



ALLIANCE FOR INNOVATION
ON MATERNAL HEALTH

CMQCC

California Maternal
Quality Care Collaborative

AIM Hypertension in Pregnancy Bundle: Treating Severe Hypertension

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Obstetric Hemorrhage and Preeclampsia: Summary

- Most common **preventable** causes of maternal mortality
- Far and away the most common causes of Severe Maternal Morbidity
- High rates of provider “quality improvement opportunities”

3 Deadly D's:

~~Denial~~

~~Delay~~

~~Dismissal~~

What is the Cause of Death for Women with Preeclampsia?



CA-PAMR Final Cause of Death Among Preeclampsia Cases, 2002-2004 (n=25)

| Final Cause of Death | Number | % | Rate/100,000 |
|-------------------------|--------|---------|--------------|
| Stroke | 16 | 64.0% | 1.0 |
| <i>Hemorrhagic</i> | 14 | (87.5%) | |
| <i>Thrombotic</i> | 2 | (12.5%) | |
| Hepatic (liver) Failure | 4 | 16.0% | 0.25 |
| Cardiac Failure | 2 | 8.0% | |
| Hemorrhage/DIC | 1 | 4.0% | |
| Multi-organ failure | 1 | 4.0% | |
| ARDS | 1 | 4.0% | |

Preventing Stroke from Preeclampsia

Blood Pressure Comparisons: Baseline and Pre-stroke

| Measure | Pregnancy Baseline (mm Hg) | Pre-stroke (mm Hg) |
|----------------------|-------------------------------|-----------------------|
| Mean systolic BP | 110.9 ± 10.7 (n=25) | 175.4 ± 9.7 (n=24) |
| Systolic BP range | 90-136 | 159-198 |
| Systolic BP % ≥ 160 | 0 | 95.8 (n=27/28) |
| Mean diastolic BP | 67.4 ± 6.5 (n=25) | 98.0 ± 9.0 (n=24) |
| Diastolic BP range | 58-80 | 81-113 |
| Diastolic BP % ≥ 110 | 0 | 12.5 (n=3) |
| Diastolic BP 5 ≥ 105 | 0 | 20.8 (n=5) |

Adapted from Martin JN, Thigpen BD, Moore RC, Rose CH, Cushman J, May. Stroke and Severe Preeclampsia and Eclampsia: A Paradigm Shift Focusing on Systolic Blood Pressure, OG 2005;105-246.

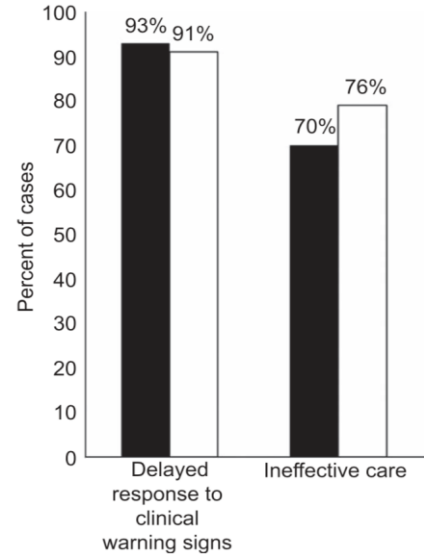


June
2019

- CA PAMR: 333 P-R maternal deaths 2002-2007
- 61% of 54 Preeclampsia/Eclampsia deaths were stroke
- 96% had Sys BP>160; only 65% had Dias BP >110
- Only 48% received any antihypertensive meds
- Only 29% received ACOG Standard Treatment

Systolic Hypertension, Preeclampsia-Related Mortality, and Stroke in California

Amy E. Judy, MD, MPH, Christy L. McCain, MPH, Elizabeth S. Lawton, MHS, Christine H. Morton, PhD, Elliott K. Main, MD, and Maurice L. Druzin, MD



■ Preeclampsia/eclampsia – all (n=54)
□ Preeclampsia/eclampsia – stroke (n=33)

“Treat the Damn Blood Pressure!”

Controlling blood pressure
is the key intervention
to prevent deaths due to stroke
in women with preeclampsia.

LABETALOL

IF SEVERE BP ELEVATIONS PERSIST FOR 15 MINUTES OR MORE, ADMINISTER

LABETALOL 20 MG IV FOR >2 MINUTES



AFTER 10 MINUTES, IF EITHER BP THRESHOLD IS STILL EXCEEDED, ADMINISTER

LABETALOL 40 MG IV FOR >2 MINUTES



AFTER 10 MINUTES, IF EITHER BP THRESHOLD IS STILL EXCEEDED, ADMINISTER

LABETALOL 80 MG IV FOR >2 MINUTES



AFTER 10 MINUTES, IF EITHER BP THRESHOLD IS STILL EXCEEDED, ADMINISTER

HYDRALAZINE 10 MG IV FOR >2 MINUTES

ACOG Protocol for Treatment of Severe HTN in Pregnancy

sBP \geq 160 or dBP \geq 110,
(persisting 15min)

- **ACOG Practice Bulletin 203**
January 2019: Chronic Hypertension in Pregnancy
- **ACOG Practice Bulletin 222**
June 2020: Gestational Hypertension and Preeclampsia

Medication Protocols: First Line Agents in Preeclampsia

| Medication Agents | Labetalol IV | Hydralazine IV | Nifedipine (Immediate release) |
|---------------------------------------|--|--|--|
| Route | IV | IV | PO |
| Initial therapy | 20 mg | 5-10 mg | 10 mg |
| Onset | 2-5 minutes | 5-20 minutes | 5-20 minutes |
| Peak | 5 minutes | 15-30 minutes | 30-60 minutes |
| Max dose (Before switching agents) | 140 mg | 20 mg | 50 mg |
| Mechanism of action | <ul style="list-style-type: none"> • Combined α and β-blocking agent • Arteriolar dilator • Decreases heart rate | <ul style="list-style-type: none"> • Arteriolar dilator | <ul style="list-style-type: none"> • Calcium channel blocker • Arterial smooth muscle dilator |
| Side effects | <ul style="list-style-type: none"> • Use with caution in patients with known asthma. • Flushing, light headedness, palpitations and scalp tingling • Safe for use after cocaine and amphetamine use (including methamphetamine)⁶ | <ul style="list-style-type: none"> • Tachycardia, headache • Upper abdominal pain (rare) • Flushing • Nausea | <ul style="list-style-type: none"> • Reflex tachycardia • Headache • Flushing • Nausea • Vomiting |

Barrier Analysis for Delays in Treating Severe Hypertension

- BP stabilized before meds given
- No knowledge of BP parameters
- Competing priorities
- Unable to rapidly access meds
- RN reluctant to give IV push
- Magnesium SO₄ given instead
- MD not available
- Fear of hypotension



Conquering “Fear of Hypotension”

As part of the CMQCC Maternal Hypertension collaborative:

- Hypotension defined as $\geq 30\%$ reduction in Systolic BP
- IV Labetalol: 69 women—10% hypotension
- IV Hydralazine: 31 women—11% hypotension
- No change in fetal heart rate category
- No women required emergent delivery for fetal indication

Kantorowska etal (NYU)

AJOG 2020 223:250

52% Delayed RX (>60min)

RR for Delayed Treatment:

3.2x Initial BP not in severe range

2.7x W/o preeclamptic
symptoms

2.7x 10pm—6am

2.2x Labor symptoms

1.8x White race

Term >> Preterm

Deshmukh etal (Yale)

AJOG 2021 in press

73% Delayed (>60min) or no RX

More likely Rx if... (aOR)

1.85x Black

1.77x Hispanic

6.65x Preterm

Less likely Rx if... (aOR)

0.79x 7pm—6am

0.66x Postpartum

AIM Structure Measures: Hypertension

- Hypertension/Preeclampsia Policy/Protocol that covers measurement of BP, treatment of severe HTN, administration of Magnesium and treatment of Mag overdose
- Drills at least annually
- Multidisciplinary case reviews
- Debriefs after case with complications
- Staff Education



New Standards for Perinatal Safety

• Issued August 21, 2019

PC.06.03.01

Reduce the likelihood of harm related to maternal severe hypertension/preeclampsia.

Element(s) of Performance for PC.06.03.01

1. Develop written evidence-based procedures for measuring and remeasuring blood pressure. These procedures include criteria that identify patients with severely elevated blood pressure.
2. Develop written evidenced-based procedures for managing pregnant and postpartum patients with severe hypertension/preeclampsia that includes the following:
 - The use of an evidence-based set of emergency response medications that are stocked and immediately available on the obstetric unit
 - The use of seizure prophylaxis
 - Guidance on when to consult additional experts and consider transfer to a higher level of care
 - Guidance on when to use continuous fetal monitoring
 - Guidance on when to consider emergent delivery
 - Criteria for when a team debrief is required

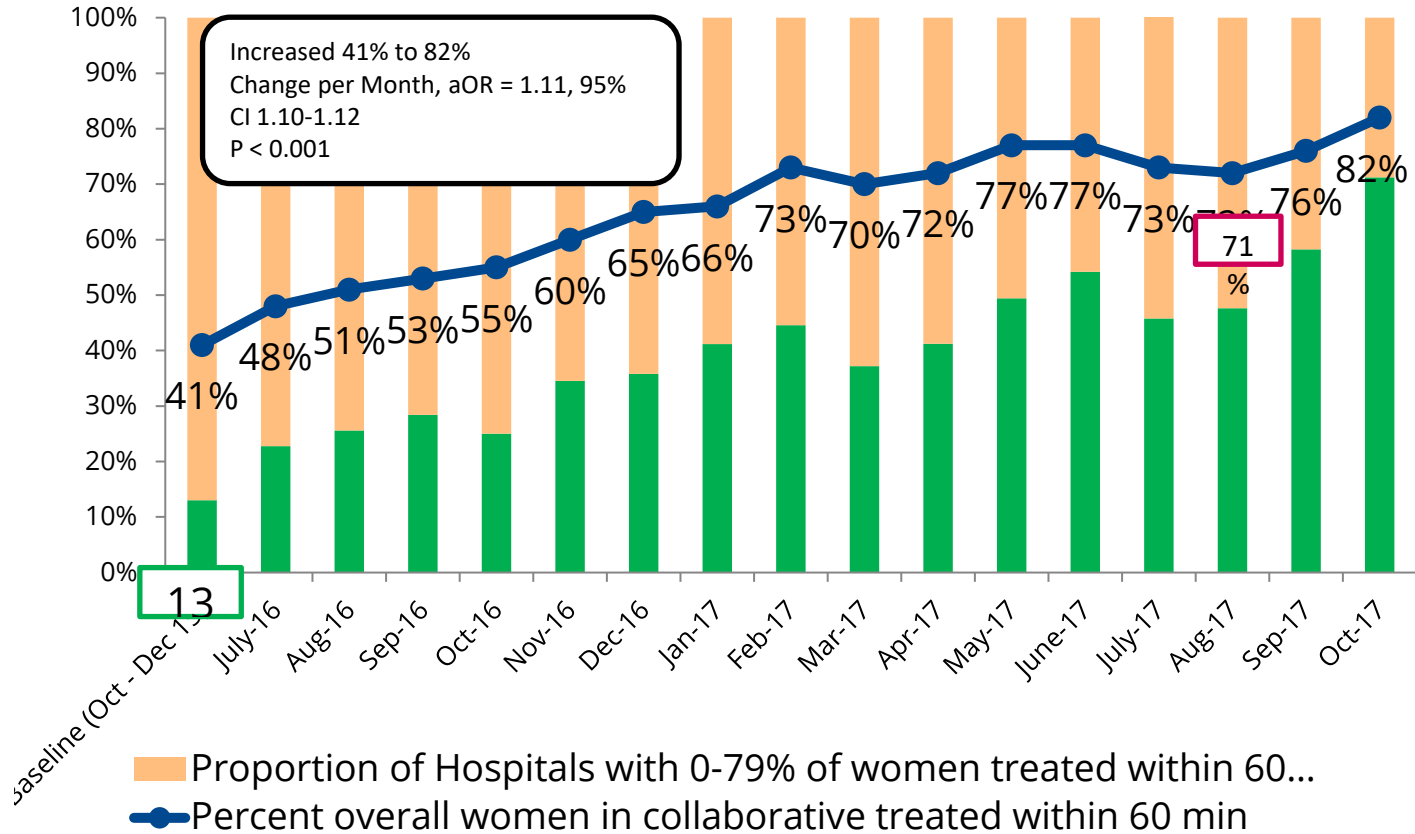
Note: The written procedures should be developed by a multidisciplinary team that includes representation from obstetrics, emergency department, anesthesiology, nursing, laboratory, and pharmacy.
3. Provide role-specific education to all staff and providers who treat pregnant/postpartum patients about the hospital's evidence-based severe hypertension/preeclampsia procedure. At a minimum, education occurs at orientation, whenever changes to the procedure occur, or every two years.

Note: The emergency department is often where patients with symptoms or signs of severe hypertension present for care after delivery. For this reason, education should be provided to staff and providers in emergency departments regardless of the hospital's ability to provide labor and delivery services.
4. Conduct drills at least annually to determine system issues as part of ongoing quality improvement efforts. Severe hypertension/preeclampsia drills include a team debrief.

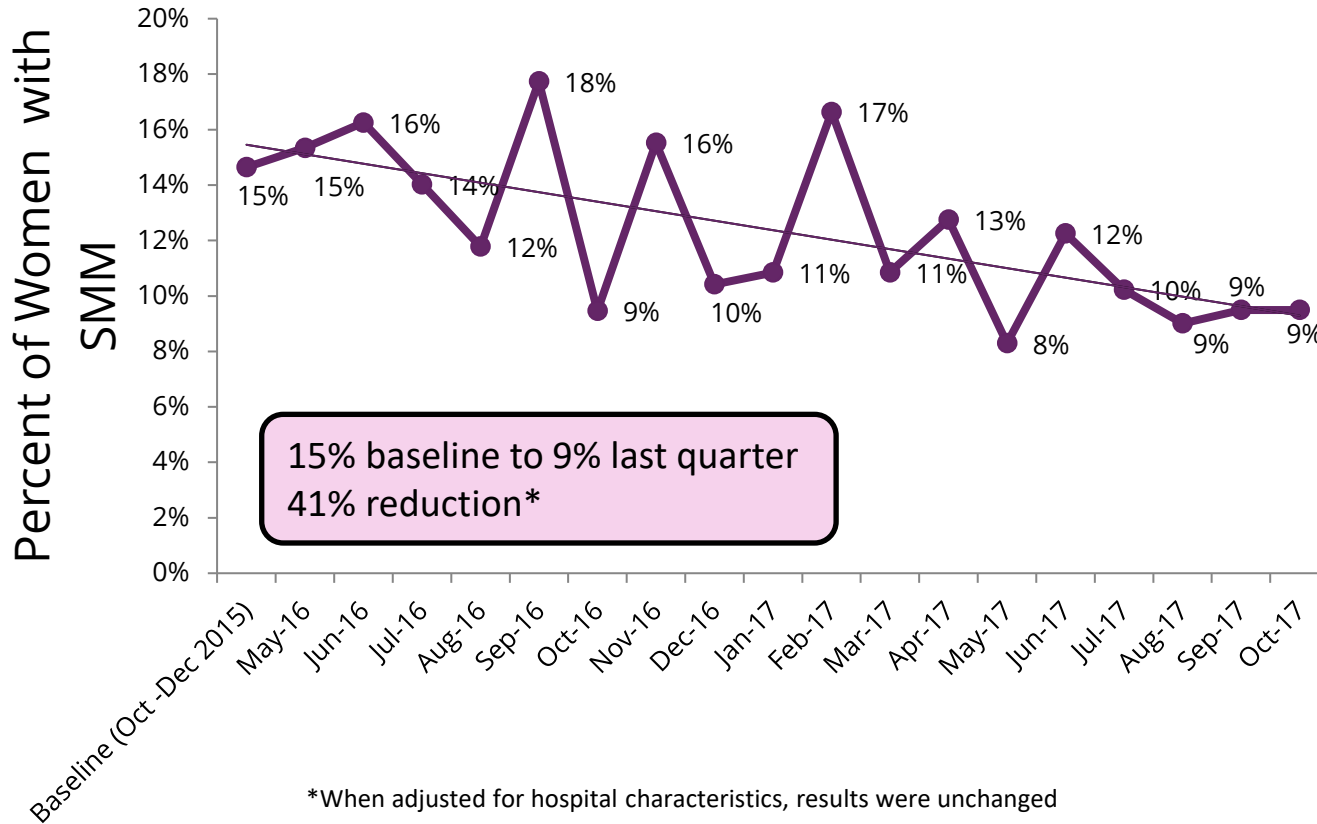
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Severe Maternal Hypertension

Goal: 80% of women treated <60 min



Severe Maternal Hypertension with Severe Maternal Morbidity Reported



OBSTETRICS

Early standardized treatment of critical blood pressure elevations is associated with a reduction in eclampsia and severe maternal morbidity



Laurence E. Shields, MD; Suzanne Wiesner, RN, MBA; Catherine Klein, RN, CNM; Barbara Pelletreau, RN, MPH; Herman L. Hedriana, MD



- 23 Community hospitals in Dignity Health (CA, NV, AZ)
- Introduction of standardized approach for HTN disorders (CMQCC)
- Comparison of 3 time periods:
 - Baseline: initial 6 months (Jan-Jun 2015)
 - Monitoring 1: next 6 months
 - Monitoring 2: next 6 months

HTN Bundle elements and criteria:

- 1. Magnesium SO₄:** all women with preeclampsia with severe features, and all women with BP ≥ 160 sys or ≥ 110 dias (regardless of HTN type)
- 2. Acute BP Treatment:** all women with BP ≥ 160 sys or ≥ 110 dias had successful reduction of BP within 1 hour
- 3. Early PP follow-up:** ≤ 2 wks for all HTN disorders; ≤ 1 week if received HTN medication during admission

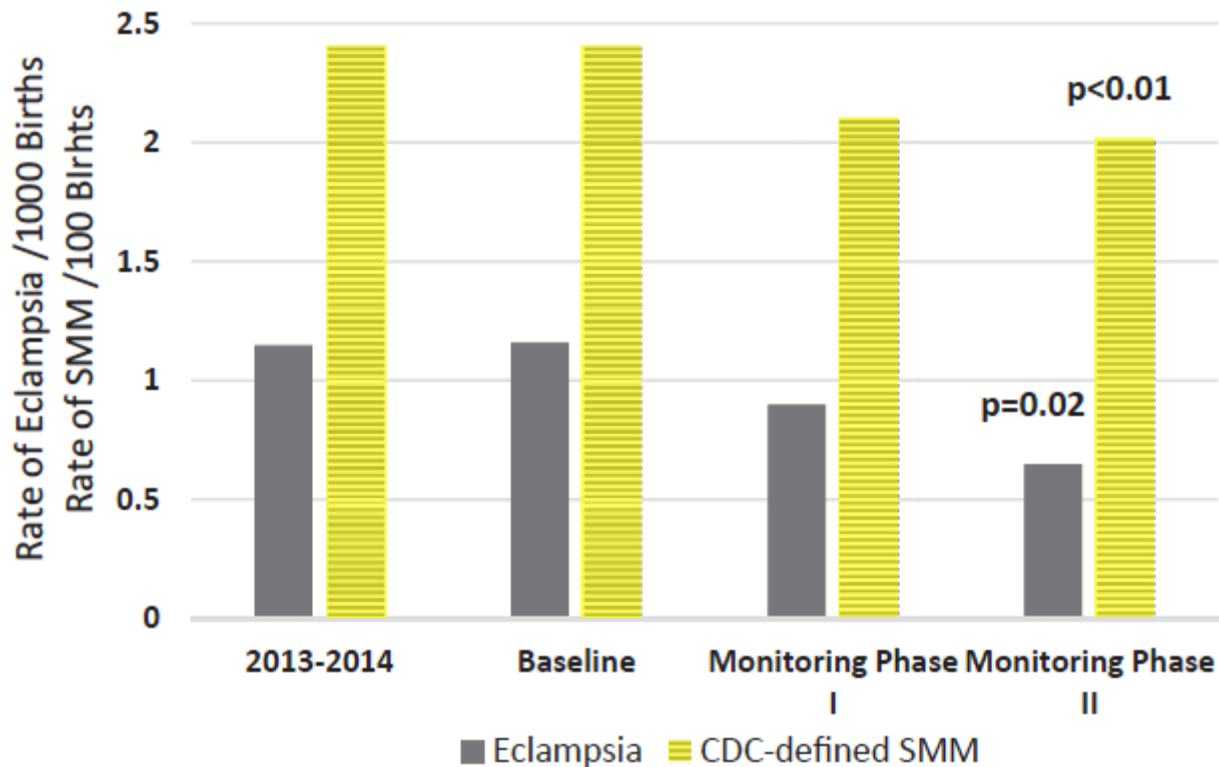
TABLE
Population characteristics and outcome data

| | Baseline | Monitoring phase I | Monitoring phase II | N |
|--|-------------|--------------------|---------------------|----------------|
| Deliveries | 22,506 | 24,409 | 22,534 | 69,449 |
| Met criteria for treatment with magnesium sulfate | 589 (2.6%) | 646 (2.6%) | 799 (3.5%) | 2034 (2.9%) |
| Appropriately treated with magnesium sulfate | 503 (85.4%) | 597 (92.0%) | 769 (96.2%) | <i>P</i> < .01 |
| Met criteria for acute blood pressure treatment | 504 (2.2%) | 490 (2.0%) | 526 (2.3%) | <i>P</i> = .5 |
| Appropriately treated with hypertensive medication | 287 (56.9%) | 388 (79.2%) | 474 (90.1%) | <i>P</i> < .01 |

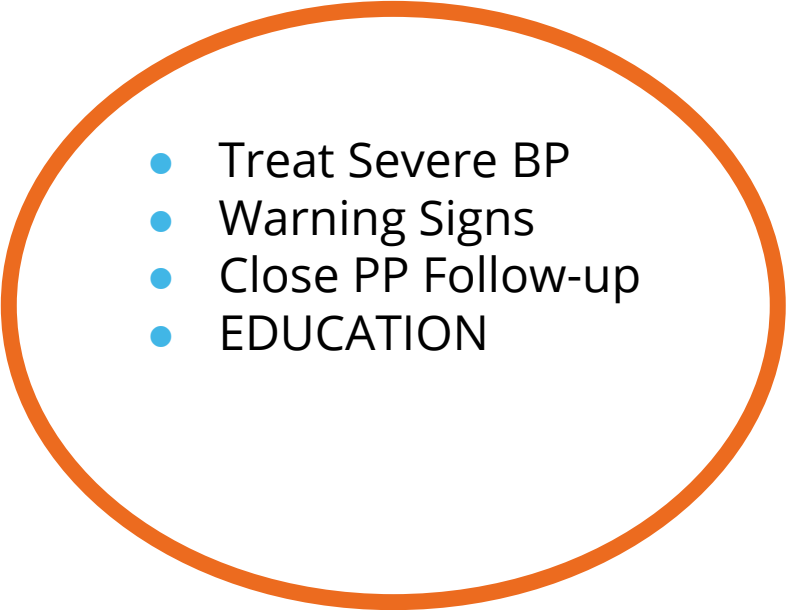
Overall 3-element bundle compliance 50.5% 88.5% *P* < .01

FIGURE

Rate of eclampsia and severe maternal morbidity Among ALL gravidas



The Hypertension Bundle: 9-word Challenge

- 
- Treat Severe BP
 - Warning Signs
 - Close PP Follow-up
 - EDUCATION

**Respectful
care
Build Trust**

Measuring Timely Treatment of Severe Hypertension

Note from Dr. Main's Presentation

- **ACOG CO 767** (February 2019) Emergent Therapy for Acute-Onset Severe Hypertension During Pregnancy and the Postpartum Period is no longer available.
- Instead, please refer to:

ACOG PB 203
January 2019
**Chronic Hypertension
in Pregnancy**

ACOG PB 222
June 2020
**Gestational
Hypertension and
Preeclampsia**

Objectives

1. Review metric specifications for AIM's timely treatment of persistent severe hypertension (SHTN) metric,
2. Discuss frequently asked questions,
3. Share other data collection and quality improvement (QI) considerations for the timely treatment of persistent SHTN.

What is a persistent severe hypertension (SHTN) episode?

- **Hypertension:** Includes chronic and gestational hypertension, preeclampsia.
- **SHTN:** Systolic BP greater than or equal to 160, diastolic BP greater than or equal to 110.
- **Persistent SHTN episode:**
 - SHTN that has not been documented to have ended within 15 minutes, **and/or**
 - One or more SHTN readings are documented 15-60 minutes after initial reading, even if interspersed with non-SHTN readings.

I took a second, non-SHTN range BP reading 16 minutes after my patient's first SHTN range BP reading. Does this still count as a persistent SHTN episode?

- Yes.
- This is a conservative inclusion criteria – the burden is on the provider to take a timely (within 15 minutes) follow-up BP reading to determine persistence of SHTN.
- Delay in follow-up BP readings is a quality gap and patient safety concern.

A patient has both SHTN range BP readings and non-SHTN BP readings interspersed 15-60 minutes after their initial SHTN range BP reading. Does this still count as one persistent SHTN episode?

- SHTN readings do not necessarily need to be sequential to be considered a persistent SHTN episode.
- If 1 or more SHTN range BP readings are taken within 15-60 minutes of the first SHTN reading, count as a persistent SHTN episode.

Timely Treatment Denominator: Number of patients with one or more episode(s) of persistent severe hypertension (SHTN)

- Include all patients on OB with persistent SHTN, regardless of gestational age, and those up to 6 weeks postpartum.
- Include patients with live births and still births.
- Record number of patients with at least 1 persistent SHTN episode, not total number of persistent SHTN episodes
 - For patients with more than 1 SHTN episode, determine numerator based on time to treat for first episode.

Why not count pregnant and postpartum patients with SHTN who receive care outside of OB?

- Difficult to identify OB patients in other departments.
- Some facilities may not use the same EMR between departments, which makes monitoring timely treatment of SHTN across departments difficult.
- **Other facility-specific QI considerations:**
 - Ensure screening for and documentation of current pregnancy or pregnancy in the last year on ED triage.
 - Educate ED providers on SHTN in pregnant and postpartum people.
 - Internally monitor timely treatment of SHTN in ED.

Why does the denominator measure number of patients with SHTN, not number of instances of SHTN?

- 5 patients with untimely treatment of persistent SHTN versus one patient with 5 persistent SHTN episodes untimely treated.
 - First is a broader systems issue, second requires careful case review.
 - Metric seeks to assess overall trends in processes of care, not outliers in care.
- **Other facility-specific QI considerations:**
 - Internally monitor timely treatment of all instances of SHTN, but still report timely treatment to AIM based on first persistent SHTN episode.

The same patient has been admitted twice with persistent SHTN episodes in each admission. How should they be counted in the denominator?

- In this case, count the patient twice in the denominator.
- Unique patient identifiers may not be readily accessible, if available at all, to determine timely treatment.
- Assume each admission is a unique patient and measure persistent SHTN episodes and timely treatment from the first SHTN range BP reading.

Timely Treatment Numerator: Among the denominator, the number of patients who received SHTN treatment within 60 minutes

- Measure timely treatment from the first recorded SHTN BP reading, assuming confirmation from a follow-up reading.
- Include case in the numerator if:
 - Patient received appropriate treatment within 60 minutes for SHTN.
 - Patient's BP returned to a non-SHTN range at the end of the 60-minute period without treatment.

Why define timely treatment as treatment within 60 minutes instead of 30 minutes?

- 60 minutes based on research demonstrating a poor timely treatment rate within 60 minutes of episode onset as well as AIM state team experiences.
- **Other facility-specific QI considerations:**
 - As facility improves 60-minute time to treat rates, internally monitor timely treatment based on 45- or 30-minute treatment times.

Why measure timely treatment from the first SHTN BP reading on OB?

- Possible delays in follow-up BP measurement may mean that patients do not receive treatment within an hour if measuring timely treatment from a follow-up BP reading.
 - Delay in follow-up BP reading a gap in patient safety.
- Measure based on first SHTN BP reading on OB due to potential lack of EMR interoperability for assessing vital signs taken on other departments.

Why measure timely treatment and not whether patient's BP returned to normal or non-SHTN range?

- Providers can control their response – the process of timely treatment – but cannot necessarily control patient BP in response to treatment – the patient health outcome.
- This is why AIM designed timely treatment of SHTN as a process measure, not an outcome measure.

How do you account for transfers in and out of a facility?

- Identify the first SHTN episode at your facility and whether it was treated within 60 minutes.
 - As a patient is **transferred in**, identify the first SHTN episode on OB – not any prior SHTN range BP readings at a different department or facility – to track timely treatment.
 - As a patient is **transferred out**, the receiving facility is responsible for identifying any additional or new SHTN episodes and tracking timely treatment.

Measurement Strategies

- Paper logbooks
 - See examples from [ILPQC](#).
- Identify potential cases for denominator by searching for ICD-10 discharge diagnosis codes, then perform chart reviews.
- Perform a query of electronic medical records by blood pressure measurements to identify denominator; merge data with pharmacy records.

Measurement Strategies – Paper Logbooks

- Manually record data as you work with Health IT and/or others at your facility to modify your EMR for streamlined data collection.
- **Other facility-specific QI considerations:**
 - Incorporate debrief elements into the paper logbook to track successes and identify barriers or systems issues.
 - Track other patient demographics in the paper logbook.
 - Monitor balancing measures in the paper logbook.

Measurement Strategies – ICD10 Codes

- Use ICD10 codes to run a query on possible OB patients who experienced 1 or more persistent SHTN episodes.
- Among this subset of patients conduct chart reviews to determine:
 - Whether they experienced persistent SHTN,
 - Whether they were treated within 1 hour.
- **Data quality consideration:** It is possible that some patients who experienced persistent SHTN may not have been assigned a hypertension-related diagnosis.

Potential ICD-10 Codes for Chart Reviews

| Topic | Potential Codes |
|--------------------------|--|
| Severe preeclampsia | O14.10, O14.12, O14.13, O14.14, O14.15 |
| Severe hypertension | I16.0, I16.1, I16.2 |
| HELLP syndrome | O14.20, O14.22, O14.23, O14.24, O14.25 |
| Eclampsia | O15.00, O15.02, O15.1, O15.2, O15.9 |
| Preexisting hypertension | O11.1, O11.2, O11.3, O11.4, O11.5, O11.9 |

Measurement Strategies – EMR Program Based on BP Readings and Pharmacy Records

- Conduct an EMR query or develop an algorithm to identify denominator cases of persistent SHTN based on BP readings and persistent SHTN definitions.
- Once denominator identified, merge data with pharmacy records to preliminarily identify a numerator.
 - Conduct chart reviews of cases in which numerator criteria were not met to assess whether persistent SHTN episode resolved within 60 minutes without treatment.

Data Quality Considerations – EMR Program Based on BP Readings and Pharmacy Records

- Pharmacy records may not always be accurate:
 - Medications ordered but never administered,
 - Medications ordered but not administered timely.
- If possible, measure timely treatment from first SHTN range BP reading to bar code medication administration scan time.

Other QI Considerations

- Monitor timely treatment of persistent SHTN disaggregated by race and ethnicity.
- Establish missed opportunity reviews for cases in which patient with persistent SHTN was not treated within 60 minutes.
- Monitor balancing measures to track possible adverse effects of antihypertensives on patient or fetus.

Disaggregate Timely Treatment by Race and Ethnicity

- One way to bring to focus potential inequity in care and disparities in patient outcomes.
- Assess if, over time, disparity ratios in timely treatment of persistent SHTN improve or worsen *in addition to* overall improvements to timely treatment of persistent SHTN.

Balancing Measures

- Concerns of maternal hypotension and emergent delivery for fetal indications may cause provider hesitancy treating persistent SHTN.
 - Evidence shows some (~10% of those treated) instances of maternal hypotension and no changes in fetal heart rate category from SHTN treatment.
- Possible balancing measures among those who received treatment for SHTN:
 - Rate of maternal hypotension,
 - Cesarean delivery rate for fetal indications.

Establish Missed Opportunity Reviews

- For patients with persistent SHTN episodes untreated within an hour, conduct debriefs or reviews with appropriate staff to:
 - Identify systems issues and other barriers preventing timely treatment of persistent SHTN,
 - Document actionable follow-up items to improve processes of care.

Key Takeaways

- Monitoring timely treatment of persistent SHTN is important for assessing processes of care and driving QI activities.
- EMRs can be leveraged for more automated measurement.
- AIM's timely treatment of persistent SHTN metric is a starting point – there are a multitude of related QI opportunities.

Thank you!



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