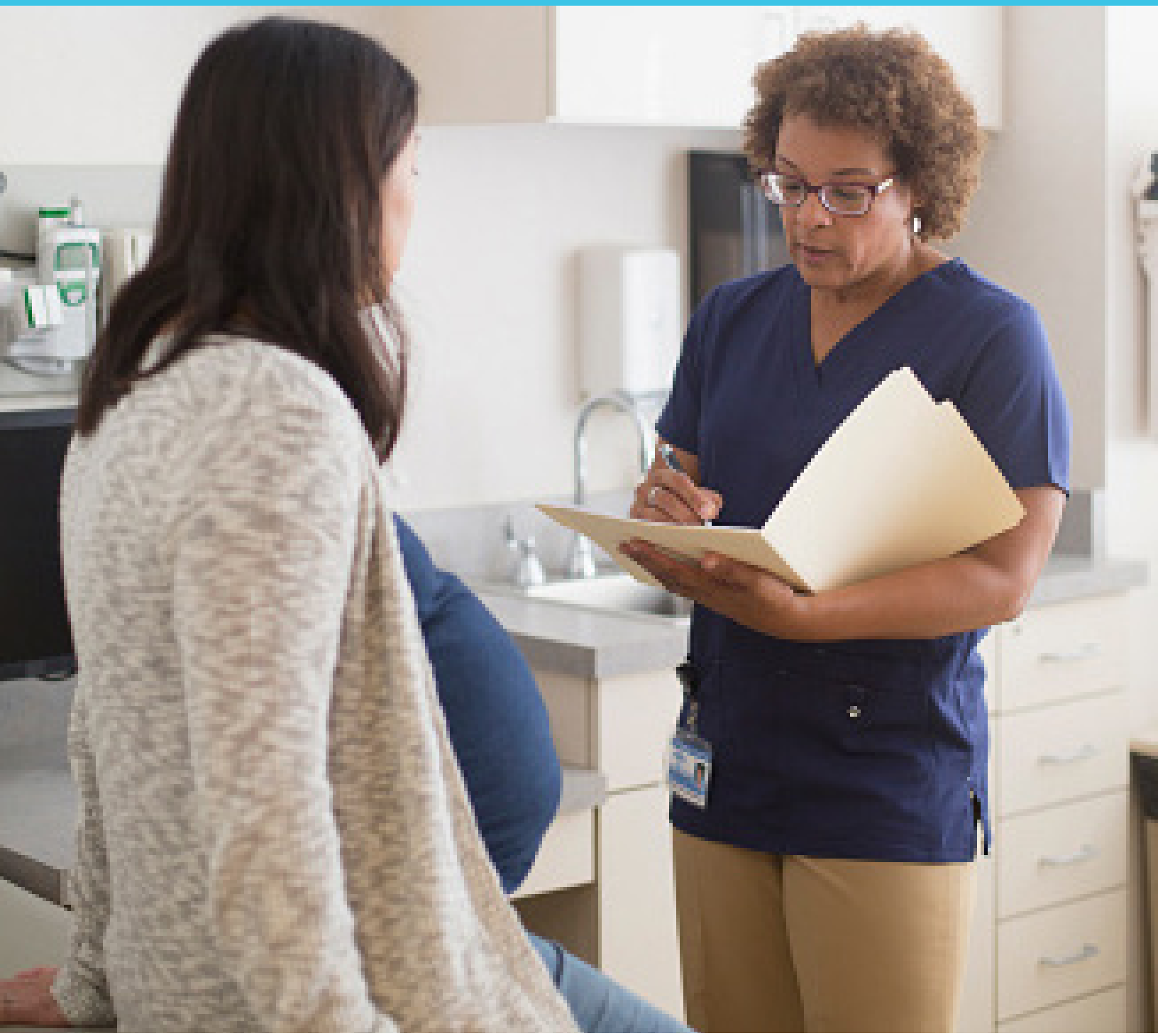
Maternal Safety: Best Practices in Hypertension



Ohio Department of Health

Ohio Hospital Association

The Ohio State University Wexner Medical Center

Cleveland Clinic

University Hospitals

MetroHealth

TriHealth

Ohio Colleges of Medicine Government Resource Center

OPQC

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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 Improvement,[3] 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. Additional staff members may include:

- RN or Unit Manager
- Front Line Staff Champion
- Quality Improvement Expert

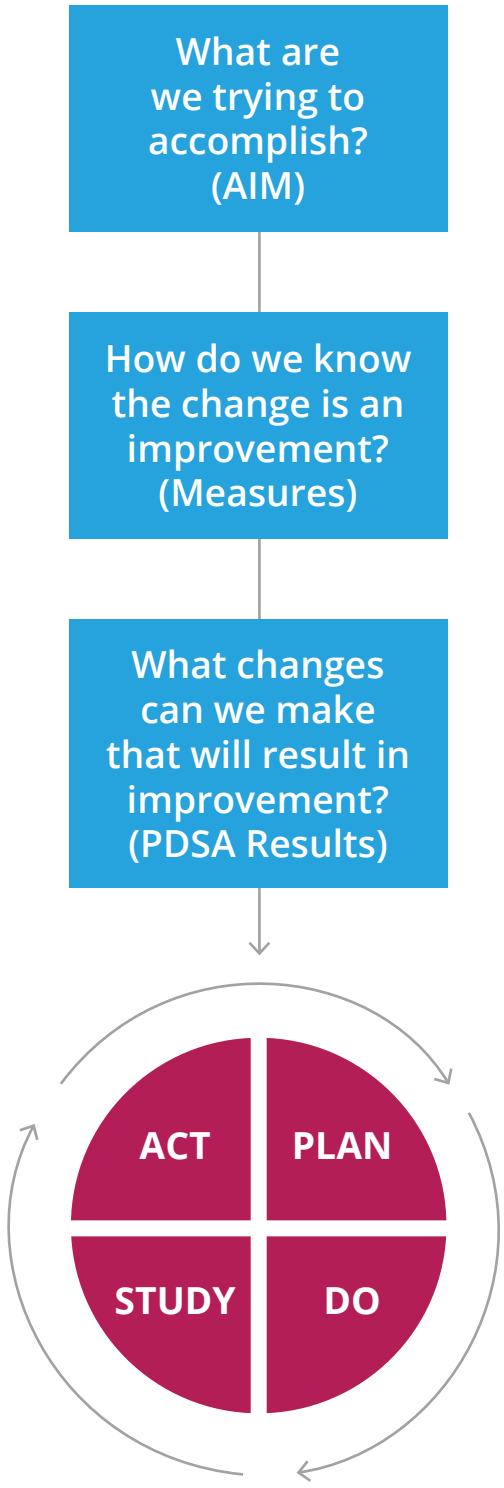
Step 2: Set Aims

"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.



Step 3: Establish Measures

"How will we know that a change is an improvement?"

Process Measures

- Timely Blood Pressure Treatment
- Appropriate Medical Management
- Discharge Education Materials
- Follow-up Appointment Scheduled
- Follow-up for Patient with Rx
- Postpartum Bundle Implementation

Balancing Measures

- Mean Arterial Pressure (MAP) Decrease
- Fetal Heart Rate (FHR) Deterioration – MAP Decrease
- Fetal Heart Rate (FHR) Deterioration

Outcome Measures

- HTN-related and cardiovascular-related Severe Maternal Morbidity (SMM) (hospital)
- Postpartum Hospital Readmission Rate
- Maternal Mortality
  - Maternal Mortality by Race/Ethnicity
- SMM (state)
  - SMM (state) by Race/Ethnicity
- SMM (hospital)
  - 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:

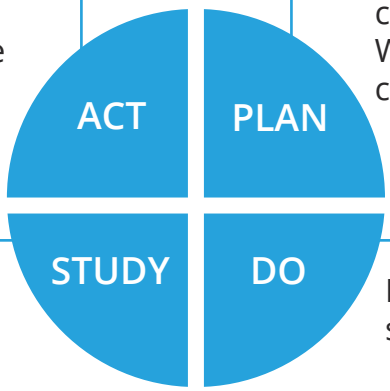
- Ensure appropriate blood pressure measurement protocol
- Utilize care checklists for care of hypertensive disorders of pregnancy

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:

Develop a plan to test the change (Who? What? When? Where? What data need to be collected?)



Implement the test on a small scale.

Use data to analyze the results of the change and determine if it made a difference.

Based on your analysis, refine the change. Determine what modification should be made and plan for the next test.

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 are[1]:

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
- Triage
- Antepartum
- Postpartum
- Emergency Department
- 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	• 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	• 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	• Continued therapy escalation and transfer to intensive care unit if: a) Transfer arrangements have not been made b) 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. Clinical Consideration for Consultation - By Service

Pulmonary	• Pulmonary edema • Fluid overload • Leaky membrane • Low colloid oncotic pressure	• Unresponsive to diuretics • Shortness of breath • Unresponsive asthmatic therapy
Cardiac	• Cardiac pump failure (such as peripartum cardiomyopathy) • Arrhythmia • Hypoxia	• Chest trauma • Allergic reaction • Magnesium toxicity
Neurologic	• Seizures (eclampsia) • Seizures unresponsive to typical therapy (magnesium followed by anti-epileptics) • Altered mental status	• New focal neurologic symptom or exam finding • Suspected or confirmed cerebrovascular accident
Hematologic	• Disseminated intravascular coagulation • Thrombocytopenia (platelet < 50,000)	• Coagulopathy • Obstetrical hemorrhage • Anticoagulation use

Pharmacy

Readily available agents and appropriate dosages for initial emergent

- 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%
- 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

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 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 Health[3]	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 Women[4]	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 #1[5]	https://www.acog.org/-/media/project/acog/acogorg/files/forms/districts/smi-hypertension-bundle-eclampsia-simulation-scenario.pdf
Eclampsia: Clinical Scenario #2[6]	https://www.acog.org/-/media/project/acog/acogorg/files/forms/districts/smi-hypertension-bundle-eclampsia-simulation-scenario.pdf
Eclampsia: Drill Assessment Tool[7]	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 II[8]	https://www.acog.org/-/media/project/acog/acogorg/files/forms/districts/smi-hypertension-bundle-emergency-checklist.pdf
Emergency Department: Postpartum Preeclampsia Checklist ACOG District II[9]	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	**IV (Use Magnesium Sulfate Continuous Infusion under L&D protocol in Alaris Pump Library):** *Initial (Loading Dose)*: 4-6 g (100 ml – 150 ml) over 20-30 minutes *Maintenance Dose*: 1-2 g/hour (25 ml/hr – 50 ml/hr) continuous infusion **Intramuscular Injection (in case of difficulty establishing venous access):** *Initial (Loading Dose):* 10 g (20 ml) *Maintenance Dose:* 5 g (10 ml) q 4 hours
Labetalol 100 mg/20 ml vial	***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
Hydralazine 20 mg/ml vial	***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
Nifedipine 10 mg PO	10–20 mg orally, repeat in 20 minutes if needed; then 10–20 mg every 2–6 hours; maximum daily dose is 180 mg
Calcium gluconate 1000 mg/10 ml vial	10% solution, 10 ml IV over 3 minutes
Supply contents	3 ml, 10 ml, and 20 ml syringes, appropriate needles and appropriate tubing sets
Esmolol 100 mg/10 ml vial **(By Anesthesiologists ONLY)**	**Requires coordination with Anesthesiologist**
Propofol 10 mg/ml, 20 ml vial **(By Anesthesiologists ONLY)**	**Requires coordination with Anesthesiologist**

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.

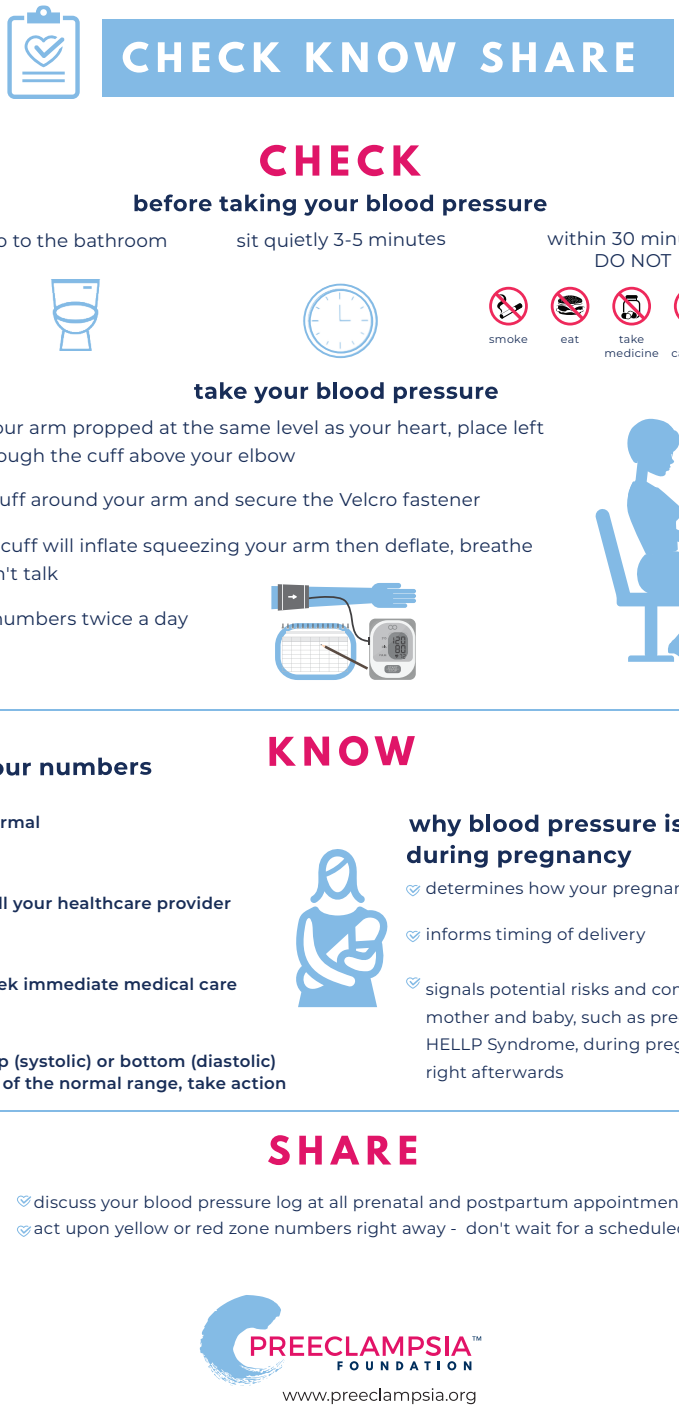
2. Standard response to maternal early warning signs including listening to and investigating patient symptoms and assessment of key laboratory values.

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 Preeclampsia Foundation[2] 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.



Preeclampsia Foundation. (2021). Check Know Share.

Proteinuria Recommendations[3]

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

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.

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

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.

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)

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.

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

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)

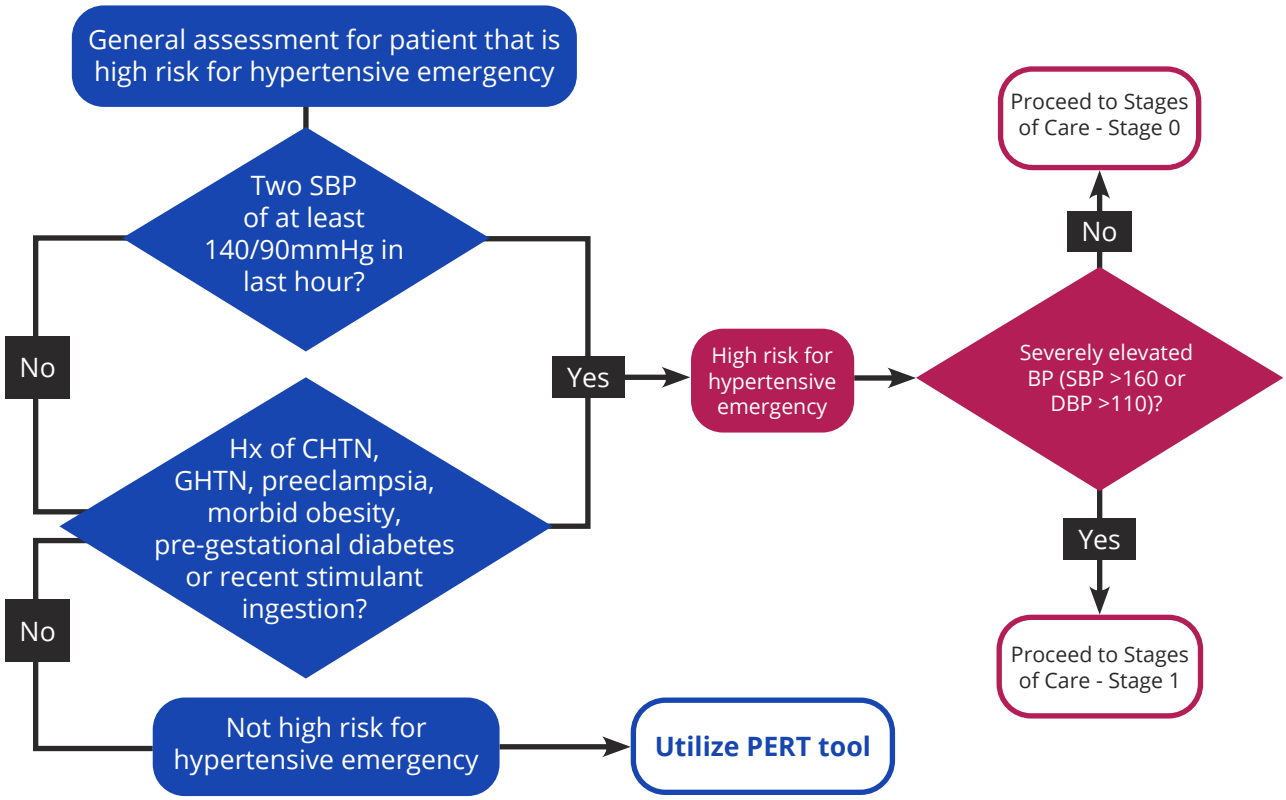
Anytime there is a concern for hypertensive disorders of pregnancy, the components of the tool should be covered and reviewed this includes:

- 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 Checklist[2]
Eclampsia, seizure prophylaxis, and magnesium over-dosage	ACOG Eclampsia Checklist[3]
Postpartum presentation of severe hypertension/preeclampsia	ACOG Postpartum Preeclampsia Checklist[4]

Minimum Requirements for Protocol

Notification of physician or PCP if Systolic BP ≥ 160 or Diastolic BP ≥ 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

Stage System for Hypertensive Emergency[5]

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	

3. 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.

4. 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.

5. Ensure the patient's family is supported and well-apprised of the situation at each stage.

Stage 1		
Definition		
Hypertensive Emergency: • SBP ≥ 160 or • DBP ≥ 110	**Notes:** • Separated by 15 minutes within 1 hour • Values do not need to be consecutive	
Care team		
At Bedside: Level 3 • Primary nurse • Primary 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	• 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 ≥ 160/110, give 40 mg IV over 2 min
- Recheck BP in 15 min
- If BP still ≥ 160/110, give 80 mg IV over 2 min
- Recheck BP in 15 min and if BP ≥ 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 ≥ 160/110, give 10 mg IV over 2 min
- Recheck BP in 15 min and if BP ≥ 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 ≥ 160/110, give 20 mg PO
- Recheck BP in 15 min
- If BP still ≥ 160/110, give 20 mg PO
- Recheck BP in 15 min and if BP ≥ 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 OB provider, bedside and charge nurses, and the anesthesiologist/CRNA**

Stage 2

Definition

Persistent Hypertensive Emergency:

- SBP ≥ 160 or
- DBP ≥ 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 in 15 min if Labetalol given OR if hydralazine given
- If BP ≥ 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 ≥ 160/110, give Labetalol 40 mg IV over 2 min
- Recheck BP in 15 min and if BP ≥ 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 ≥ 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 ≥ 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 OB provider, bedside and charge nurses, and the anesthesiologist/CRNA**

Stage 3

Definition

Persistent Hypertensive Emergency:

- SBP ≥ 160 or
- DBP ≥ 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 300 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 Form[6]	https://safehealthcareforeverywoman.org/council/patient-safety-tools/support-after-a-severe-maternal-event-patient-safety-bundle-aim/__;!!Cjnu1T6GFXg!4CT9-4YOptiP9UuHzXGLp1ZHxGIfmCtakmuQ82pDV_OkkmsClCV-YHcjLmZj3q7Yvp_kTE4$
Recognizing Signs of Acute Stress Disorder in Postpartum women in the Hospital Setting[7]	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 Events[8]	ACOG Committee Opinion 681
Emergent Therapy for Acute-Onset, Severe Hypertension During Pregnancy and the Postpartum Period[9]	https://www.acog.org/clinical/clinical-guidance/practice-bulletin/articles/2020/06/gestational-hypertension-and-preeclampsia__;!!Cjnu1T6GFXg!4CT9-4YOptiP9UuHzXGLp1ZHxGIfmCtakmuQ82pDV_OkkmsClCV-YHcjLmZj3q7YGMsacaI$

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
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.	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.	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.

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 and 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 on implicit bias, racial and ethnic disparities, and shared decision making.