

Actionable Patient Safety Solutions™ (APSS™): Severe Hypertension in Pregnancy and Postpartum

How to use this guide

This APSS provides evidence-based actions and resources for executives, leaders, clinicians, and performance improvement specialists. This document is intended to be used as a guide for healthcare organizations to examine their own workflows, identify practice gaps, and implement improvements. In it, you'll find:

Best Practice Summary: A high level summary of evidence-based, clinical best practices. (page 2)

Executive Summary: Executives should understand the breadth of the problem and its clinical and financial implications. (page 3)

Leadership Checklist: This section is for senior leaders to understand common patient safety problems and their implications related to severe hypertension in pregnancy and postpartum. Most preventable medical harm occurs due to system defects rather than individual mistakes. Leaders can use this checklist to assess whether best practices are being followed and whether action is needed in their organization around severe hypertension in pregnancy and postpartum. (page 4)

Clinical Workflow: This section includes more specific information about maternal hypertension across the continuum of care. Leaders should include the people doing the work in improving the work. This section outlines what should be happening on the frontline. Clinicians can use this section to inform leaders whether there are gaps and variations in current processes. This is presented as an infographic that can be used for display in a clinical area. (page 5)

Education for Patients and Family Members: This section outlines what frontline healthcare professionals should be teaching patients and family members about severe hypertension in pregnancy and postpartum. Clinicians can inform leaders whether there are gaps and variations in the current educational processes. (page 9)

Performance Improvement Plan: If it has been determined that there are gaps in current practice, this section can be used by organizational teams to guide them through an improvement project. (page 11)

What We Know about Severe Hypertension in Pregnancy and Postpartum: This section provides additional detailed information about severe hypertension in pregnancy and postpartum. (page 13)

Resources: This section includes helpful links to free resources from other groups working to improve patient safety. (page 16)

Endnotes: This section includes the conflict of interest statement, workgroup member list, and references. (page 17)

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Best Practice Summary

Prenatal Care

- Determine the patient's history of chronic hypertension and their current antihypertensive medications, if applicable. Adjust any antihypertensive medications as needed.
- Consult with women who have a history of hypertension and educate on the potential issues related to pregnancy.
- Monitor trends in the patient's blood pressure.
- Utilize routine urine dipstick testing to measure proteinuria in all patients during each prenatal visit. In doing so, monitor for preeclampsia if the patient presents with proteinuria without hypertension.
- Continue to closely monitor blood pressure readings and if blood pressure is over 140 systolic or 90 diastolic on two occasions 24 hours apart, send a protein creatinine ratio (PCR) on a single urine sample or check urine protein on a 24 hour urine collection.
- Educate the patient and family members, if appropriate, on preeclampsia and help them understand the relationship between hypertension and the placenta.
- Help your patients identify the signs and symptoms of hypertension and preeclampsia and ensure that they are aware of what signs to look for that may warrant an urgent visit to the hospital.

Hospital Admission and Routine Care

- Check the vital signs of all pregnant and postpartum women. Be sure to measure:
 - Blood pressure
 - Urine protein
 - Coagulation profile
 - Full blood count
 - Renal function for women with signs and symptoms of preeclampsia.
- Take the patient's blood pressure every four hours and document readings in the medical record, including:
 - Hypertension defined by a blood pressure reading greater than or equal to 140 mm Hg (systolic) or 90 mm Hg (diastolic) on two measurements separated by a period of rest. If reading is persistently greater than or equal to 160 mmHg (systolic) or 110 mmHg (diastolic) over a 15minute period, initiate treatment with a fast acting blood pressure medication.
 - If blood pressure is consistently above 150/100 mm Hg during the postpartum period, consider beginning an oral antihypertensive medication.

Diagnosis and Treatment

- Before making a final diagnosis of preeclampsia or hypertension, assess all criteria and vital measurements. Consider all of the risk factors based on the patient and their status upon hospital admission.
- Create a plan and carefully select appropriate antihypertensive drugs for the patient based on initial examination.
- Review a plan of care with patients with severe preeclampsia.
- If the patient developed eclampsia, treat it as an obstetric emergency. Use the ABCDE

approach to stabilize their airway, breathing, and circulation.

- Administer antihypertensive medications to prevent stroke typically within 30 to 60 minutes.
- If the condition is life threatening, prioritize delivery regardless of gestation and stabilize the mother.

Labor and Discharge

- Work with the care team to devise a plan should an emergency situation arise at any time.
- Closely monitor the mother and the fetus during labor.
- Frequently measure the mother's blood pressure throughout the labor.
- Continually check blood pressure even after labor and ensure that the patient's magnesium is maintained for 24 hours post delivery.
- Counsel women who experienced a hypertensive event during their labor and emphasize to them the recommendation of low dose aspirin during pregnancy for future pregnancies.
- Ensure that the patient's primary care provider has all information pertaining to the patient and their labor.
- Follow up with the mother postpartum.
- Examine outcomes by demographic variables, such as race, to identify areas for improvement for vulnerable populations. Use this information to advocate for improved resources across the continuum of care for vulnerable populations.

Executive Summary

The Problem

Hypertension is the most common problem during pregnancy, complicating 10% of all pregnancies, causing 9-26% of global maternal mortality, and contributing to 15% of all preterm births ([Khalil et al., 2016](#)). Additionally, the implications of hypertension during pregnancy do not remain only in the immediate peripartum timeframe, but infants born from pregnancies complicated by hypertension are more likely to suffer from cardiovascular disease and metabolic syndromes at earlier ages and are more likely to spend time in the NICU. Because pre-existing hypertension can make it difficult to detect growing complications during pregnancy, such as preeclampsia, and because women who have chronic hypertension can experience decline rapidly, hospitals and healthcare organizations must adopt standard workflows and processes to optimize preparation and performance.

The Cost

Chronic hypertension, or hypertension before pregnancy or before 20 weeks of gestation, complicates 3-5% of pregnancies ([Seely et al., 2014](#)). The two major causes of hypertension in pregnancy, obesity and older age, are increasing in prevalence and as such, optimal outcomes will be increasingly dependent on coordination across the continuum to manage hypertension before delivery. Additionally, because poorly managed chronic hypertension in the woman can manifest in multiple significant ways, including into preeclampsia, fetal growth restriction, preterm birth, and C-sections, the impacts can spread to the second patient: the newborn. As such, according to 2012 data, the cost of preeclampsia in the first 12 months following delivery was \$2.18 billion in the US alone, delineated into \$1.03 billion for the

mothers and \$1.15 billion for the newborn ([Stevens et al., 2017](#)).

The Solution

Many healthcare organizations have successfully implemented and sustained improvements and reduced death from severe hypertension in pregnancy and postpartum. This document provides a blueprint that outlines the actionable steps organizations should take to successfully reduce complications from severe hypertension in pregnancy and postpartum and summarizes the available evidence-based practice protocols. This document is revised annually and is always available free of charge on our website.

Leadership Checklist

On a monthly basis, or more frequently if a problem exists, the executive team should review the outcomes of patients with complications due to hypertension in pregnancy. Use this checklist as a guide to determine whether current evidence-based guidelines are being followed in your organization:

- Measure and report severe maternal mortality monthly. Note trends in areas with low compliance and severe hypertension incidence. Routinely reassess outcomes.
- If hypertension, preeclampsia, or eclampsia rates indicate room for improvement, initiate a PI (performance improvement) project. If a problem is not identified, routinely reassess to identify gaps, and ensure integrity of the data collected. Expect that when the organization starts tracking serious safety events, there will be an increase in adverse events reported. Recognize that these metrics are ultimately serving as an objective baseline for impactful tracking and improvement in the future.
- If a PI plan is put in place, measure the associated process outcomes.
- Ensure frontline involvement in hypertension improvement activities. Maintain their engagement and remove barriers to progress.
- Ensure that hypertension protocols are embedded into clinical workflows, whether electronic or paper.
- Develop facility-wide standard protocols with checklists and escalation policies for early warning sign detection, diagnostic criteria, monitoring standards, and treatment of severe preeclampsia/eclampsia. Adopt a standard process to identify women most at risk for serious adverse events with continued pregnancy.
- Devise a thorough verbal, written, and digital strategy for communication with outpatient providers.
- Standardize a process for timely triage and evaluation of pregnant and postpartum women with hypertension, including in the emergency department and in outpatient areas.
- Standardize a process for escalation and maternal transport to a higher level of care if appropriate .
- Ensure medications for severe hypertension and eclampsia are stocked and immediately available on labor and delivery units and other areas where patients may be treated.
- Ensure there are enough staff to effectively manage necessary preventive care.
- Ensure adequate training and documentation of hypertension recognition and management competencies and skills. Ensure competency of accurate measurement of blood pressure.
- Provide unit education on protocols and include simulation training and drills with

debriefs following.

- Eliminate barriers to making rapid changes to documentation templates and order sets.
- Debrief on a regular basis to solicit team feedback about barriers to sustained compliance. Adjust the plan quickly and nimbly as needed.
- Hold staff accountable for providing the standard of care and reward success.
- Ensure that leaders have a simple process to oversee hypertension recognition and management improvement work while also considering how it aligns with other initiatives across the organization.
- Facilitate post-event debriefs to discuss successes and opportunities for improvement.

Clinical Workflow

1. PRENATAL CARE

- Understand possible causes of hypertension, if possible.
- Evaluate women with chronic hypertension before pregnancy for end-organ damage.
- Adjust hypertensive medications as needed for optimization.
- Consult all chronically hypertensive women about potential issues for pregnancy. Explain how to optimize lifestyle to minimize the impact of hypertension upon pregnancy.



2. PRENATAL MONITORING

- [Classify hypertension in pregnancy](#) and document women with chronic hypertension before pregnancy.
- Record and monitor trends in blood pressure. Distinguish the hypertensive disorders of pregnancy based on signs, symptoms, and history. Consider all possibilities, including pre-pregnancy hypertension, gestational hypertension, preeclampsia, preeclampsia superimposed on preexisting hypertension, and severe preeclampsia.
- Measure proteinuria in all pregnant women on routine urine dipstick testing each prenatal visit. If 2+ protein is noted on dipstick testing, consider checking a protein creatinine ratio (PCR) or a 24 hour urine collection. Monitor the woman for development of preeclampsia if she presents with proteinuria without hypertension, as more than half of women presenting with proteinuria without hypertension will go on to develop preeclampsia ([Khalil et al., 2016](#)).
- If the patient has blood pressures over 140 systolic or 90 diastolic on two occasions 24 hours apart, send a protein creatinine ratio (PCR) on a single urine sample or check urine protein on a 24 hour urine collection. A protein creatinine ratio of 0.3 or more, or a 24 hour urine protein of 300mg or greater should indicate significant

proteinuria. If neither a 24-hour urine collection nor a spot PCR is available, use dipstick testing ([ACOG practice bulletin 222](#)).

- Consider prophylaxis with daily low dose aspirin starting after 12 weeks if there is an increased risk for preeclampsia, as this has been shown to reduce the risk of preeclampsia by 50% ([Bujold et al., 2010](#)). See the [ACOG committee opinion 743](#) for more information about risk factors.
- If preeclampsia is suspected during antenatal care, help the mother and, if appropriate, the family, understand the relationship between hypertension and the placenta, the optimal course of treatment, and what risks this might impose to her pregnancy and fetus. Recognize that a continuum for risk exists and the goals of treatment should include maintenance of healthy blood pressure, monitoring for and prevention of deterioration, and safety of fetal growth. Help prenatal women understand the signs and symptoms of hypertension and preeclampsia as it relates to their circumstance.
- If hospitalization is not necessary due to stable blood pressure, normal laboratory values, and safety of the fetus, help the woman understand the signs and symptoms that may warrant urgent hospitalization. Regularly monitor blood pressure and laboratory values.
- Consider beginning antihypertensive treatment if blood pressure is consistently above 150/100 mm Hg.
- Have a discussion with women and families about the potential pregnancy complications due to hypertension. Have a conversation about how to recognize signs of complications and what steps should be taken to optimize pregnancy.



3. HOSPITAL ADMISSION

- Measure blood pressure and urine protein for all pregnant and postpartum women. Assess VTE risk. Check coagulation profile, full blood count, and renal and liver function for women with signs and symptoms of preeclampsia. Understand gestational period and risk factors of the mother. Assess all current medications and complications of previous pregnancies.



4. HOSPITAL ROUTINE CARE FOR WOMEN ADMITTED WITHOUT HYPERTENSIVE DIAGNOSIS

- Check blood pressure at least every four hours.
- Document hypertension, defined by a blood pressure of greater than or equal to

140 mm Hg (systolic) or 90 mm Hg (diastolic) on two measurements separated by a period of rest. If the blood pressure is persistently greater than or equal to 160 mmHg (systolic) or 110 mmHg (diastolic) over a 15-minute period, initiate treatment with an immediate acting blood pressure medication. Treatment should be initiated within 30-60 minutes (ACOG Committee Opinion 767). Document severe hypertension, defined as a blood pressure of greater than 160 mm Hg over 110 mm Hg. Elevate systolic hypertension, defined as greater than 180 mm Hg, as a medical emergency.

- If blood pressure is consistently above 150/100 mm Hg during the postpartum period, consider beginning an oral antihypertensive medication.
- Critically appraise all criteria before making a diagnosis. Preeclampsia is often a default diagnosis but many other conditions can share similar features and misdiagnosis can delay proper treatment and have detrimental consequences. Rule out all [other possibilities](#) before making a diagnosis.
- Help prenatal and postpartum women understand the signs and symptoms of hypertension and preeclampsia as it relates to their circumstance. Educate patients about which symptoms should be reported to their obstetric provider and which require immediate attention.



5. TREATMENT FOR WOMEN ADMITTED WITH HYPERTENSION

- Consider [all risk factors](#) before diagnosis with any hypertensive disorders. Critically appraise all criteria before making a diagnosis. Preeclampsia is often a default diagnosis but many other conditions can share similar features and misdiagnosis can delay proper treatment and have detrimental consequences. Rule out [all other possibilities](#) before making a diagnosis.
- Assess fetal growth.
- While the hypertensive values for which to initiate therapy are controversial, many guidelines hover around 150/100 mm Hg to 160/110 mm Hg for intervention. In all cases, use caution to avoid over-reduction of blood pressure (below 110/80 mm Hg) to avoid placental underperfusion.
- Select [appropriate antihypertensive drugs](#) to be used in pregnancy and breastfeeding. Follow [ACOG guidelines](#) for first line therapy and for treatment of resistant hypertension.
- If women have signs or symptoms of severe preeclampsia, initiate magnesium sulfate for seizure prophylaxis ([ACOG Practice Bulletin Number 767](#)). Document onset and duration of magnesium sulfate seizure prophylaxis therapy. Closely monitor any patient treated with magnesium sulfate and document urine output, respiratory rate, and deep tendon reflexes. Note that magnesium sulfate should not

be used as an antihypertensive agent but as a mechanism for seizure prophylaxis.

- Manage women with severe preeclampsia or with signs of impending severe eclampsia by reviewing the plan of care for optimal outcomes of both the mother and fetus.
- Treat eclampsia as an obstetric emergency. Stabilize airway, breathing, and circulation using the ABCDE approach. Initiate or increase magnesium sulfate therapy. Prioritize the mother's stabilization over the fetus's and as soon as the mother is stabilized, deliver the fetus in the fastest way possible ([Khalil et al., 2016](#)). Induction of labor can be considered if fetal well-being is established and delivery expected within 24-48 hours.
- Treat systolic blood pressure greater than 160 mm Hg or diastolic blood pressure greater than 110 with immediate intravenous antihypertensives. Check blood pressure typically every 5 minutes while gaining control but ensure that the frequency of checking blood pressure is aligned with the medications administered. See [here](#) for more information.
- Prevent stroke by administering antihypertensive medications immediately, typically within 30-60 minutes. The majority of women who die of severe preeclampsia die from stroke ([Bushnell & Chireau, 2011](#)).
- Prioritize delivery at any gestation if the condition is life threatening. In all cases, stabilize the mother before delivery. The timing of delivery should be guided by assessing the risk versus benefit of prolonging the pregnancy for the mother and fetus.
- Use the organizational clinical risk assessment tool with elements such as gestational age, chest pain, SpO₂, platelet count, and creatinine to identify risk of adverse events with continued pregnancy.



6. LABOR

- Collaborate with the anesthesiologist to develop a contingency plan for emergencies.
- Consider the need for blood products at the onset of labor. Initiate platelet transfusion if platelets fall below $20 \times 10^9/L$ or if less than $50 \times 10^9/L$.
- Initiate continuous fetal monitoring during labor for women with hypertension.
- Measure blood pressure as frequently as deemed necessary by her condition.
- Participate in post-event debriefs to identify successes and opportunities for improvement.



7. DISCHARGE

- Maintain magnesium sulfate for 24 hours post delivery if initiated before delivery

and follow above appropriate monitoring protocols.

- Continuously check blood pressure postpartum for all mothers, as 32-44% of eclampsia occurs postpartum ([Bramham et al., 2013](#)). Follow guidelines for [Postpartum Management of Hypertension](#).
- Help postpartum women understand the signs and symptoms of hypertension and preeclampsia as it relates to their circumstance.
- Counsel women who experienced any form of a hypertensive complication during pregnancy about future pregnancies. Emphasize the recommendation for early administration of low dose aspirin in any future pregnancy.
- Ensure thorough and extensive communication with the outpatient provider to ensure the outpatient provider has all information necessary to continue care for the new mother and child.
- Ensure the patient has appropriate interval follow up to monitor blood pressures if they were elevated during the pregnancy.

Education for Patients and Family Members

The outline below illustrates all of the information about severe hypertension in pregnancy and postpartum that should be conveyed to the patient and family members by someone on the care team in a consistent and understandable manner.

Explain why early recognition and prevention of severe hypertension is important. A member of the healthcare team should elaborate on the importance of early recognition of high blood pressure and signs/symptoms of preeclampsia.

Indicate what to watch out for as it relates to the patient's individual circumstance and risk factors. The patient and family members should be aware of signs of preeclampsia including hypertension, persistent headaches, swelling (edema) especially in the face or hands, nausea or vomiting, right upper abdominal pain or epigastric pain, sudden weight gain (3-5 pounds in a week), changes in vision (flashing lights, auras, light sensitivity, blurry vision, or spots), or shortness of breath.

Describe what monitoring and treatment interventions can be anticipated. In addition to explaining when to call for help in the case of a potential emergency, healthcare providers should also thoroughly explain the typical treatment that can be expected surrounding delivery and postpartum care. Additionally, it is important to discuss the signs of worsening disease during prenatal care and the potential need for hospitalizations during the antenatal course.

Discussions surrounding blood pressure management, the use of magnesium, and expectations regarding duration of care in the hospital and follow up postpartum should be communicated to the patient and her family. By engaging in these conversations before a problem arises, family members can be prepared in the circumstance of necessary treatment and will have an understanding of where to go to find out more information about their loved one's condition.

Explain what is expected of them during their care. By giving patients and family members a "job" while they are in the hospital, they can be immersed fully in the routine care, can hold other team members accountable, can feel more confident voicing their concerns or opinions,

and can serve as an extra set of informed and vigilant eyes to optimize surgical safety. This team involvement can also reduce their anxiety by transforming concern into proactive action.

Patients and family members can:

- Engage in conversations around current potential health conditions
- Ask for clarification of the plan of care and management of hypertension in pregnancy
- Monitor for symptoms of worsening preeclampsia
- Alert the medical team of any seizure-like activity or change in mental status of the patient
- Ensure the patient takes all prescribed medications
- Assist with checking blood pressures at home

Explore next steps. Planning for discharge from the hospital should begin as early as possible between the healthcare providers and the patient and family.

- If the patient is a smoker, the healthcare team should encourage smoking cessation and provide additional resources for further information, groups, or strategies for smoking cessation.
 - Try to understand what specific barriers that patient as an individual faces in cessation.
- Describe the strategies to monitor blood pressures closely at home.
 - Consider prescribing a blood pressure cuff for home use.
 - Establish standards for postpartum monitoring of blood pressures in regards to frequency of visits.
- Ensure thorough explanation of necessary post-discharge appointments, therapies, medications, and potential complications.
 - Assess for patient preference in time and location of follow-up appointments, if possible.
 - If available to your institution, consider utilizing telemedicine visits immediately postpartum to assist in access to care to monitor blood pressures.
- Provide patients and family members resources, including direct contact phone numbers, to the hospital for post-discharge questions.
 - Make sure the resources are in their own language.
- Provide thorough instructions to the patient and family members in the days leading up to discharge regarding wound care and recovery after discharge (What you should know, 2020).

Patients and family members should understand that, although all clinicians in the hospital do their best, no one is ultimately coordinating their care. Patients and family members should understand that they are the managers of their care and as such, should demand to be an active part of the care team including conversations and decisions.

Performance Improvement Plan

Follow this checklist if the leadership team has determined that a performance improvement project is necessary:

- **Gather the right project team.** Be sure to involve the right people on the team. You'll want two teams: an oversight team that is broad in scope, has 10-15 members, and includes the executive sponsor to validate outcomes, remove barriers, and facilitate spread. The actual project team consists of 5-7 representatives who are most impacted by the process. Whether a discipline should be on the advisory team or the project team depends upon the needs of the organization. Patients and family members should be involved in all improvement projects, as there are many ways they can contribute to safer care.

Complete this Lean Improvement Activity:



Conduct a [SIPOC](#) analysis to understand the current state and scope of the problem. A SIPOC is a lean improvement tool that helps leaders to carefully consider everyone who may be touched by a process, and therefore, should have input on future process design.

RECOMMENDED HYPERTENSION IN PREGNANCY AND POSTPARTUM IMPROVEMENT TEAM

- | | |
|------------------|------------------------------------|
| • Physicians | • Pharmacists |
| • Nurses | • Admitting and registration staff |
| • Midwives | • Quality and safety specialists |
| • Social workers | • Patients and family members |
| • Case managers | |

Table 1: Understanding the necessary disciplines for a hypertension in pregnancy and postpartum improvement team. Ensure representation from disciplines across the continuum of care.

- **Understand what is currently happening and why.** Reviewing objective data and trends is a good place to start to understand the current state, and teams should spend a good amount of time analyzing data (and validating the sources), but the most important action here is to go to the point of care and observe. Even if team members work in the area daily, examining existing processes from every angle is generally an eye-opening experience. The team should ask questions of the frontline during the observations that allow them to understand each step in the process and identify the people, supplies, or other resources needed to improve patient outcomes.

Create a [process map](#) once the workflows are well understood that illustrates each step and the best practice gaps the team has identified ([IHI, 2015](#)). Brainstorm with the advisory team to understand why the gaps exist, using whichever [root cause analysis tool](#) your organization is accustomed to ([IHI, 2019](#)). Review the map with the advisory team and invite the frontline to validate accuracy.



HYPERTENSION IN PREGNANCY AND POSTPARTUM PROCESSES TO CONSIDER ASSESSING

- Admission criteria
- VTE risk assessment
- Protocol for managing hypertension
- Communication between in-patient and out-patient providers
- Magnesium sulfate administration
- Patient education in antenatal care and leading up to discharge
- Frequency and adjustment of blood pressure monitoring in alignment with medications administered
- Time to onset of antihypertensive treatment

Table 2: Consider assessing these processes to understand where the barriers contributing to unrecognized and untreated hypertension be in your organization

- Prioritize the gaps to be addressed and develop an action plan.** Consider the cost effectiveness, time, potential outcomes, and realistic possibilities of each gap identified. Determine which are a priority for the organization to focus on. Be sure that the advisory team supports moving forward with the project plan so they can continue to remove barriers. Design an experiment to be trialed in one small area for a short period of time and create an action plan for implementation.

The action plan should include the following:

- Assess the ability of the culture to change and adopt appropriate strategies
- Revise policies and procedures
- Redesign forms and electronic record pages
- Clarify patient and family education sources and content
- Create a plan for changing documentation forms and systems
- Develop the communication plan
- Design the education plan
- Clarify how and when people will be held accountable

TYPICAL GAPS IDENTIFIED IN HYPERTENSION IN PREGNANCY AND POSTPARTUM

- Defaulting to preeclampsia as a diagnosis without considering alternative possibilities
- Late recognition and treatment of hypertension in pregnancy and postpartum
- Poor communication between outpatient and inpatient care settings
- Lack of adjustment of blood pressure monitoring with changes in medications
- Delay in delivery
- Overcorrection of blood pressure

Table 3: By identifying the gaps in recognition and management of hypertension in pregnancy and postpartum, organizations can tailor their project improvement efforts more effectively

- Evaluate outcomes, celebrate wins, and adjust the plan when necessary.** Measure both process and outcome metrics. Outcome metrics include the rates outlined in the leadership checklist. Process metrics will depend upon the workflow you are trying to improve and are generally expressed in terms of compliance with workflow changes. Compare your outcomes against other related metrics your organization is tracking.

[Read this paper](#) from the Institute for Healthcare Improvement to understand how small local steps

Routinely review all metrics and trends with both the advisory and project teams and discuss what is going well and what is not. Identify barriers to completion of action plans, and adjust the plan if necessary. Once you have the desired outcomes in the trial area, consider spreading to other areas ([IHI, 2006](#)).

It is important to be nimble and move quickly to keep team momentum going, and so that people can see the results of their labor. At the same time, don't move so quickly that you don't consider the larger, organizational ramifications of a change in your plan. Be sure to have a good understanding of the other, similar improvement projects that are taking place so that your efforts are not duplicated or inefficient.

SEVERE HYPERTENSION IN PREGNANCY AND POSTPARTUM METRICS TO CONSIDER ASSESSING

- Number of women who delivered with eclampsia, pre-eclampsia, or gestational hypertension
- Number of premature births due to hypertension complications
- Low dose aspirin administration for pre-eclampsia prevention
- Number of pregnant or postpartum women given hypertensive medication
- Treatment of persistent severe hypertension within an hour of diagnosis

Table 4: Consider evaluating related metrics to better understand hypertension, preeclampsia, and eclampsia presence and contributing factors. See [SMFM table B12](#) for more information.

What We Know About Severe Hypertension in Pregnancy and Postpartum

Hypertensive disorders occur in 12-22% of all pregnancies and are one of the leading conditions that impact women during pregnancy. Hypertension may be pre-existing, may be induced by pregnancy, or both ([Singh et al., 2014](#)).

Approximately 15-17% of all maternal mortality is caused by hypertensive disorders which include: chronic (pre-existing) hypertension, gestational hypertension, preeclampsia with or without severe features, eclampsia, and HELLP (Hemolysis, Elevated Liver Enzymes, Low Platelets) ([Walker, 2000](#)). Studies show that between 50-70% of deaths due to severe preeclampsia are preventable ([WHO, 2011](#); [Aukes et al., 2007](#)).

During pregnancy, hypertensive disorders not only affect the mother but also may contribute to significant neonatal morbidity and mortality ([Backes et al., 2011](#)).

Spectrum of Hypertensive Disorders of Pregnancy

There are four main categories within the spectrum of hypertensive disorders of pregnancy:

- **Chronic hypertension during pregnancy:** Defined as blood pressure (BP, mm Hg) $\geq 140/90$ mm Hg prior to the 20th week of pregnancy, and leads to complications in 5% of all pregnancies ([Seely & Maxwell, 2007](#); [Druzin et al., 2013](#); [Yanit et al., 2012](#))
- **Gestational hypertension:** Defined as new-onset hypertension associated with a systolic BP of ≥ 140 mm Hg or diastolic BP ≥ 90 mm Hg, or both, presenting at or after 20-weeks gestation without proteinuria or other severe features of preeclampsia
- **Preeclampsia:** Defined as systolic BP ≥ 140 mm Hg or diastolic BP ≥ 90 mm Hg (on 2 occasions, at least 4 hours apart) or systolic BP ≥ 160 mm Hg or diastolic BP ≥ 110 mm Hg (within a short interval (minutes)) and associated with proteinuria ≥ 300 mg per day.

In the absence of proteinuria, diagnosis can be confirmed with the inclusion of at least 1 severe feature:

- o Thrombocytopenia (platelet count $\leq 100,000/\mu\text{L}$)
 - o Renal insufficiency (serum creatinine more than 1.1 mg/dL or a doubling of the serum creatinine concentration in the absence of other renal disease)
 - o Impaired liver function not explained by other diagnoses (more than twice the upper limit of normal concentration), or persistent severe right upper quadrant or epigastric pain unresponsive to medications
 - o Pulmonary edema
 - o Cerebral or visual symptoms
 - o New onset headache unresponsive to medication and not accounted for by alternative diagnoses
- **Preeclampsia superimposed on chronic hypertension:** preeclampsia that complicates hypertension of another cause

Causes and Risk Factors for Severe Hypertension in Pregnancy and Postpartum

The causes of pregnancy-induced hypertension and the risk factors are still being widely studied. However, hypertension among pregnant women in the US has increased significantly over the last 2 decades, due to increased rates of obesity and diabetes ([Leddy et al., 2008](#)).

The leading patient factors among maternal deaths due to preeclampsia are (Main et al., 2015):

- Delays in seeking care - 42%
- Presumed lack of knowledge regarding the severity of a symptom or condition - 39%
- Underlying medical condition - 39%

Complications of Preeclampsia

Complications of preeclampsia can range from impact on cardiorespiratory, neurological, renal, hepatic, and hematological systems. See "[Complications of Preeclampsia by Organ System](#)" for a table of possibilities.

Case Study: The Connection with Cardiovascular Disease

Some of the complications of preeclampsia may overlap with those seen in cardiovascular disease in pregnancy. This may particularly be relevant in the following settings.

Preeclampsia complicates 2-8% of all pregnancies. Several studies have demonstrated that patients with preeclampsia are at a much higher risk of developing cardiovascular disease in later life. This may be due to a combination of the persistent endothelial, vascular, and metabolic derangements inherently linked to preeclampsia. The [2011 AHA guidelines for the prevention of cardiovascular disease in women](#) added preeclampsia as an additional cardiovascular risk factor. This may provide an opportunity for these women to address modifiable risk factors to improve their long-term health outcomes.

There is an overlap in the pathophysiology of preeclampsia and peripartum cardiomyopathy. Preeclampsia has been shown to cause diastolic dysfunction, which is considered a form of cardiac toxicity. Furthermore, prevalence of preeclampsia is 4-5 times higher in women with peripartum cardiomyopathy. Therefore, early diagnosis and treatment of cardiomyopathy may decrease morbidity and even mortality ([Melchiorre K et. al. Hypertension. 2011;57:708-715](#)).

The pulmonary edema should be suspected with dropping oxygen saturation levels and classic changes on chest X-ray. Consideration of other causes, such as cardiomyopathy, may also require performance of an echocardiogram to evaluate ventricular contractility.

Pregnancy may be considered as a failed “stress test” in this setting and therefore, these women may benefit from interventions to prevent cardiovascular disease ([Ahmed et. al. JACC;63,No. 18,2014](#)).

Preventing Severe Hypertension in Pregnancy and Postpartum

No clear strategies have emerged to prevent the onset of preeclampsia, although low-dose aspirin taken daily starting at the end of the first trimester has been shown to reduce preeclampsia among high risk women (Emergent therapy for acute-onset, severe hypertension during pregnancy and the postpartum period. Committee Opinion No. 692. American College of Obstetricians and Gynecologists. *Obstet Gynecol* 2017;129:e90-5).

In the past, the focus was placed on the prevention of eclamptic seizures, which is associated with an increase in both neonatal and maternal morbidity and mortality. Eclamptic seizures can be prevented through the administration of magnesium sulfate ([Sibai, 2004](#); [MTCG, 2002](#); [Duley et al., 2003](#); [Martin et al., 2005](#)).

Unlike the relatively straightforward prophylaxis of eclamptic seizures, there is a gap in knowledge and application of therapeutic interventions for stroke prevention through controlled blood pressure. Typically, treatment of systolic blood pressure ≥ 160 mm Hg, and/or diastolic blood pressure ≥ 105 mm Hg has been recommended ([Kayem et al., 2011](#)). In practice, consider instituting therapies at a lower level of systolic or diastolic blood pressures.

Treatment for Severe Hypertension in Pregnancy and Postpartum

Early recognition and timely treatment of preeclampsia is a critical factor in reducing maternal and neonatal morbidity and mortality. Delay in treating hypertension is the primary cause of concern. When a patient is diagnosed with preeclampsia, it is important to recognize worsening signs and symptoms to try and prevent progression to eclampsia or stroke.

The most important intervention in the treatment for preeclampsia/eclampsia is delivery of the fetus and placenta. The phrase “delivery is the cure” is widely accepted, however, in many cases, preeclampsia/eclampsia may continue for a variable amount of time after delivery. Therefore prophylaxis with magnesium sulfate is recommended for 24 hours post-delivery for those with severe features of preeclampsia/eclampsia. For this reason, preeclamptic mothers should continue to be evaluated post-delivery. Serious clinical outcomes can continue postpartum for days and even weeks ([Chescheir, 2015](#)).

The majority of women who die of severe preeclampsia die from stroke ([Bushnell & Chireau, 2011](#)). Stroke can only be prevented with rapid administration of antihypertensive medications. The key to saving lives from complications of severe preeclampsia is administration of antihypertensive medication within 30-60 minutes (Emergent therapy for acute-onset, severe hypertension during pregnancy and the postpartum period. Committee Opinion No. 692. American College of Obstetricians and Gynecologists. *Obstet Gynecol* 2017;129:e90-5).

Global Maternal Mortality

Global maternal deaths have fallen by 44% since 1990, but there are still more than 303,000 women who die each year from complications related to pregnancy, delivery, or within the first 6 weeks after delivery ([WHO, 2015](#)). The majority of deaths (64%) occur from the day of

delivery through 41 days postpartum ([Creanga et al., 2015](#)). This equates to approximately 830 women dying every day, with 550 occurring in sub-Saharan Africa, 180 in Southern Asia, and 5 in developed countries ([WHO, 2015](#)). In some developing countries, the maternal mortality rate is as high as 1% of live births ([AbouZahr, 1998](#)).

US Maternal Mortality

Within the US, it is estimated that approximately 600 women die each year, which is 14 per 100,000 live births ([CDC, 2015](#); [WHO and UNICEF, 2015](#)). While that number seems to pale in comparison on the global scale, the US ranks 46th in the world for maternal mortality ([Agrawal, 2015](#)). Of all industrialized countries, the US lags behind Kazakhstan, Libya, and Qatar, and is one of only 13 countries whose maternal mortality rates have continued to increase instead of improve (by declining) over the last 25 years ([Kempner, 2015](#)).

The reasons for the overall increase in maternal mortality within the US are unclear. Delaying childbearing and using assisted reproductive technology (e.g., in-vitro fertilization) have given rise to older mothers with an increased risk of complications than younger women (Bewley et al., 2005). Additionally, the obesity epidemic gives rise to chronic conditions such as hypertension, diabetes, and chronic heart disease which increase the risk of problems during pregnancy ([CDC, 2015](#); [Kuklina et al., 2009](#); [Albrecht et al., 2010](#); [Kuklina et al., 2012](#)).

More than one-third of maternal deaths in the US are preventable, and 40% could be avoided if women had access to quality care ([Berg et al., 2005](#)). Most notably, black women have a 3- to 4-fold increased risk of death due to pregnancy compared to any other race or ethnicity ([Creanga et al., 2014](#); [Callaghan et al., 2008](#)). The reasons are extremely complex and not well-documented.

Resources



For Severe Hypertension Improvement:

- [Joan Donnelly Patient Video](#)
- [Current Best Practice in the Management of Hypertensive Disorders in Pregnancy](#)
- [Preeclampsia Foundation "Educating Patients"](#)
- [Preeclampsia Foundation "Best Practices" for Healthcare Professionals](#)
- [California Maternal Quality Care Collaborative: Chronic Hypertension in Pregnancy Toolkit](#)
- [California Maternal Quality Care Collaborative: Preeclampsia Toolkit](#)
- [Hypertensive Disorders of Pregnancy Speaker Presentation](#)

For General Improvement:

- [CMS: Hospital Improvement Innovation Networks](#)
- [IHI: A Framework for the Spread of Innovation](#)
- [The Joint Commission: Leaders Facilitating Change Workshop](#)
- [IHI: Quality Improvement Essentials Toolkit](#)
- [SIPOC Example and Template for Download](#)
- [SIPOC Description and Example](#)

Endnotes

Conflicts of Interest Disclosure

The Patient Safety Movement Foundation partners with as many stakeholders as possible to focus on how to address patient safety challenges. The recommendations in the APSS are developed by workgroups that may include patient safety experts, healthcare technology professionals, hospital leaders, patient advocates, and medical technology industry volunteers. Workgroup members are required to disclose any potential conflicts of interest.

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