ARM.
- 2** USE PROPERLY VALIDATED, CALIBRATED BP MEASUREMENT DEVICE. SUPPORT PATIENT'S ARM AND POSITION CUFF ON BARE ARM AT LEVEL OF THE RIGHT ATRIUM. USE CORRECT CUFF SIZE.
Usual sizes based on arm circumference:
22-26 cm = Small Adult
27-34 cm = Adult
35-44 cm = Large Adult
45-52 cm = Adult Thigh
- 3** FIRST VISIT, RECORD BP IN BOTH ARMS, USING THE ARM WITH HIGHER READING. SEPARATE REPEATED MEASUREMENTS BY 1-2 MINUTES.*
*For auscultatory determinations, use a palpated estimate of systolic (distal pulse) diastolic pressure to estimate SBP (inflate the cuff 20-30 mmHg above this level) for an auscultatory determination of SBP (real). For auscultatory readings, deflate the cuff pressure, 2 mmHg per second and listen for Korotkoff sounds.
**For auscultatory technique, record SBP and DBP as onset of the first Korotkoff sound and disappearance of all Korotkoff sounds respectively, using the nearest even number.
- 4** RECORD SBP AND DBP**. NOTE TIME OF MOST RECENT BP MED TAKEN BEFORE MEASUREMENT.
- 5** USE AN AVERAGE OF 2 READINGS OBTAINED ON 2 OCCASIONS TO ESTIMATE THE INDIVIDUAL'S LEVEL OF BP.
- 6** PROVIDE PATIENT THE SBP/DBP READINGS BOTH VERBALLY AND IN WRITING.

American Heart Association. (2018). Steps for Accurate BP Measurement

Proteinuria Recommendations³

The presence of proteinuria is NOT required for the initial diagnosis and treatment of severe hypertension in pregnancy or preeclampsia.

Proteinuria in pregnancy is defined as ≥ 300 mg/dL of protein on a 24 hour urine collection or a urine protein-to-creatinine of 0.30 or higher

While proteinuria remains one of the diagnostic criteria for preeclampsia, the quantity of proteinuria is NOT predictive of perinatal outcomes and should NOT be used to define the severity of disease (see box – severe features)

Following the initial documentation of proteinuria and establishment of the diagnosis of preeclampsia, additional quantitative assessments of proteinuria are NOT indicated.

1. As a heterogeneous and progressive syndrome, preeclampsia may present in some women with hypertension and other clinical features/symptoms in the absence of proteinuria.
2. A urine protein-to-creatinine ratio is considered an alternative to a 24 hour urine collection for assessment of proteinuria in pregnancy as a urine protein-to-creatinine ratio may be performed more rapidly.
3. When quantitative methods to assess proteinuria are unavailable, a urine protein dipstick can be substituted with 2+ protein as the discriminant value. Dipstick urinalysis has a high false-positive and false-negative rate when compared to quantitative assessments of proteinuria.
4. HELLP syndrome and eclampsia can occur in the absence of proteinuria.
5. In patients at a high risk for preeclampsia or preexisting renal disease (such as chronic hypertension, diabetes, or lupus among other comorbidities), a baseline quantitative assessment of proteinuria should be obtained early in pregnancy.
6. In pregnancy, the presence of proteinuria in the absence of hypertension requires close clinical surveillance for evolving preeclampsia and consideration of other underlying etiologies (medical renal disease).

Standard Response to Maternal Early Warning Signs

Risk Assessment – Preeclampsia Early Recognition Tool (PERT)

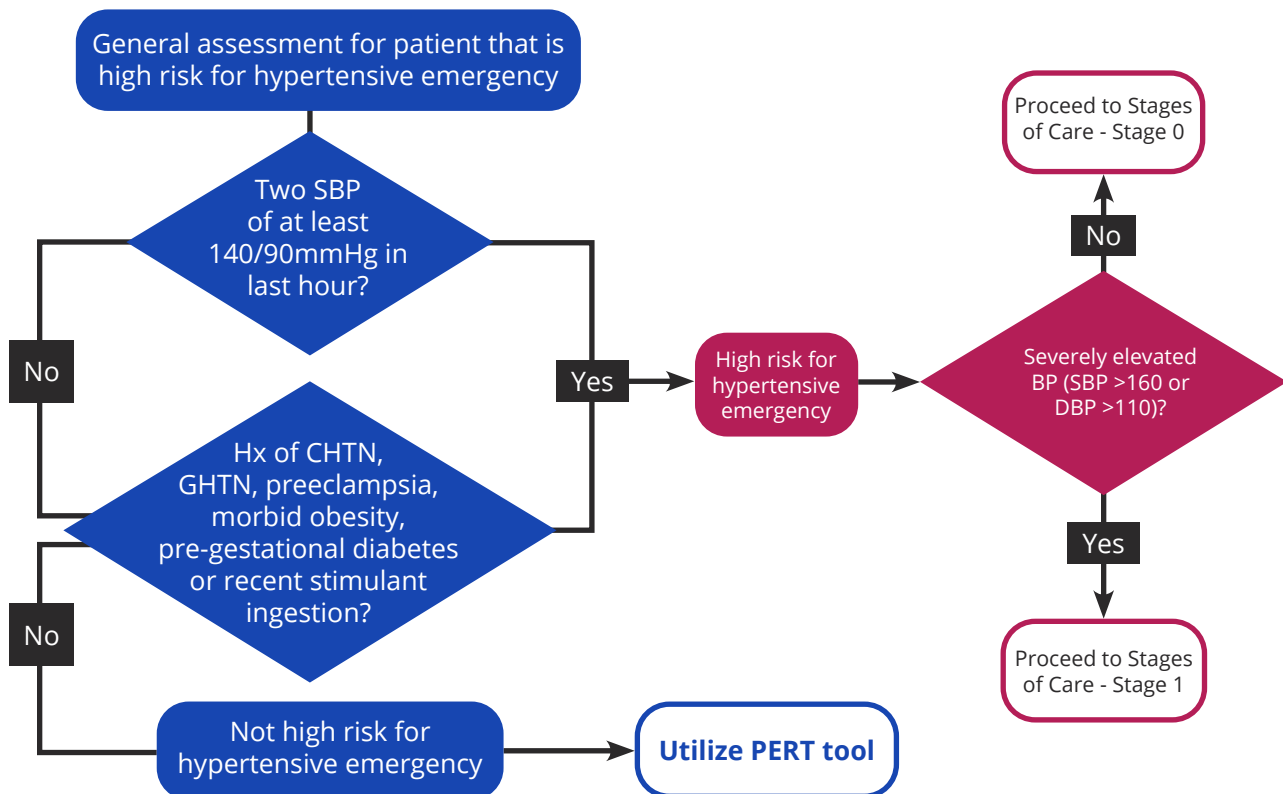
Anytime there is a concern for hypertensive disorders of pregnancy, the components of the tool should be covered and reviewed this includes:

- Initial and on-going assessments in outpatient Obstetrical care settings, OB Triage, Labor and Delivery, Antepartum, Postpartum, Emergency Department, and non-obstetrical inpatient units

Centers should utilize the tool to develop:

- A process for the recognition and appropriate response in the event of a patient's deteriorating condition
- Written criteria describing early warning signs and intervention strategies
 - When possible, these criteria should be built into the EMR system
- Magnesium sulfate toxicity monitoring and magnesium levels should only be considered if the patient is receiving magnesium sulfate infusion for seizure prophylaxis or treatment of eclampsia

The flowchart below may be used to evaluate a patient's risk level for a hypertensive emergency, and indicates which tool should be referenced.⁴



Use the PERT tool when there is any concern that a patient is experiencing a hypertensive disorder of pregnancy.⁵

Preeclampsia Early Recognition Tool (PERT)			
Patient Signs/Symptoms			
	Normal (green)	Worrisome (yellow)	Severe (red)
Awareness	Alert/Oriented	Agitated/confused Drowsy Difficulty speaking	Unresponsive
Headache	None	Mild headache Nausea/vomiting	Unrelieved headache
Vision	None	Blurred or impaired	Temporary blindness
Shortness of breath	None	Present	Present
Pain	None	Nausea/vomiting Chest pain Abdominal pain	Nausea/vomiting Chest pain Abdominal pain
Vital Signs			
Systolic BP (mmHg)	100-139	140-159	≥160
Diastolic BP (mmHg)	50-89	90-110	≥110
Heart rate (bpm)	61-110	111-129	≥130
Respiration rate	12-24	25-30	< 10 or > 30
O2 saturation	≥95	91-94	≤90
Urine output (mL/hr)	≥50	30-49	≤30 (over 2 hours)
Magnesium sulfate toxicity monitoring*	DTR + 1	Depressed patellar reflexes	Respiratory rate < 12
Fetal Monitoring			
Fetal HR tracing	Category 1	Category 2	Category 3
NST	Reactive	Nonreactive	Nonreactive

Laboratory Findings			
Proteinuria	Protein/creatinine ratio < 0.3 24 hour < 300 mg	Urine protein/creatinine ratio ≥ 0.3 24 hour ≥ 300 mg	
Platelets	> 100,000 / μL	50,000 – 100,000 / μL	< 50,000 / μL
AST or ALT	< 70 IU / L	> 70 IU / L	> 70 IU/L
Creatinine	< 0.8 mg / dL	0.9 – 1.1 mg / dL	>1.1 mg / dL
Magnesium*	4.8 – 6.6 mg / dL	6.6 – 8.4 mg / dL	≥ 8.4 mg / dL
Response to PERT Tool			
	Proceed with usual care either inpatient or outpatient	1 trigger – notify provider for additional assessment ≥ 2 triggers – proceed to “Stages of Care - Stage 0” for further care *Consider inpatient surveillance*	Proceed to “Stages of care – Stage 1” for further care *Inpatient surveillance recommended*

Morton, C.H., Peterson, N., Shields, L. California Maternal Quality Care Collaborative. (2014). Preeclampsia Early Recognition Tool (PERT)

Facility-wide Standards for Educating Prenatal and Postpartum Women

For additional educational resources for the healthcare team and patients, please see Appendix C.

Table 7. Educational Resources on Signs and Symptoms of Hypertension and Preeclampsia	
Alliance for Innovation on Maternal Health (AIM) eModules: Severe Hypertension (HTN) in Pregnancy	https://safehealthcareforeverywoman.org/aim-emodules/#link_acc-1-5-d
Alliance for Innovation on Maternal Health (AIM): Urgent Maternal Warning Signs	https://safehealthcareforeverywoman.org/urgentmaternalwarningsigns/



Response

The Hypertension Maternal Safety Bundle Response Domain is intended to ensure that hospital units employ standard and appropriate interventions to treat and address hypertensive emergencies. This is accomplished through the implementation of best clinical practices and protocols to prevent delays in treatment and to encourage standards of practice for the response and treatment of severe hypertension, preeclampsia, and eclampsia. There are three key elements that each organization should utilize to fulfill the requirements of the Response domain.¹

1. Facility-wide standard protocols with checklists and escalation policies for management and treatment of: severe hypertension, eclampsia, seizure prophylaxis, magnesium over-dosage, and postpartum presentation of severe hypertension/preeclampsia.
2. Minimum requirements for protocol:
 - a) Notification of physician or primary care provider if systolic BP ≥ 160 or diastolic BP ≥ 110 for two measurements within 15 minutes.
 - b) After the second elevated reading, treatment should be initiated ASAP (preferably within 60 minutes of verification).

- c) Includes onset and duration of magnesium sulfate therapy.
 - d) Includes escalation measures for those unresponsive to standard treatment.
 - e) Describes manner and verification of follow-up within seven to 14 days postpartum.
 - f) Describe postpartum patient education for women with preeclampsia.
3. Support plan for patients, families, and staff for ICU admissions and serious complications of severe hypertension.

Facility-wide Standard Protocols with Checklists and Escalation Policies for Management and Treatment of:

Severe Hypertension	ACOG Hypertensive Emergency Checklist²
Eclampsia, seizure prophylaxis, and magnesium over-dosage	ACOG Eclampsia Checklist³
Postpartum presentation of severe hypertension/preeclampsia	ACOG Postpartum Preeclampsia Checklist⁴

Minimum Requirements for Protocol

Notification of physician or PCP if Systolic BP \geq 160 or Diastolic BP \geq 110 for 2 measurements within 15 minutes	After the second elevated BP reading, treatment should be initiated ASAP (within 60 minutes of verification)	Protocol includes onset and duration of magnesium sulfate therapy	Protocol includes escalation measures for those unresponsive to standard treatment	Protocol describes manner and verification of follow-up within 7-14 days postpartum	Protocol describes postpartum education for women with preeclampsia
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Stage System for Hypertensive Emergency⁵

1. Primary nurse or Obstetrical provider initiates protocol.
2. Once activated, orders should be placed for appropriate anti-hypertensive therapy based on the patient's past medical history, allergies, and clinical findings.

Conditions	Therapy
Suspicion for underlying heart failure, asthma, cocaine or methamphetamine abuse, bradycardia (HR < 60 bpm)	Recommend hydralazine or immediate-release nifedipine (avoid labetalol)
Predominantly systolic hypertension and pulse pressure > 70	Recommend labetalol
Predominantly diastolic hypertension and pulse pressure < 50	Recommend hydralazine
If mixed systolic or diastolic hypertension and pulse pressure	Recommend labetalol
If no IV access	Recommend immediate release nifedipine

Initiate magnesium for seizure prophylaxis

- Continue assessments until two consecutive BP readings no sooner than 15 minutes apart are obtained that are < 160 mmHg (systolic) and < 110 mmHg (diastolic) appropriately measured.
- Once BP thresholds are achieved, repeat BP measurement every 15 min for one hour, then every 30 minutes for one hour, then every hour for four hours.
- Ensure the patient's family is supported and well-apprised of the situation at each stage.

Stage 1	
Definition	
Hypertensive Emergency: <ul style="list-style-type: none"> SBP ≥ 160 or DBP ≥ 110 	Notes: <ul style="list-style-type: none"> Separated by 15 minutes within 1 hour Values do not need to be consecutive
Care team	
At Bedside: Level 3 <ul style="list-style-type: none"> Primary nurse Primary resident In-house OB (if available) If in ER, primary ER provider (if available) 	Notify: Level 3 <ul style="list-style-type: none"> Charge nurse Chief resident In-house OB provider Consider telephone MFM consultation if coexisting medical issue if not immediately available

Monitoring

- Continuous external fetal monitoring
- Continuous pulse oximetry
- IV access: single 18g

Labs:

- Complete blood count
- Comprehensive metabolic panel
- Uric acid
- Coagulation panel
- Lactic dehydrogenase
- Consider placement of Foley catheter

Therapy - Content and Dose Guidelines (See Appendix D)

Labetalol Protocol

- 20 mg IV over 2 min initially
- Recheck BP in 15 min
- If BP still $\geq 160/110$, give 40 mg IV over 2 min
- Recheck BP in 15 min
- If BP still $\geq 160/110$, give 80 mg IV over 2 min
- Recheck BP in 15 min and if BP $\geq 160/110$ move to Stage 2

Hydralazine Protocol

- 5 or 10 mg IV over 2 min initially
- Recheck BP in 15 min
- If BP still $\geq 160/110$, give 10 mg IV over 2 min
- Recheck BP in 15 min and if BP $\geq 160/110$ move to Stage 2

Nifedipine Immediate-Release Protocol (No IV access)

- 10 mg PO initially
- Recheck BP in 15 min
- If BP still $\geq 160/110$, give 20 mg PO
- Recheck BP in 15 min
- If BP still $\geq 160/110$, give 20 mg PO
- Recheck BP in 15 min and if BP $\geq 160/110$ move to Stage 2

If adequate decrease (SBP ≥ 20 mmHg or a DBP ≥ 10 mmHg) occurs, withhold additional treatment dosages for 10 minutes and repeat BP measurements

If progression to Stage 2 becomes necessary:

1. **Contact the charge nurse, attending OB, anesthesia staff, intensivist staff, or maternal-fetal medicine specialist where appropriate;**
2. **Bring an additional staff nurse to the patient's room to aid in care;**
3. **A "huddle" should be performed at the bedside with the team leader, nursing, and recorder/time keeper.**

Stage 2

Definition

Persistent Hypertensive Emergency:

- SBP \geq 160 or
- DBP \geq 110 after giving maximum dose of one type of medication from Stage 1

Care team

At Bedside: Level 3

- Primary nurse
- Charge nurse
- Primary resident
- Chief resident
- In-house OB (if available)
- If in ER, primary ER provider (if available)

Notify: Level 3

- Charge nurse
- Chief resident
- In-house OB provider
- Anesthesia staff
- Consider telephone MFM consultation if coexisting medical issue if not immediately available

Monitoring

- Continuous external fetal monitoring
- Continuous pulse oximetry
- IV access: single 18g
- Foley catheter with urometer

Therapy - Content and Dose Guidelines (See Appendix D)

Labetalol Protocol

- Consider repeat 80 mg IV over 2 min or switch to Hydralazine 10 mg IV over 2 min
- Recheck BP in 15 min if Labetalol given OR if hydralazine given
- If BP \geq 160/110 move to Stage 3

Hydralazine Protocol

- Switch to Labetalol 20 mg IV over 2 min
- Recheck BP in 15 min
- If BP still \geq 160/110, give Labetalol 40 mg IV over 2 min
- Recheck BP in 15 min and if BP \geq 160/110 move to Stage 3
- Hydralazine administered at 30 min

Nifedipine Immediate Release Protocol

- Switch to Labetalol 20 mg IV over 2 min
- Recheck BP in 10 min and if BP \geq 160/110 move to Stage 3

Magnesium Sulfate Protocol

- 6g IV bolus of 10% solution followed by 2g maintenance **OR**
- 5g IM injection of 50% solution in each buttock (2 injections) with additional 5g injections (1 injection) every 4 hours
 - May give lidocaine to reduce pain

If adequate decrease (SBP \geq 20 mmHg or a DBP \geq 10 mmHg) occurs, withhold additional treatment dosages for 10 minutes and repeat BP measurements

If progression to Stage 2 becomes necessary:

1. Contact the charge nurse, attending OB, anesthesia staff, intensivist staff, or maternal-fetal medicine specialist where appropriate
2. Bring an additional staff nurse to the patient's room to aid in care
3. A "huddle" should be performed at the bedside with the team leader, nursing, and recorder/time keeper.

Stage 3

Definition

Persistent Hypertensive Emergency:

- SBP \geq 160 or
- DBP \geq 110 after giving maximum dose of medication from Stage 2

Care team

At Bedside: Level 3

- Primary nurse
- Charge nurse
- Primary resident
- Chief resident
- In-house OB (if available)
- If in ER, primary ER provider (if available)
- Anesthesia staff
- Intensivist staff
- Maternal-Fetal Medicine (if available)

Notify: Level 3

- Charge nurse
- Chief resident
- In-house OB provider
- Anesthesia staff
- Intensivist staff
- Maternal-Fetal Medicine

Monitoring

- Continuous external fetal monitoring
- Continuous pulse oximetry
- IV access: two 18 g
- Foley catheter with urometer
- Telemetry
- Consider arterial line
- Consider repeat labs from Stage 1

Therapy - Content and Dose Guidelines (See Appendix D)

Labetalol Protocol

May continue with dosing escalation up to:

- Labetalol 200 mg IV cumulatively (in 20-80 mg dose increments)
- Hydralazine 20 mg IV cumulatively (in 5-10 mg dose increments)
- Nifedipine 180 PO cumulatively (in 10-20 mg dose increments)

Second-Line Suggested Protocols (only to be used in conjunction with Anesthesia or ICU providers)

- Nicardipine infusion initially at 5 mg/hr with a maximum dose of 15 mg/hr
- Esmolol
 - Immediate: 1000 mcg/kg over 30 sec followed by 150 mcg/kg/min infusion with maximum of 300 mcg/kg/min
 - Gradual: 500 mcg/kg over 1 min followed by 50 mcg/kg/min over 4 min with either continuing the 50 mcg/kg/min rate thereafter or titrating up 50 mc/kg/min over 4 min up to a maximum of 300 mcg/kg/min

Patient should be transferred to ICU

Support Plan for Patients, Families, and Staff

For more support and response resources, please see Appendix D.

Support Plan for ICU Admissions and Serious Complications of Severe Hypertension	
Patient Clinical Summary After a Severe Maternal Event Form⁶	https://safehealthcareforeverywoman.org/patient-safety-tools/summary-after-a-severe-maternal-event/
Recognizing Signs of Acute Stress Disorder in Postpartum women in the Hospital Setting⁷	https://safehealthcareforeverywoman.org/wp-content/uploads/2016/09/7-Response-Recognizing-Signs-of-Acute-Stress-Disorder-in-Postpartum-Women-in-the-Hospital-Setting-MFHall.pdf
Disclosure and Discussion of Adverse Events⁸	ACOG Committee Opinion 681
Emergent Therapy for Acute-Onset, Severe Hypertension During Pregnancy and the Postpartum Period⁹	ACOG Committee Opinion 767



Reporting

The Hypertension Maternal Safety Bundle Reporting is intended to ensure that hospital units have systems in place to review patient care, risks, and events. This is accomplished through the implementation of practices such as huddles and debriefs, multidisciplinary committee reviews, and monitoring of contribution metrics. There are three key elements in the Reporting domain.¹

1. Establishing a culture of huddles for high risk patients and post-event debriefs to identify successes and opportunities.
2. Conducting a multidisciplinary review of all severe hypertension/eclampsia cases admitted to ICU for systems issues.
3. Monitoring outcomes and process metrics.

Establish a Culture of Huddles and Post-Event Debriefs

A standardized system of briefs, huddles, and debriefs should be established to coordinate patient care, identify potential risks and events, acknowledge successes and opportunities for growth, and promote team-centered approaches for the treatment and management of severe maternal hypertension. In addition, facilities should develop a system to perform debriefs and case reviews for select

Briefs	Huddles	Debriefs
<p>Meetings to fulfill planning functions such as forming the team, designating roles, and establishing goals. They should engage the entire team in patient planning. Patients should be involved in the plan of care and briefings to promote active involvement and shared decision making.</p>	<p>Short ad hoc team meetings that are intended to allow the team to regain situational awareness, discuss critical issues and emerging events, anticipate outcomes and contingencies, assign resources, and express any concerns.</p>	<p>Brief, informal feedback sessions that take place after an event has occurred. They are intended to identify opportunities for improvement in teamwork, skills, and outcomes.</p>

cases of severe hypertension in pregnant and postpartum mothers. For tools and techniques to implement in these systems, please see Appendix E.²

Multidisciplinary Review of All Severe Hypertension/ Eclampsia Cases Admitted to ICU for Systems

Multidisciplinary reviews differ from debriefs and huddles in that they are formal meetings that include the staff members involved in the incident, as well as unit and facility leadership and the risk management team. They are intended to identify any systems issues or breakdowns that contributed to the outcome of the event. The reviews should take place as soon as possible after the event occurs.

A multidisciplinary Perinatal Quality Committee is a practical method to review cases and track process and outcome measures.

Reviews should include an in-depth records review, an event timeline, and a root cause analysis. All hospitals should have a process to perform multidisciplinary systems-level reviews on all severe hypertension cases that are admitted to the intensive-care unit. In addition, all severe hypertension cases in which a quality issue or adverse event was identified should also be reviewed.

If your site is establishing a framework for a safety and quality committee, please see Appendix E for example documents.

Monitor Outcomes and Process Metrics

Process measures are steps in a process or workflow that contribute to specific outcome metrics. They can have a positive or a negative impact, and are a representation of a system's efforts to apply evidence-based practices or interventions to improvement processes. Process, balancing, and outcomes measures may be found in the executive summary of the toolkit.

Semi-Annual General Assessment

A prospective survey will be administered over the course of the project to determine the availability of the following resources that may help to structure and guide the internal review process:

- Does your organization provide educational resources for Maternal Hypertension?
- Is there a system in place for interdisciplinary huddles for Hypertension care in your Labor and Delivery, Triage, Antepartum, and Postpartum units?
- Is there a system for Quality and Safety Committee Reviews for episodes of severe maternal morbidity?
- Does your team have simulation training directed toward Maternal Hypertension?
- Does your organization offer education and training for disparities in health care and health equity and training for patients of color?

Health equity is a crucial aspect of maternal safety. Hospitals are encouraged to establish a framework to address disparities for mothers in Ohio. This includes resources for on implicit bias, racial and ethnic disparities, and shared decision making.

Appendix

Appendix A – Executive Summary
References

Appendix B - Section 1 Readiness
Resources: Tools and Tables
Resources: Additional Links
References

Appendix C – Section 2 Recognition
Resources: Tools and Tables
Resources: Additional Links
References

Appendix D – Section 3 Response
Resources: Tools and Tables
Resources: Additional Links
References

Appendix E – Section 4 Reporting
Resources: Tools and Tables
Resources: Additional Links
References

Appendix A – Executive Summary

References

1. Ohio Department of Health. (2019). *A Report on Pregnancy-Associated Deaths in Ohio 2008-2016*. Columbus, OH: Ohio Department of Health.
2. Ohio Department of Health. (2017). Severe Maternal Morbidity (SMM). *Maternal and Child Health Women and Infants Health*. Retrieved from https://odh.ohio.gov/wps/wcm/connect/gov/db0ab299-4e0d-411e-a107-2db1f555106a/SMM-Factsheet.pdf?MOD=AJPERES&CONVERT_TO=url&CACHEID=ROOTWORKSPACE.Z18_M1HGGIK0N0JO00QO9DDDDM3000-db0ab299-4e0d-411e-a107-2db1f555106a-mMBwu6k
3. Institute for Healthcare Improvement. (n.d.). Model for Improvement.

Appendix B - Section 1 Readiness

Resources: Tools and Tables

[Patient Sticker Here] or Enter: **Receiving Hospital (Name, Logo)** Date: _____
Name: _____ Transport Center: (phone #) Initial Call (time): _____
DOB: _____ Labor & Delivery: (phone #) Transport Accepted: _____
Fax Documents: (phone #) Pt Left Sending Hosp: _____

Maternal Transport Summary & Checklist

This form is an example and should be modified to fit each receiving facility's unique requirements

G_P_____ EDC_____ Gest Age__wk __d {or Date Delivered:_____} Pt Weight_____

Indication(s) for transfer: Maternal_____ Fetal_____

Primary Diagnosis: _____

Secondary Diagnoses: _____

Pertinent PMH, PSH: _____

Other services needed on transfer: NICU ICU Cardiac Other_____

Referring Hospital: _____ Level of Care: Maternal__ Neo__

Referring Physician: _____ Phone: _____

Primary Obstetrician: _____ Phone: _____

Receiving Hospital: _____ Level of Care: Maternal__ Neo__

Accepting Physician: _____ Phone: _____

Vitals: Current Time:_____ BP___/___ P___ R___ O2 sat:___ T___

On transfer Time:_____ BP___/___ P___ R___ O2 sat:___ T___

Vaginal exam: ___/___/___ date/time _____

Vaginal exam: ___/___/___ date/time _____

Membranes: Intact Ruptured Bulging

Bleeding: Yes (EBL: _____ml) No

Ultrasound: Presentation Cephalic Breech Transverse Unknown

Placenta Yes No Unknown

EFW: _____g

EFM: Baseline: _____ Variability: _____ Accels: _____ Decels: _____

Category I (normal) II (indeterminate) III (Abnormal)

Contractions ≥ 4 /hr? Yes No

Medications: Antenatal steroids (1st dose date and time _____)

Magnesium Sulfate: Bolus (time)_____, then Drip at _____gm/hr

Terbutaline (time _____) Antibiotics: _____

Other: _____

Blood Products: Units Given (___PRBC ___Cryoprecipitate ___FFP ___Platelets)

Transportation: Ambulance Air Private car Responsible for arranging: _____

Monitoring on transport Continuous EFM Tele Medications _____

Physician-to-Physician communication done Nurse-to-Nurse communication done

Document Checklist: Documents sent how: with patient fax to receiving hospital

Prenatal record Prenatal labs Ultrasound reports Current labs H&P Discharge Summary

Current admission other relevant notes EFM strips if relevant findings

Admission face sheet Patient consent for transfer Copy of this completed form

Notes _____

MetroHealth Simulation Scenario

Case Overview: This case will start with a patient brought to labor and delivery by ambulance with severe hypertension and will have an eclamptic seizure that the team will manage.

Learning Objectives & Key Debriefing Points:

- 1) Medical Knowledge
 - a) Be familiar with the diagnostic criteria (signs and laboratory values) for preeclampsia and eclampsia
 - b) Understand that the fetal heart rate should improve once the seizure resolves
- 2) Patient Care
 - a) Be familiar with the diagnostic criteria (signs and laboratory values) for preeclampsia and eclampsia
 - b) Understand that the fetal heart rate should improve once the seizure resolves and an urgent cesarean section is not required during the seizure
 - c) Be able to provide appropriate care during the seizure to include supportive care, administration of magnesium sulfate, and antihypertensive medication as indicated
 - d) Avoid surgical intervention until mother is stable.
 - e) Make plans for delivery and magnesium for seizure prophylaxis
- 3) Teamwork and Communication
 - a) Be able to communicate the critical tasks that should be performed upon diagnosis of an eclamptic seizure
 - b) Review interactions with the patient and family in terms of explaining what is happening

Case Flow Overview:

Diagnosis of severe preeclampsia and then treatment of an eclamptic seizure

Simulators: The simulator for this simulation will be a high-fidelity mannequin with a wig. It must have the ability to provide feedback in the form of changes in vital signs as well as demonstrate basic physiologic functions such as pulses and breathing. She can seize.

Personnel Required:

Simulation technician: responsible for the simulator

Simulation facilitator: responsible for guiding the team through the simulation

Roles to be Assigned: OB/MFM Physician #1, OB/MFM Physician #2, OB/MFM Physician #3, OB Nurse #1, Staff Anesthesia

Medical Equipment and Instruments: IV fluids, labeled and available, D5 NS, LR, NS, Fetal monitoring belts (toco/doppler), Intubation equipment, Foley catheter (have dark urine in the bladder if possible), Facemask for O2, Pulse oximeter, Central line kit (they can order this, but will not have them actually place it), AED, EKG/maternal telemetry (vital signs will display on the simulator monitors), Gloves (non-sterile)

Simulated Medications: Medications should be labeled and available: Magnesium sulfate, Labetalol (20-40mg IV), Hydralazine (5-10 mg IV), Ativan 2mg IM, PRBC, FFP, Cryoprecipitate

Moulage instructions:

The patient is confused and complains of headache.

Background information to read to OB Nurse #1: The patient is brought to the hospital with confusion and blood pressure increased to 155/95 with a headache. She received Tylenol at home but it has not helped her headache at all.

Initial Vital Signs:

Temp: 98.6°F

Respiration Rate: 12

Heart Rate: 105

BP Systolic: 170

BP Diastolic: 110 SpO2: 100%

on RA

Weight: 75kg

Pain Score: 8/10 (headache)

Physical Exam:

General: Patient appears in no acute distress, except for complaint of severe frontal headache HEENT:

WNL

Neck: WNL Lungs: WNL

Heart: Mild tachycardia, regular, no murmurs

Abdomen: Soft, non-tender, gravid

Back: WNL Extremities:

WNL

Neuro: WNL with no deficits Vaginal

exam: 2/50%/-3 VTX

Toco: Irregular uterine contractions (q5-8min)

Fetal heart rate tracing: Baseline 150's with average variability and accelerations.

Laboratory Results (only provided if ordered and/or requested by the team)

CBC: WBC 11.4, Hgb 12.9, Hct 41.3, Platelets 110k

BMP: Na 135, K 3.8, Cl 106, CO2 21, BUN 15, Cr 0.9, Glucose 90 AST/ALT:

88/103

Uric Acid: 6.2

LDH: 770

Urine protein/creatinine ratio: 0.25

Vital Signs during Eclamptic Seizure

Temp: 98.6°F

Respiration Rate: 8

Heart Rate: 120

BP Systolic: 180

BP Diastolic: 115

SpO2: 85% on RA or facemask Weight:

60kg

Pain Score: n/a, unconscious

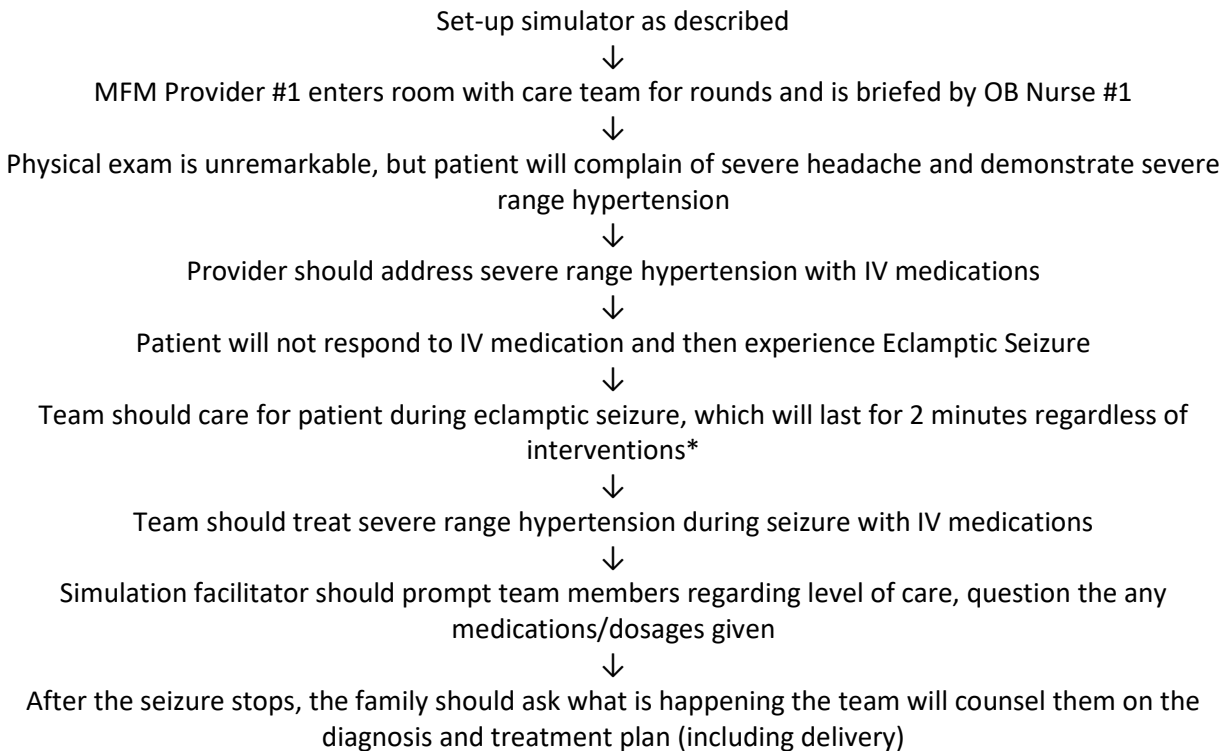
Toco: Irregular uterine contractions (q5-8min)
Fetal heart rate tracing: Baseline 80's with repetitive late decelerations

No additional lab results will be available during the seizure. They may be ordered after the seizure, but will not come back until part 3 of the simulation.

Vital Signs after Eclamptic Seizure

Temp: 98.6°F
Respiration Rate: 8
Heart Rate: 120
BP Systolic: 140
BP Diastolic: 100
SpO2: 95% on RA or facemask
Pain Score: n/a, groggy and post-ictal
Toco: Irregular uterine contractions (q5-8min)
Fetal heart rate tracing: Baseline recovers to the 120's

Case Flow:



****Patient refuses Cesarean Section if offered or counseled for this****

***If the team attempts to go and do an emergency cesarean section, tell them that the OR technician is on their way and do NOT move to the OR**

Assessment/Actions/Outcomes:

Assessment/Action	Outcome/Result	Evaluation
Recognition of severe preeclampsia prior to eclamptic seizure	No change	Not Done / Done Poorly / Done Well
Recognition of eclampsia	No change	Not Done / Done Poorly / Done Well
Supplemental O2 during seizure	No change	Not Done / Done Poorly / Done Well
Administer correct dose of magnesium sulfate (6 grams IV over 15-20 minutes)	No change	Not Done / Done Poorly / Done Well
Protects patient during seizure (turns to side/puts bedrails up)	No change	Not Done / Done Poorly / Done Well
Addresses severe hypertension during seizure with correct IV medications	BP decreases to 140/90 after administration of correct dose	Not Done / Done Poorly / Done Well
Orders repeat lab evaluation after seizure stops	No change	Not Done / Done Poorly / Done Well
Continues magnesium sulfate prophylaxis after the seizure	No change	Not Done / Done Poorly / Done Well
Administration of steroids for fetal lung maturity (if not done previously)	No change	Not Done / Done Poorly / Done Well
Counsels patient/family regarding plan of care for delivery	No change	Not Done / Done Poorly / Done Well
Inappropriate Actions:		
Decision to move to emergent cesarean section during seizure		Circle YES if Done - YES
Attempts intubation during seizure		Circle YES if Done - YES

Simulations/Drills: Appendices G-N

Appendix G: Severe Preeclampsia/Eclampsia In LDR v2.0 SimMan 3G: General Information

Severe Preeclampsia and Eclampsia in LDR v2.0 SimMan3G

Part 1 – General Information

Authors: Mark Meyer MD, Darin Bowers MA – Southern California Permanente Medical Group

Scenario	SimMan3G – LDR Severe Preeclampsia & Eclampsia v2.0 (Labor/Delivery/Recovery)
Scenario Time	15-20 minutes
Debriefing Time	20-45 minutes – longer if used as 1 st scenario and requires more time to discuss non-technical skills (teamwork, communication, etc.) and CMQCC guidelines
Target Group	L&D nurses, OB physicians, Anesthesiologists, CRNA's, & scrub techs.
Case Summary	<p>This is a case of a patient on L&D who is being induced for mild preeclampsia. The patient develops severe preeclampsia and eclampsia that requires anti-hypertensive treatment as well as additional magnesium to control seizures. Despite maximal magnesium therapy, the patient continues to seize and the patient will require additional medications to control her seizures. In addition, the patient's SpO2 will fall due to airway occlusion during/after the seizure. Simple repositioning of the head and opening the airway will restore SpO2. No intubation is required, but this could be required, if desired. This case is designed to ensure staff are following ACOG & CMQCC guidelines for appropriate treatment of preeclampsia and eclampsia. Therefore, there is a great emphasis on appropriate medication dosing and timing per these guidelines.</p> <p>It is critical that the participants recognize the patient is seizing. Unfortunately, the effectiveness of the SimMan3G seizure feature is limited, so confederate may be required to point out the seizure if the team does not recognize this.</p> <p>Fetal monitoring simulators can also be used, however, a non-reassuring fetal heart tracing may prompt the treatment team to move the patient to the OR before the patient has received appropriate treatment for eclampsia and is stable for urgent c-section.</p>
Teaching Personnel	<ol style="list-style-type: none"> 1. GUI operator 2. Observer to note team communication and medical management skills – will serve as lead debriefer 3. Family member to voice observation of seizure signs if staff doesn't recognize seizure (essential if using SimMan Classic and SimMan3G) 4. OB physician for clinical expertise if the lead debriefer is not OB 5. Voice of patient – could be GUI operator
Participants	<ol style="list-style-type: none"> 1. 1-2 OB Physicians 2. 2-4 L&D nurses – varies depending on usual staffing on your unit 3. 1 CNM 4. Anesthesiologist and/or CRNA
Learning Objectives	<ol style="list-style-type: none"> 1. Demonstrate effective teamwork and communication skills with a focus on adequate shared mental model and role clarity. This includes clear identification of all team members and SBAR to new team members as they arrive. 2. Diagnose severe preeclampsia 3. Treat hypertension per CMQCC Preeclampsia/Eclampsia guidelines 4. Provide appropriate initial management of eclamptic seizures with magnesium 5. Manage eclamptic seizures when magnesium is ineffective 6. Maintain airway and oxygenation in seizing and post-ictal patient
References	<ol style="list-style-type: none"> 1. Emergent therapy for acute-onset, severe hypertension with pre- eclampsia or eclampsia. Committee Opinion No. 514. American College of Obstetricians and Gynecologists. Obstet Gynecol 2011;118: 1465–8 2. Preeclampsia care guidelines and compendium of best practices. California Maternal Quality Care Collaborative (CMQCC). 2013.

Appendix N: Simulation Scenario: Hypertension in Pregnancy, HELLP with Seizure

Simulation: HELLP with Seizure

Leslie Cragin, CNM, California Nurse Midwives Association Ana

Delgado, CNM, California Nurse Midwives Association

Ocean Berg, RN, MSN, IBCLC, Nurse Family Partnership Program, San Francisco

**Topic: Hypertension in Pregnancy Scenario: HELLP
with seizure Duration of Scenario: 6 - 13 min**

General Description of the Scenario:

Jackie is a 17 yo G1P0 @ 36 weeks by sure normal LMP. She came to triage accompanied by her sister after beginning uterine contractions 8 hours ago, that have been increasing in intensity and frequency.

The contractions are every 3-4 minutes, lasting a minute. Jackie complains of a strong headache beginning 2 days ago. The baby is moving less than before labor began. She was admitted for labor 4 hours ago with V/E 4cm, 70%, -2 station.

Brief Medical/OB History:

- Regular visits, no chart available
- Fundal height = 34
- Admit labs: hgb 9.2, hct 30, platelets 90,000

Objectives:

Cognitive:

1. Accurately identify risk factors for severe preeclampsia/HELLP
2. Identify the differential diagnosis for eclampsia
3. Identify medications to be used in managing an eclamptic seizure
4. Know the steps in management eclampsia

Technical:

1. Provide protection from injury and patent airway during seizure
2. Evaluate for interval to delivery
3. Evaluate fetal status
4. Prepare for fetal resuscitation and potentially postpartum hemorrhage

Behavioral:

1. Calls for help in a timely manner
2. Communication with team
3. Maintains a calm demeanor during the emergency
4. Clear communication with the frightened family members

Roles of the participants:

RN, CNM, extra RN, obstetrician,

- Facilitator taps out fetal heart rate
- MD is slow to come in after being called– doesn't intervene or direct but does ask what is happening

Roles of the Confederates:

- Patient in PartoPants©, Significant other

Equipment: Partopants, bed, sheets, footstool, baby, IV pole/set/fluid, Doppler or fetoscope, delivery set, Simulator: Actress as Patient with PartoPants
Opening scene: Mother is laboring with _____

Progression of Scenario

Time	Events for Actress and Confederates	Appropriate Actions	Symptoms/Results of inappropriate action
0-5 min	<p>Patient (IV in place); midwife/OB RN and significant other in room</p> <p>Patient in labor with ctx q3 min</p> <p>FHR 120's</p> <p>Pt begins to seize at about 5 minutes into scenario - seizure lasts 90 seconds</p> <p>Fetal bradycardia to 80 BPM for 3 min begins with seizure and lasts 3 min</p>	<p>Clean hands</p> <p>Begins assessment: talks with patient</p> <p>Requests vital signs Asks about urine and proteinuria</p> <p>May ask for additional labs</p> <p>May turn mom into side-lying Notes FHR</p>	<p>Initial vitals 138/89 P=110 No pain meds given yet No proteinuria Vaginal exam if done 8 cm, 100 % 0 station</p> <p>BP stays in this range - never severely elevated</p>
4/5-10 min	<p>Seizure resolves Sister asks what is happening</p> <p>FHR 160's then back to normal</p> <p>Pt is postictal/sleepy Pt involuntarily pushes</p>	<p>Pt turned to L side, O2 on Mag. sulfate ordered: 4-6 gm IV over 15 minutes or 5 gm IM in each buttock if no IV No BP meds since BP is not elevated</p> <p>Calls for help</p> <p>Evaluates FHR</p> <p>Gives accurate concise report to attending</p> <p>Vaginal exam</p>	<p>If no Mag. ordered by 2 min postictal, another seizure begins- this should be treated with MgSO4, diazepam ok, but NOT optimal</p> <p>STOP SCENARIO</p>

Guide for review of simulation:

(Remember to focus on cues from the video; these are only triggers for discussion.)

General:

1. How did that feel?
2. Would someone give an overview of the scenario?
3. What did you see?
4. What went well?
5. What didn't?
6. Was there anything in the **10 commandments** that would've helped you? (Translated and modified with permission from CAPE, Center for Advanced Pediatric and Perinatal Education (CAPE) 2007; Anderson et al., 2006. Ten Commandments of Simulation: 1) know your environment; 2) anticipate and plan for crises; 3) assume a leadership role; 4) communicate effectively; 5) distribute workload optimally; 6) allocate attention wisely; 7) utilize all available information; 8) utilize all available resources; 9) call for help early enough; 10) maintain professional behavior.)

Cognitive:

1. What were you thinking when you heard about the report?
2. What are the risk factors for pre-eclampsia/severe and HELLP?
3. What are the signs and symptoms of HELLP?
4. What labs would help to evaluate this pt?
5. What other emergencies/complications follow eclampsia (PPH, neonatal compromise)?

Technical:

1. What should be done to protect the patient?
2. What are the components of intrauterine resuscitation?
3. What are the medications to be used in eclampsia with severe HTN?

Behavioral: Focus on 2-3 points

1. Know your environment and team
2. Plan and anticipate
3. Assume the role of leader
 - a. Who was the leader?
 - b. How did that go? (ask leader and participants)
4. Communicate in an effective manner with the team, the patient and her family
 - a. How was the interaction between the midwife/OB and nurse?
 - b. How was the communication with the patient?
5. Delegate appropriately
6. Allocate attention wisely
7. Use all your available resources
8. Use all your available information
9. Call for help in a timely manner
 - a. What made you call for help?
10. Maintain professional conduct/attitude at all times.

Used with permission of Leslie Cragin, CNM, Ana Delgado, CNM, Ocean Berg, RN, MSN, IBCLC.

OUTPATIENT MANAGEMENT OF PREECLAMPSIA

Sarah Kilpatrick, MD, PhD, Cedars Sinai Medical Center

BACKGROUND

Once a diagnosis of preeclampsia has been made based on new onset systolic blood pressure \geq 140 mm Hg and or diastolic blood pressure \geq 90 mm Hg, and new onset significant proteinuria, or signs and symptoms of preeclampsia as seen in the Chapter: Classification and Diagnosis or Hypertensive Disorders of Pregnancy, (Table 1, pg. 20), the provider must decide if the woman has preeclampsia without severe features (mild) or severe preeclampsia. Outpatient treatment should only be considered for women with preeclampsia without severe features (mild) at less than 37 weeks and only after confirming fetal wellbeing and maternal stability.¹ It is imperative in the initial evaluation to document the severity of preeclampsia and the following evaluation is recommended: blood pressure, proteinuria assessment, CBC (complete blood count) with platelet count, AST (Aspartate Aminotransferase), ALT (Alanine Aminotransferase), Cr (Creatinine), bilirubin, and LDH (Lactate dehydrogenase).² The symptoms that should be assessed and documented as present or absent include headache, abdominal pain, and significant visual disturbances.

Fetal assessment should include NST (Non-stress Test) or BPP (Biophysical Profile), which includes NST plus fetal movement, tone, breathing, and heart rate and amniotic fluid volume, and ultrasound assessment of fetal growth. The goal of outpatient management in women with preeclampsia without severe features (mild) is early identification of the development of severe preeclampsia so that the woman is hospitalized and delivered if necessary, before significant maternal or fetal morbidity ensues.

If any abnormalities in either maternal or fetal assessments are consistent with severe preeclampsia, further management should occur in the hospital (see Chapter: Special Circumstances: Severe Preeclampsia At < 34 weeks, pg. 76). If preeclampsia without severe features (mild) is documented and outpatient management is considered then there should be a clear documented follow-up plan that is understood by the patient.

Heightened surveillance is recommended to diagnose signs of worsening disease, which would prompt hospitalization and/or delivery. This generally includes twice-weekly maternal and fetal assessment. Maternal blood pressure, urine protein assessment and a verbal review of signs and symptoms should be performed twice per week. The fetus should have an NST and AFI (Amniotic Fluid Index) or BPP twice per week during outpatient observation. Additional maternal laboratory tests should be done as indicated if there is a suspicion of worsening disease. Once the patient develops any sign of severe preeclampsia *she should be admitted to the hospital and her plan should change accordingly*. If the patient continues to have only preeclampsia without severe features (mild) but reaches 37 weeks, the plan of treatment should include delivery. If the patient is diagnosed with severe preeclampsia, she should be admitted to the hospital and—if gestational age is 34 weeks or greater—delivered.³ If she is less than 34 weeks with severe preeclampsia, she should be admitted and managed at a tertiary care facility with close observation for worsening disease or complications that necessitate delivery.

EVIDENCE GRADING

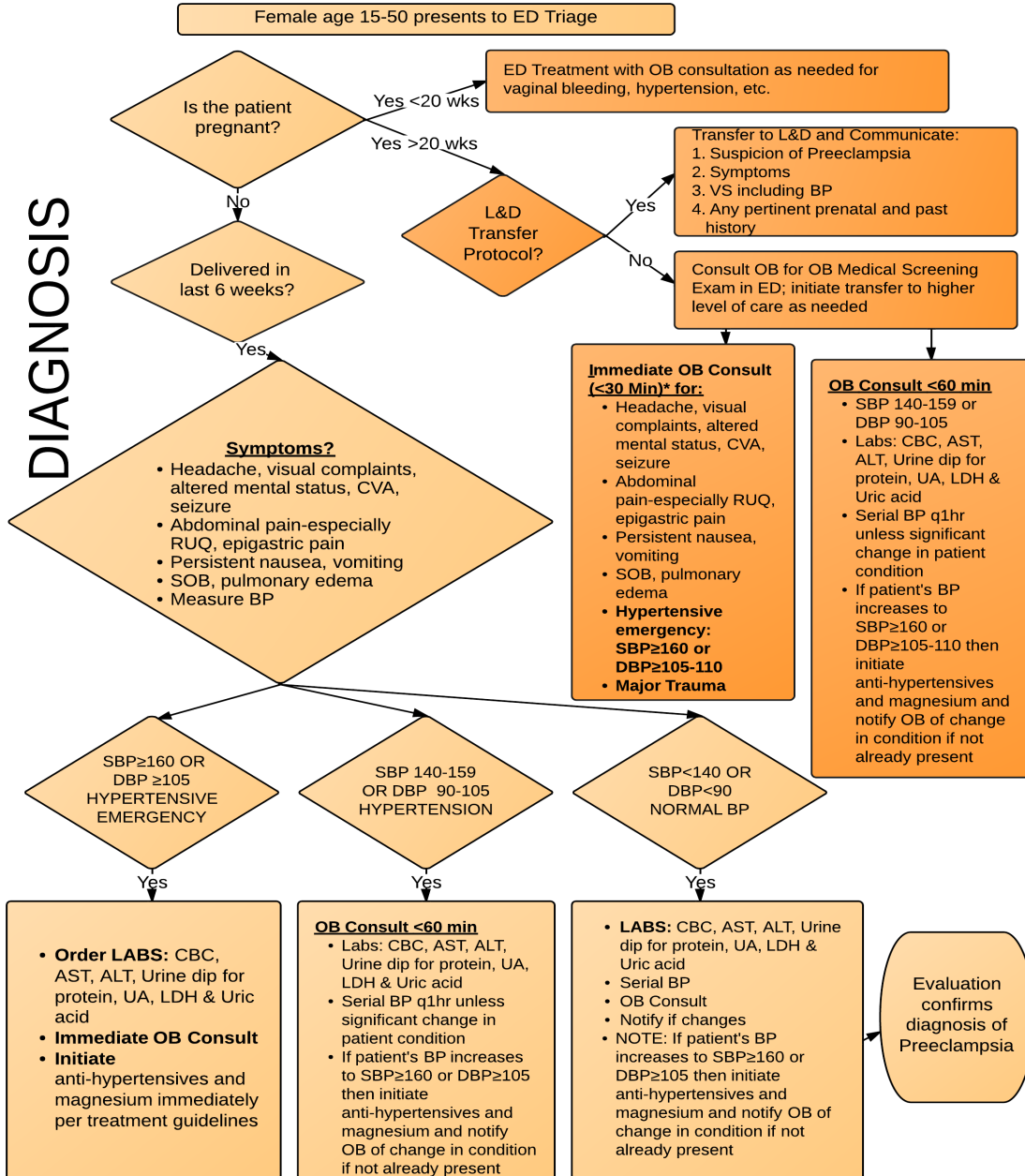
Level of Evidence: C REFERENCES

1. ACOG. Diagnosis and Management of Preeclampsia and Eclampsia #33. *American Congress of Obstetricians and Gynecologists Practice Bulletin Number 33. 2002 (Reaffirmed 2012).*
2. Sibai BM. Diagnosis and management of gestational hypertension and preeclampsia. *Obstet Gynecol.* Jul 2003;102(1):181-192.
3. Sibai BM. Evaluation and management of severe preeclampsia before 34 weeks' gestation. *Am J Obstet Gynecol.* Sep 2011;205(3):191-198.

Part 1 of 2: Diagnosis - Evaluation and Treatment of Antepartum and Postpartum Preeclampsia and Eclampsia in the Emergency Department

Errata v 5/13/14

Evaluation and Treatment of Antepartum and Postpartum Preeclampsia and Eclampsia in the Emergency Department



Part 2 of 2: Treatment - Evaluation and Treatment of Antepartum and Postpartum Preeclampsia and Eclampsia in the Emergency Department

Errata v 5/13/14

Evaluation and Treatment of Antepartum and Postpartum Preeclampsia and Eclampsia in the Emergency Department

TREATMENT

1st Line Anti-Hypertensive Treatment: Labetalol & Hydralazine*
 Target BP: 140-160/90-100 (BP<140/90 = decreased fetal perfusion)
 See CMQCC Preeclampsia Toolkit for "Antihypertensives in Preeclampsia" for 2nd line therapy

Magnesium

LABELTALOL as Primary Anti-Hypertensive

- Administer Labetalol 20 mg IV
- Repeat BP in 10 min
 - If BP threshold is still exceeded, administer Labetalol 40 mg IV
 - If SBP<160 and DBP<100, continue to monitor closely
- Repeat BP in 10 min
 - If BP threshold is still exceeded, administer Labetalol 80 mg IV
 - If SBP<160 and DBP<100, continue to monitor closely
- Repeat BP in 10 min
 - If BP threshold is still exceeded, administer Hydralazine 10 mg IV
 - If SBP<160 and DBP<100, continue to monitor closely
- Repeat BP in 20 min; if BP threshold is still exceeded, obtain emergent consultation from maternal-fetal medicine, internal medicine, anesthesiology, or critical care
- Once target BP achieved, monitor BP q10 min for 1 hour, q 15 min for 2nd hour

HYDRALAZINE as Primary Anti-Hypertensive

- Administer Hydralazine 5 or 10 mg IV
- Repeat BP in 20 min
 - If BP threshold is still exceeded, administer Hydralazine 10 mg IV
 - If SBP<160 and DBP<100, continue to monitor closely
- Repeat BP in 20 min
 - If BP threshold is still exceeded, administer Labetalol 20 mg IV
 - If SBP<160 and DBP<100, continue to monitor closely
- Repeat BP in 10 min
 - If BP threshold is still exceeded, administer Labetalol 40 mg IV and obtain emergent consultation from maternal-fetal medicine, internal medicine, anesthesiology, or critical care
 - If SBP<160 and DBP<100, continue to monitor closely
- Once target BP achieved, monitor BP q10 min for 1 hour, q 15 min for 2nd hour

Initial Treatment

- Loading Dose: 4-6 gm over 15-20 min
- Maintenance 1-2 gm/hr
- Close observation for signs of toxicity
 - Disappearance of deep tendon reflexes
 - Decreased RR, shallow respirations, shortness of breath
 - Heart block, chest pain
 - Pulmonary edema

If Patient Seizes While on Magnesium:

- Secure airway and maintain oxygenation
- Give 2nd loading dose of 2 gm Magnesium over 5 min
- If patient seizes after 2nd magnesium bolus, consider the following:
 - Midazolam 1-2 mg IV; may repeat in 5-10 min **OR**
 - Lorazepam 2 mg IV-may repeat **OR**
 - Diazepam 5-10 mg IV. May repeat q15 min to max of 30 mg
 - Phenytoin 1 g IV over 20 min

Seizures Resolve

- Maintain airway and oxygenation
- Monitor VS, cardiac rhythm/ECG for signs of medication toxicity
- Consider brain imaging for:
 - Head trauma
 - Focal seizure
 - Focal neurologic findings
 - Other neurologic diagnosis is suspected

*Labetalol and Hydralazine recommendations based on 2011 ACOG Committee Opinion #514 and Practice Bulletin #33, Reaffirmed 2012

Resources: Additional Links

Arizona Maternal and Newborn Transport Services Policy and Procedure Manual	https://www.azdhs.gov/documents/prevention/womens-childrens-health/reports-fact-sheets/high-risk/complete-transport-manual.pdf
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References

1. Council on Patient Safety in Women's Health Care. (2015). Severe Hypertension Bundle. Retrieved from <https://safehealthcareforeverywoman.org/wp-content/uploads/2017/11/Severe-Hypertension-Bundle.pdf>
2. Ohio Department of Health. (2019). *A Report on Pregnancy-Associated Deaths in Ohio 2008-2016*. Columbus, OH: Ohio Department of Health.
3. Ohio Department of Health. (2020). Managing Implicit Bias and Maternal Health. Retrieved from <https://odh.ohio.gov/wps/portal/gov/odh/know-our-programs/pregnancy-associated-mortality-review/Webinars/>
4. National Institute for Children's Health Quality. (2020). *Addressing Black Maternal Mortality Rates Starts with Listening to Black Women*. Retrieved from <https://www.nichq.org/insight/addressing-black-maternal-mortality-rates-starts-listening-black-women>
5. The American College of Obstetricians and Gynecologists District II. (2014). Eclampsia Simulation Scenario Overview. Retrieved from <https://www.acog.org/-/media/project/acog/acogorg/files/forms/districts/smi-hypertension-bundle-eclampsia-simulation-scenario.pdf>
6. The American College of Obstetricians and Gynecologists District II. (2014). Eclampsia Drill Clinical Scenario. Retrieved from <https://www.acog.org/-/media/project/acog/acogorg/files/forms/districts/smi-hypertension-bundle-eclampsia-drill-scenario.pdf>
7. The American College of Obstetricians and Gynecologists District II. (2014). Eclampsia Drill Assessment Tool. Retrieved from <https://www.acog.org/-/media/project/acog/acogorg/files/forms/districts/smi-hypertension-bundle-eclampsia-drill-assessment.pdf>
8. The American College of Obstetricians and Gynecologists District II. (2014). Hypertensive Emergency Checklist. Retrieved from <https://www.acog.org/-/media/project/acog/acogorg/files/forms/districts/smi-hypertension-bundle-emergency-checklist.pdf>
9. The American College of Obstetricians and Gynecologists District II. (2014). Postpartum Preeclampsia Checklist. Retrieved from <https://www.acog.org/-/media/project/acog/acogorg/files/forms/districts/smi-hypertension-bundle-postpartum-preeclampsia-checklist.pdf>
10. California Maternal Quality Care Collaborative. (2014). Sample Preeclampsia/Eclampsia Medication Toolbox List. Retrieved from <https://www.cmqcc.org/resources-tool-kits/toolkits/preeclampsia-toolkit>
11. Gibson, K.S., McLean, D. (2020). A Maternal Transport Briefing Form and Checklist.
12. MetroHealth Medical Center. (n.d.). Simulation Scenario.

13. California Maternal Quality Care Collaborative. (2014). Severe Preeclampsia/Eclampsia in LDR v2.0 SimMan 3G: General Information. Retrieved from <https://www.cmqcc.org/resources-tool-kits/toolkits/preeclampsia-toolkit>
14. California Maternal Quality Care Collaborative. (2014). Simulation Scenario: Hypertension in Pregnancy, HELLP with Seizure. Retrieved from <https://www.cmqcc.org/resources-tool-kits/toolkits/preeclampsia-toolkit>
15. California Maternal Quality Care Collaborative. (2014). Outpatient Management of Preeclampsia. Retrieved from <https://www.cmqcc.org/resources-tool-kits/toolkits/preeclampsia-toolkit>
16. California Maternal Quality Care Collaborative. (2014). Tool: Diagnosis: Evaluation and Treatment of Antepartum and Postpartum Preeclampsia and Eclampsia in the Emergency Department. Retrieved from <https://www.cmqcc.org/resources-tool-kits/toolkits/preeclampsia-toolkit>
17. California Maternal Quality Care Collaborative. (2014). Tool: Treatment: Evaluation and Treatment of Antepartum and Postpartum Preeclampsia and Eclampsia in the Emergency Department. Retrieved from <https://www.cmqcc.org/resources-tool-kits/toolkits/preeclampsia-toolkit>
18. Arizona Department of Health Services. (2020). High Risk Perinatal Program (HRPP) Transport Services Policy and Procedure Manual. Retrieved from <https://www.azdhs.gov/documents/prevention/womens-childrens-health/reports-fact-sheets/high-risk/complete-transport-manual.pdf>

Appendix C – Section 2 Recognition

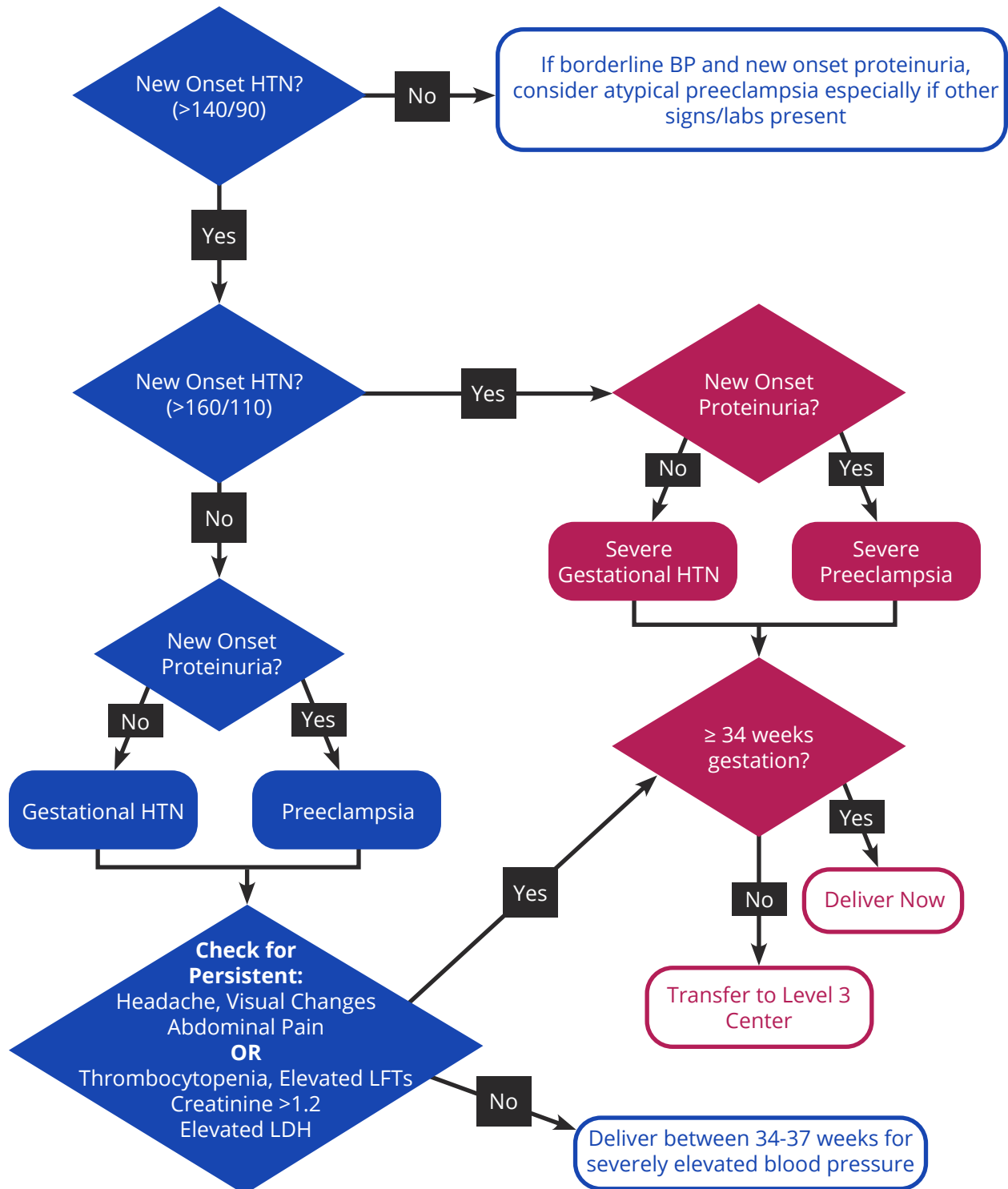
Resources: Tools and Tables

Classification of hypertension in pregnancy table

Classification	Criteria
Chronic hypertension	<ul style="list-style-type: none"> • Persistent stage 1 hypertension (BP of 130-139 mmHg systolic or 80-89 mmHg diastolic) • Identified prior to 20 weeks gestation and diagnosed first time during pregnancy • Diagnosed for the first time during pregnancy and doesn't resolve postpartum
Superimposed preeclampsia or eclampsia on chronic hypertension	<ul style="list-style-type: none"> • New onset preeclampsia after 20 weeks in a woman with chronic hypertension • Sudden increase in proteinuria if already present in early gestation • Sudden increase in baseline hypertension • Development of HELLP syndrome
Gestational hypertension	<ul style="list-style-type: none"> • ≥ 140 mm Hg systolic or ≥ 90 mm Hg diastolic, or both, on two occasions at least 4 hours apart occurring after 20 weeks gestation • Transient diagnosis with normalization of BP by 12 weeks postpartum • May represent pre-proteinuric phase of preeclampsia or recurrence of chronic hypertension abated in mid-pregnancy
Preeclampsia	<ul style="list-style-type: none"> • BP ≥ 140 mm Hg systolic or ≥ 90 mm Hg diastolic or higher (after 20 weeks gestation) • Proteinuria – protein/creatinine ratio of 0.3 mg/dL or more or 300 mg or more in a 24-hour urine specimen <ul style="list-style-type: none"> • In the absence of proteinuria, new-onset hypertension with new-onset of any severe features (see below)
Eclampsia	<ul style="list-style-type: none"> • Presence of new onset tonic-clonic, focal, or multifocal seizures in the absence of other causative conditions • New onset seizures 48-72 hours postpartum (other central nervous system pathology is the likely reason for the seizure after 7 days)
Preeclampsia with severe features	<p>If one or more of the following criteria are present:</p> <ol style="list-style-type: none"> 1. Blood pressure of 160 mm Hg systolic or 110 mm Hg diastolic or higher on two occasions at least 4 hours apart (unless antihypertensive therapy is initiated before this time) 2. New-onset headache unresponsive to medication and not accounted for by alternative diagnoses 3. Cerebral or visual disturbances 4. Pulmonary edema or cyanosis 5. Impaired liver function as indicated by abnormally elevated blood concentrations of liver enzymes (twice normal concentration or higher), severe persistent right upper quadrant or epigastric pain unresponsive to medication and not accounted for by alternative diagnoses, or both 6. Thrombocytopenia (platelet count $< 100,000 \times 10^9/L$) 7. Renal insufficiency (serum creatinine concentration > 1.1 mg/dL or a doubling of the serum creatinine concentration in the absence of other renal disease)
HELLP Syndrome	<p>Presence of all 3 criteria concurrently</p> <ul style="list-style-type: none"> • Hemolysis (serum LDH > 600 U/L or total bilirubin > 1.1 mg/dL) • Elevated Liver enzymes (twice the upper limit of normal concentration) • Low Platelets (platelet count $< 100,000 \times 10^9/L$)

Suspected Preeclampsia Algorithm

The Suspected Preeclampsia Algorithm flowchart may be used to inform potential care and delivery decisions for patients determined to be experiencing severe gestational hypertension and preeclampsia.



Resources: Additional Links

Provider and Patient education

Healthcare team

- 1.) Alliance for Innovation on Maternal Health (AIM) eModules: Severe Hypertension (HTN) in Pregnancy
 - a. https://safehealthcareforeverywoman.org/aim-emodules/#link_acc-1-5-d
- 2.) American College of Obstetricians and Gynecologists Safe Motherhood Initiative: Severe Hypertension
 - a. <https://www.acog.org/community/districts-and-sections/district-ii/programs-and-resources/safe-motherhood-initiative/severe-hypertension>
- 3.) Preeclampsia Foundation: Healthcare Providers
 - a. <https://www.preeclampsia.org/healthcare-providers>

Patient Education

- 1.) Preeclampsia Foundation: Educating Patients
 - a. <https://www.preeclampsia.org/educating-patients>
- 2.) American College of Obstetricians and Gynecologists Preeclampsia and High Blood Pressure During Pregnancy: Frequently Asked Questions
 - a. <https://www.acog.org/patient-resources/faqs/pregnancy/preeclampsia-and-high-blood-pressure-during-pregnancy>
- 3.) Alliance for Innovation on Maternal Health (AIM): Urgent Maternal Warning Signs
 - a. <https://safehealthcareforeverywoman.org/urgentmaternalwarningsigns/>

Blood Pressure Cuffs and Measurement

AAMI – Association for the Advancement of Medical Instrumentation

BHS – British Hypertension Society

EHS – European Hypertension Society

List of validated home blood pressure monitors

<https://www.validatebp.org/>

How to use your blood pressure monitor at home

<https://www.youtube.com/watch?v=K9HU2F3TOal&feature=youtu.be>

Self-Measured Blood Pressure Monitoring (Tools and Protocols)

<https://millionhearts.hhs.gov/tools-protocols/smbp.html#refs>

References

1. Council on Patient Safety in Women's Health Care. (2015). Severe Hypertension Bundle. Retrieved from <https://safehealthcareforeverywoman.org/wp-content/uploads/2017/11/Severe-Hypertension-Bundle.pdf>

2. American Heart Association. (2018). Steps for Accurate BP Measurement. Retrieved from https://www.heart.org/-/media/files/health-topics/high-blood-pressure/tylenol-hbp/aha_toolkit_poster_final_102618.pdf
3. Champagne, Holly. California Maternal Quality Care Collaborative. (2014). Proteinuria. Retrieved from <https://www.cmqcc.org/resources-tool-kits/toolkits/preeclampsia-toolkit>
4. TriHealth. (n.d.). Hypertensive Emergency Protocol.
5. Morton, C.H., Peterson, N., Shields, L. California Maternal Quality Care Collaborative. (2014). Preeclampsia Early Recognition Tool (PERT). Retrieved from <https://www.cmqcc.org/resources-tool-kits/toolkits/preeclampsia-toolkit>
6. California Maternal Quality Care Collaborative. (2014). Suspected Preeclampsia Algorithm. Retrieved from <https://www.cmqcc.org/resources-tool-kits/toolkits/preeclampsia-toolkit>
7. Druzin, M. California Maternal Quality Care Collaborative. (2014). Classification and Diagnosis of Hypertensive Disorders of Pregnancy. Retrieved from <https://www.cmqcc.org/resources-tool-kits/toolkits/preeclampsia-toolkit>
8. Alliance for Innovation of Maternal Health. (2020). AIM eModules. Retrieved from https://safehealthcareforeverywoman.org/aim-emodules/#link_acc-1-5-d
9. The American College of Obstetricians and Gynecologists. (2020). Safe Motherhood Initiative: Severe Hypertension. Retrieved from <https://www.acog.org/community/districts-and-sections/district-ii/programs-and-resources/safe-motherhood-initiative/severe-hypertension>
10. Preeclampsia Foundation. (2020). Healthcare Providers. Retrieved from <https://www.preeclampsia.org/healthcare-providers>
11. Preeclampsia Foundation. (2020). Educating Patients. Retrieved from <https://www.preeclampsia.org/educating-patients>
12. The American College of Obstetricians and Gynecologists. (2020). Preeclampsia and High Blood Pressure During Pregnancy: Frequently Asked Questions. Retrieved from <https://www.acog.org/patient-resources/faqs/pregnancy/preeclampsia-and-high-blood-pressure-during-pregnancy>
13. Council on Patient Safety in Women's Health Care. (2020). Urgent Maternal Warning Signs. Retrieved from <https://safehealthcareforeverywoman.org/urgentmaternalwarningsigns/>
14. Million Hearts. (2020). Self-Measured Blood Pressure Monitoring. Retrieved from <https://millionhearts.hhs.gov/tools-protocols/smbp.html#refs>

Appendix D – Section 3 Response

Resources: Tools and Tables

L&D Severe Preeclampsia & Eclampsia Box – Content and Dose Guideline	
Magnesium 20 grams/500 ml bag	<p><u>IV (Use Magnesium Sulfate Continuous Infusion under L&D protocol in Alaris Pump Library):</u> <i>Initial (Loading Dose):</i> 4-6 g (100 ml – 150 ml) over 20-30 minutes <i>Maintenance Dose:</i> 1-2 g/hour (25 ml/hr – 50 ml/hr) continuous infusion</p> <p><u>Intramuscular Injection (in case of difficulty establishing venous access):</u> <i>Initial (Loading Dose):</i> 10 g (250ml) <i>Maintenance Dose:</i> 5 g (125 ml) q 4 hours</p>
Labetalol 100 mg/20 ml vial	<p><i>Initial: Draw 4 ml from the vial.</i> 10–20 mg (2 ml - 4ml) IV, then 20–80 mg (4ml - 16ml) every 10–30 minutes to a maximum cumulative dosage of 300 mg (60 ml); or constant infusion 1-2 mg/min IV</p>
Hydralazine 20 mg/ml vial	<p><i>Initial: Draw 0.25 ml from the vial.</i> 5 mg IV or IM, then 5–10 mg IV every 20–40 minutes to a maximum cumulative dosage of 20 mg; or constant infusion of 0.5–10 mg/hr</p>
Nifedipine 10 mg PO	<p>10–20 mg orally, repeat in 20 minutes if needed; then 10–20 mg every 2–6 hours; maximum daily dose is 180 mg</p>
Calcium gluconate 1000 mg/10 ml vial	<p>10% solution, 10 ml IV over 3 minutes</p>
Supply contents	<p>3 ml, 10 ml, and 20 ml syringes, appropriate needles and appropriate tubing sets</p>
Esmolol 100 mg/10 ml vial (By Anesthesiologists ONLY)	<p>Requires coordination with Anesthesiologist</p>
Propofol 10 mg/ml, 20 ml vial (By Anesthesiologists ONLY)	<p>Requires coordination with Anesthesiologist</p>

Resources: Additional Sources

Onset and Duration of magnesium sulfate therapy	CMQCC “Magnesium Sulfate” pages 51-57
Postpartum patient education	Urgent Maternal Warning Signs
Labetalol	ACOG Labetalol Algorithm
Hydralazine	ACOG Hydralazine Algorithm
Oral Nifedipine	ACOG Immediate-Release Oral Nifedipine Algorithm

References

1. Council on Patient Safety in Women's Health Care. (2015). Severe Hypertension Bundle. Retrieved from <https://safehealthcareforeverywoman.org/wp-content/uploads/2017/11/Severe-Hypertension-Bundle.pdf>
2. The American College of Obstetricians and Gynecologists. (2019). Hypertensive Emergency Checklist. Retrieved from <https://www.acog.org/-/media/project/acog/acogorg/files/forms/districts/smi-hypertension-bundle-emergency-checklist.pdf>
3. The American College of Obstetricians and Gynecologists. (2019). Eclampsia Checklist. Retrieved from <https://www.acog.org/-/media/project/acog/acogorg/files/forms/districts/smi-hypertension-bundle-eclampsia-checklist.pdf>
4. The American College of Obstetricians and Gynecologists. (2019). Postpartum Preeclampsia Checklist. Retrieved from <https://www.acog.org/-/media/project/acog/acogorg/files/forms/districts/smi-hypertension-bundle-postpartum-preeclampsia-checklist.pdf>
5. TriHealth. (n.d.). Hypertensive Emergency Protocol.
6. Council on Patient Safety in Women's Health Care. (2020). Patient Clinical Summary After a Severe Maternal Event Form. Retrieved from <https://safehealthcareforeverywoman.org/patient-safety-tools/summary-after-a-severe-maternal-event/>
7. Council on Patient Safety in Women's Health Care. (2015). Recognizing Signs of Acute Stress Disorder in Postpartum women in the Hospital Setting. Retrieved from <https://safehealthcareforeverywoman.org/wp-content/uploads/2016/09/7-Response-Recognizing-Signs-of-Acute-Stress-Disorder-in-Postpartum-Women-in-the-Hospital-Setting-MFHall.pdf>
8. The American College of Obstetricians and Gynecologists. (2019). Committee Opinion 681. Retrieved from <https://www.acog.org/clinical/clinical-guidance/committee-opinion/articles/2016/12/disclosure-and-discussion-of-adverse-events>
9. The American College of Obstetricians and Gynecologists. (2019). Committee Opinion 767. Retrieved from <https://www.acog.org/clinical/clinical-guidance/committee-opinion/articles/2019/02/emergent-therapy-for-acute-onset-severe-hypertension-during-pregnancy-and-the-postpartum-period>
10. California Maternal Quality Care Collaborative. (2014). Sample Preeclampsia/Eclampsia Medication Toolbox List. Retrieved from <https://www.cmqcc.org/resources-tool-kits/toolkits/preeclampsia-toolkit>
11. California Maternal Quality Care Collaborative. (2014). Magnesium Sulfate. Retrieved from <https://www.cmqcc.org/resources-tool-kits/toolkits/preeclampsia-toolkit>
12. The American College of Obstetricians and Gynecologists. (2019). Labetalol Algorithm. Retrieved from <https://www.acog.org/-/media/project/acog/acogorg/files/forms/districts/smi-hypertension-bundle-labetalol-algorithm.pdf>

13. The American College of Obstetricians and Gynecologists. (2019). Hydralazine Algorithm. Retrieved from <https://www.acog.org/-/media/project/acog/acogorg/files/forms/districts/smi-hypertension-bundle-hydralazine-algorithm.pdf>
14. The American College of Obstetricians and Gynecologists. (2019). Immediate-Releasing Oral Nifedipine Algorithm Retrieved from <https://www.acog.org/-/media/project/acog/acogorg/files/forms/districts/smi-hypertension-bundle-oral-nifedipine-algorithm.pdf>

Appendix E – Section 4 Reporting

Resources: Tools and Tables

SBAR-R-R Communication Technique

A specific strategy for structured communication that many health care providers are familiar with is “SBAR.” This format, developed by Kaiser Permanente, was adapted from military and aviation crew resource management practices. It is recommended and taught in most healthcare teamwork improvement programs. The SBAR format, which stands for Situation-Background-Assessment-Recommendation, provides a brief, organized, predictable flow of information that facilitates critical thinking and communication skills between healthcare providers, and may be especially helpful in leveling communication styles between disciplines. However SBAR alone does not explicitly incorporate essential teamwork principles of assertive communication of concern and closed loop communication. These two principles can be built into SBAR with a simple expansion to SBAR-R-R (Table 3), which includes the steps “Reasoning,” to ensure team members understand each other’s interpretation of the present situation if immediate agreement is not reached, and “Ratification,” to ensure the team members have an agreed upon plan for moving forward.

Table 3: SBAR-R-R Communication Technique Applied to Preeclampsia

<p>Prepare for an SBAR-R-R by:</p> <ol style="list-style-type: none">1. Assessing the patient2. Reviewing recent notes and laboratory results3. Having the medical record available during the conversation <p>Situation: Always identify yourself, where you are calling from, the name of the woman you are calling about, quickly state the main reason and the <u>level of urgency</u> for the call.</p> <p>Background: Give brief pertinent background information – medical history, complaints, vital signs, and interventions that have already occurred</p> <p>Assessment: Say what you think is going on</p> <p>Recommendation: Say what you think should happen or ask for specific orders</p> <p>Reasoning: If the response is not what you expect and requested, state <i>why</i> what you think should happen is important. What could happen if we don’t do this?</p> <p>Ratification: Close the loop by confirming actions to be taken. Assure mutual agreement on the plan.</p>

Table 4: Sample SBAR-R-R Scenarios

	Ambulatory Care or Emergency Department	Inpatient Antepartum or Intrapartum	Postpartum
Situation	<p>I am calling about Ms. ____, who</p> <ul style="list-style-type: none"> <input type="checkbox"/> is pregnant <input type="checkbox"/> recently had a baby <p>and is here in the ED with stomach pain. I am concerned about</p> <ul style="list-style-type: none"> • High blood pressure • Headache • Visual disturbances • Decreased fetal movement • Nausea and vomiting 	<p>I am calling about Ms. ____, who is an antepartum patient being monitored for preeclampsia. I am concerned about:</p> <ul style="list-style-type: none"> • New onset headache • Increasing blood pressures • Headache that has not resolved • Visual disturbances • Stomach pain • Abnormal or indeterminate fetal status • Altered/worsening lab values 	<p>I'm calling about Ms. ____ who had her second baby yesterday at 3 pm. I am concerned about:</p> <ul style="list-style-type: none"> • New onset headache • Increasing blood pressures • Headache that has not resolved • Visual disturbances • Stomach pain • Altered/worsening lab values
Background	<ul style="list-style-type: none"> • GPTAL @__weeks or G_P_ #days post birth • Significant OB and medical history • Current problems • Patient complaints • Vital Signs • Interventions and response 	<ul style="list-style-type: none"> • GPTAL @__weeks • Significant OB and medical history • Current problems • Patient complaints • Vital Signs • FHR tracing baseline, variability, accelerations, decelerations • Uterine activity • Interventions already completed 	<ul style="list-style-type: none"> • G P__ • Mode of birth (vaginal/cesarean) • Significant OB and medical history • Current problems • Patient complaints • Vital Signs • Interventions already completed
Assessment	<ul style="list-style-type: none"> • I'm thinking she may have preeclampsia and need an OB evaluation before we can clear her. • I'm concerned she may have severe preeclampsia and needs medication to control her blood 	<ul style="list-style-type: none"> • Her preeclampsia seems to be progressing and her blood pressures indicate severe hypertension and severe preeclampsia. • The FHR tracing is indeterminate and the 	<ul style="list-style-type: none"> • I'm thinking that her increasing BPs and new onset headache may represent preeclampsia and that she would benefit from an initial preeclampsia workup.

	pressure now.	decelerations do not resolve with position change.	
Recommendation	<ul style="list-style-type: none"> • Could you please come and evaluate her within ___? <ul style="list-style-type: none"> ○ Now ○ Within 30 min ○ Before ___, etc. • Could I have orders for: _ <ul style="list-style-type: none"> ○ CBC, liver function, kidney function ○ Antihypertensive • Magnesium sulfate 	<ul style="list-style-type: none"> • I need you to come and evaluate her now. • May I please have an order for antihypertensive medication? • Are there any labs we need to repeat? • When can I expect you? 	<ul style="list-style-type: none"> • May I have an order for a preeclampsia lab panel? • When can I expect you in to evaluate Ms. ___?
Reasoning	<ul style="list-style-type: none"> • I don't think it is safe to send her home without evaluating the possibility of preeclampsia • If we don't lower her blood pressure to a safer range she could have a stroke 	<ul style="list-style-type: none"> • It is really important to control her blood pressure while we make preparations to proceed to birth. • If we don't lower her blood pressure to a safer range she could have a stroke. 	<ul style="list-style-type: none"> • It's important for us to get baseline data before considering discharge in the morning.
Ratification	<ul style="list-style-type: none"> • Ok, I'll do ___, and You'll evaluate her in ___ or call ___ for ___. 	<ul style="list-style-type: none"> • Ok, I'll do ___, and you'll be here to evaluate her in ___. 	<ul style="list-style-type: none"> • OK, I'll do ___ and you'll be in to evaluate her in ___.

Adapted from Kaiser Permanente SBAR Guidelines and SBAR Report to Physician about a Critical Situation, and Ascension Health Perinatal SBAR Report Template.

Abstraction

SMM (recorded cause) _____ SMM Date _____
 MR # or PATIENT ID _____ Zip code of patient residence _____
 Abstraction Date ____/____/____ Abstractor _____
 Birth Facility _____
 Hospital Level 1 2 3 4 Birth center Other (Specify) _____

Patient Characteristics		
Age ____ Weight/Height ____/____ Body mass index (BMI) at first prenatal visit ____ Most recent BMI ____		
Race (Indicate race patient identifies) Choose an item.		Obstetric History Gravida _____ Para ____ Term ____ Premature ____ Aborted ____ Living ____ # Previous fetal deaths ____ # Previous infant deaths ____
Hispanic or Latina No <input type="checkbox"/> Yes <input type="checkbox"/> Unknown <input type="checkbox"/>		
Prenatal Care (PNC)		
Yes <input type="checkbox"/> Week PNC began ____ Week unknown Yes <input type="checkbox"/> No <input type="checkbox"/> Number of PNC visits ____ Visit # unknown Yes <input type="checkbox"/> No <input type="checkbox"/> Unknown PNC status <input type="checkbox"/>		
Discipline of Primary PNC Provider (choose one) Choose an item.	Prenatal care source/location Choose an item.	
Planned/intended place of delivery Choose an item.	Timing of maternal morbidity Choose an item.	
Maternal Transport (during peripartum period) No Choose an item. Yes <input type="checkbox"/> From facility _____ to facility _____ Unknown <input type="checkbox"/>	Perinatologist consultation (during peripartum period) No Choose an item. Yes <input type="checkbox"/> Provider type: _____ Unknown <input type="checkbox"/>	
Delivery Information Gestational age at time of morbidity _____ Singleton <input type="checkbox"/> Multiple <input type="checkbox"/> (If multiple fill out additional delivery information per fetus)		
Birth status Choose an item.	Labor Yes <input type="checkbox"/> No <input type="checkbox"/>	Delivery type Choose an item.
If C-Section Type of C-section Choose an item.	If C-Section Primary reason for C-Section Choose an item.	
Type of anesthesia Choose an item.	Primary payer source Choose an item.	

Case Narrative

Should include brief synopsis focused on the specific severe maternal morbidity that occurred that allow you to address the disease specific questions. It should be concise and pertinent to the particular SMM and include appropriate time line, evaluation, and be in chronologic format. Try to identify key moments that impacted care

Case Analysis

Assessment

MR# or PATIENT ID _____

Date of event: _____

Date of review: _____

Reviewers: _____

1. Morbidity Category ICU Admission Transfused 4 or more units Other _____

2. Sequence of Morbidity 1.

Indicate the course of events:

Clinical Cause of Morbidity: 1 &

2 reflect what initiated the final

cause resulting in the severe 2.

morbidity. 3 is the final cause

For example: 1. Preeclampsia

2. uncontrolled hypertension 3 3.

intracranial bleed,

So that 1, caused 2, that

resulted in 3 – the severe

morbidity

3. Primary Cause of Morbidity Choose an item.

If trauma indicated as primary cause of morbidity: Choose an item.

Other cause _____

Resolution

Refer to the SMM Outcome Factors Guide (pg. 7) of the SMM Review Long Form to determine contributing factors and opportunities

Opportunity to Alter Outcome	<input type="checkbox"/> Strong	<input type="checkbox"/> Possible	<input type="checkbox"/> None
If opportunity to alter outcome present were opportunities largely: Circle all that apply			
Provider			
System			
Patient			
List up to 3 things that could be done to alter outcome:			
Identify practices that were done well and should be reinforced:			
Recommendations for system, practice, provider improvements:			

This form was originally developed by the California Pregnancy-Associated Mortality Review (CA-PAMR) using Title V MCH funding and is adapted with permission from the California Department of Public Health, Maternal, Child and Adolescent Health Division. Sacramento, CA

Geller SE, Adams MG, Kominiarek MA, Hibbard JU, Endres LK, Cox SM, Kilpatrick SJ. Reliability of a preventability model in maternal death and morbidity. *AJOG* 2007;196:57.e1

Geller SE, Cox SM, Kilpatrick SJ. A descriptive model of preventability in maternal morbidity and mortality. *J Perinat* 2006;26:79-84

Lawton B, Macdonald EJ, Brown SA, Wilson L, Stanley J, Tait JD, Dinsdale RA, Coles CL, Geller SE. Preventability of severe acute maternal morbidity. *AJOG* 2014;210:557.

Resources: Additional Links

Alliance for Innovation on Maternal Health	AIM eModules
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References

1. Council on Patient Safety in Women's Health Care. (2015). Severe Hypertension Bundle. Retrieved from <https://safehealthcareforeverywoman.org/wp-content/uploads/2017/11/Severe-Hypertension-Bundle.pdf>
2. Alliance for Innovation on Maternal Health. (2020). AIM eModules. Retrieved from https://safehealthcareforeverywoman.org/aim-emodules/#link_acc-1-5-d
3. California Maternal Quality Care Collaborative. (2014). SBAR-R-R Communication Technique. Retrieved from <https://www.cmqcc.org/resources-tool-kits/toolkits/preeclampsia-toolkit>
4. The American College of Obstetricians and Gynecologists. (2020). Obstetric Team Debriefing Form. Retrieved from <https://www.acog.org/-/media/project/acog/acogorg/files/forms/districts/smi-ob-hemorrhage-bundle-debriefing-form.pdf>