Quality and Safety: Hypertension Disorders of Pregnancy

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Objectives

- Define and review the categorization of hypertension in pregnancy
- Discuss management of preeclampsia
- Review criteria for expectant management of severe preeclampsia
- Examine systems/approaches for optimizing care of pregnant women with hypertensive emergencies or eclampsia
- Review pertinent literature about MEWS/MEOWS

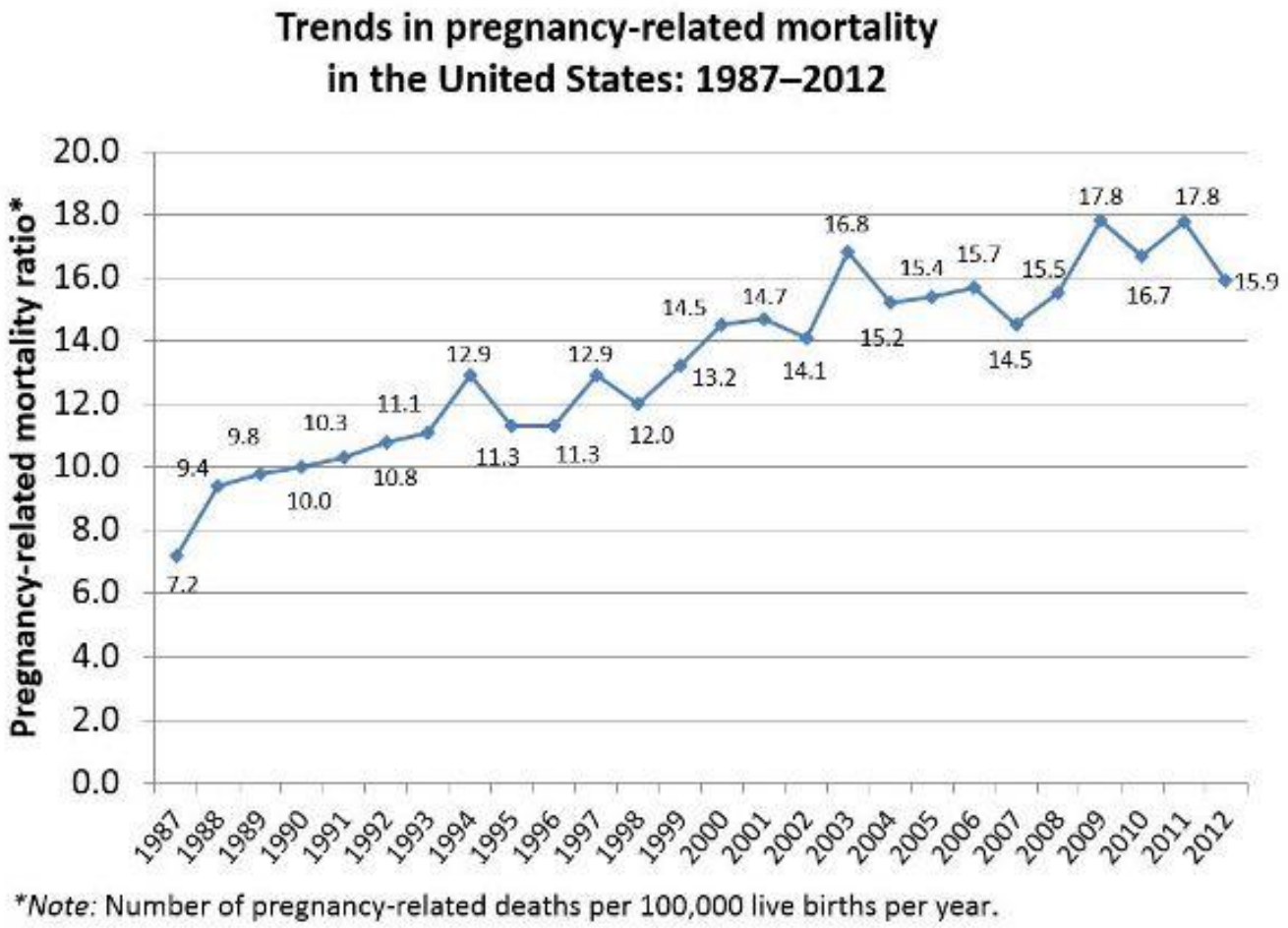
Epidemiology

- The incidence of preeclampsia has increase 25% in the past two decades[1]
- Hypertensive disorders in pregnancy are common (5-10% of all pregnancies in the United States)[2]
- Preeclampsia is the leading cause of maternal and perinatal morbidity and mortality worldwide[3]

[1]Wallis et al Secular trends in the rates of prematurity, eclampsia and gestational hypertension, United States 1987-2004. Am J Hypertension. 2008

2 Kuklina et al. Hypertensive disorders and severe obstetric morbidity in the US. Obstet Gynecol 2009

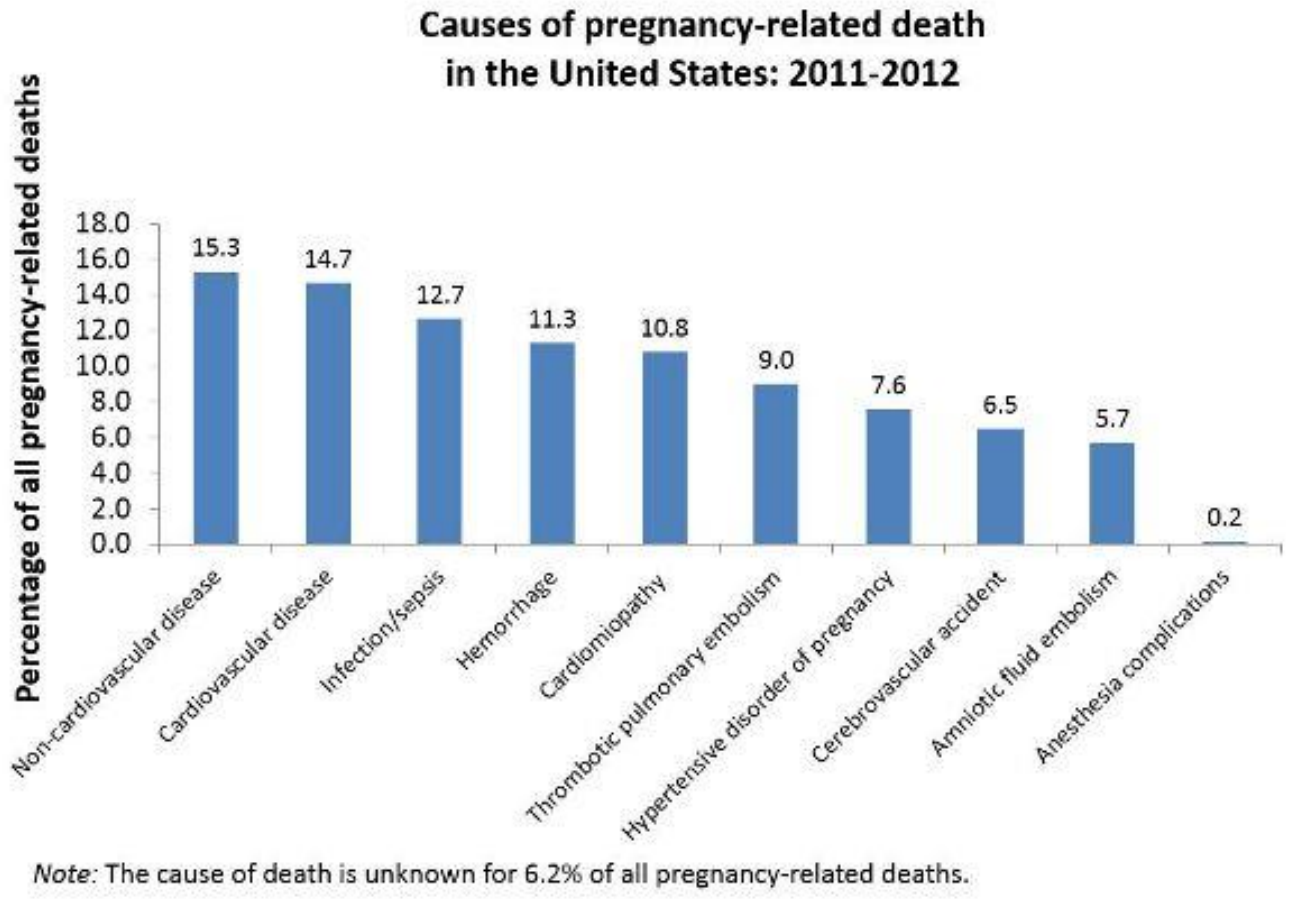
[3] Callaghan et al. Identification of severe maternal morbidity during delivery hospitalizations, United States. 1991-2003. AJOG. 2008



Pregnancy Risk Assessment Monitoring System : http://www.cdc.gov/reproductivehealth/maternalinfanthealth/pmss.html

Selected Maternal Mortality Rates 2010-2013

Source: www.smfm.org/data/mortality-map



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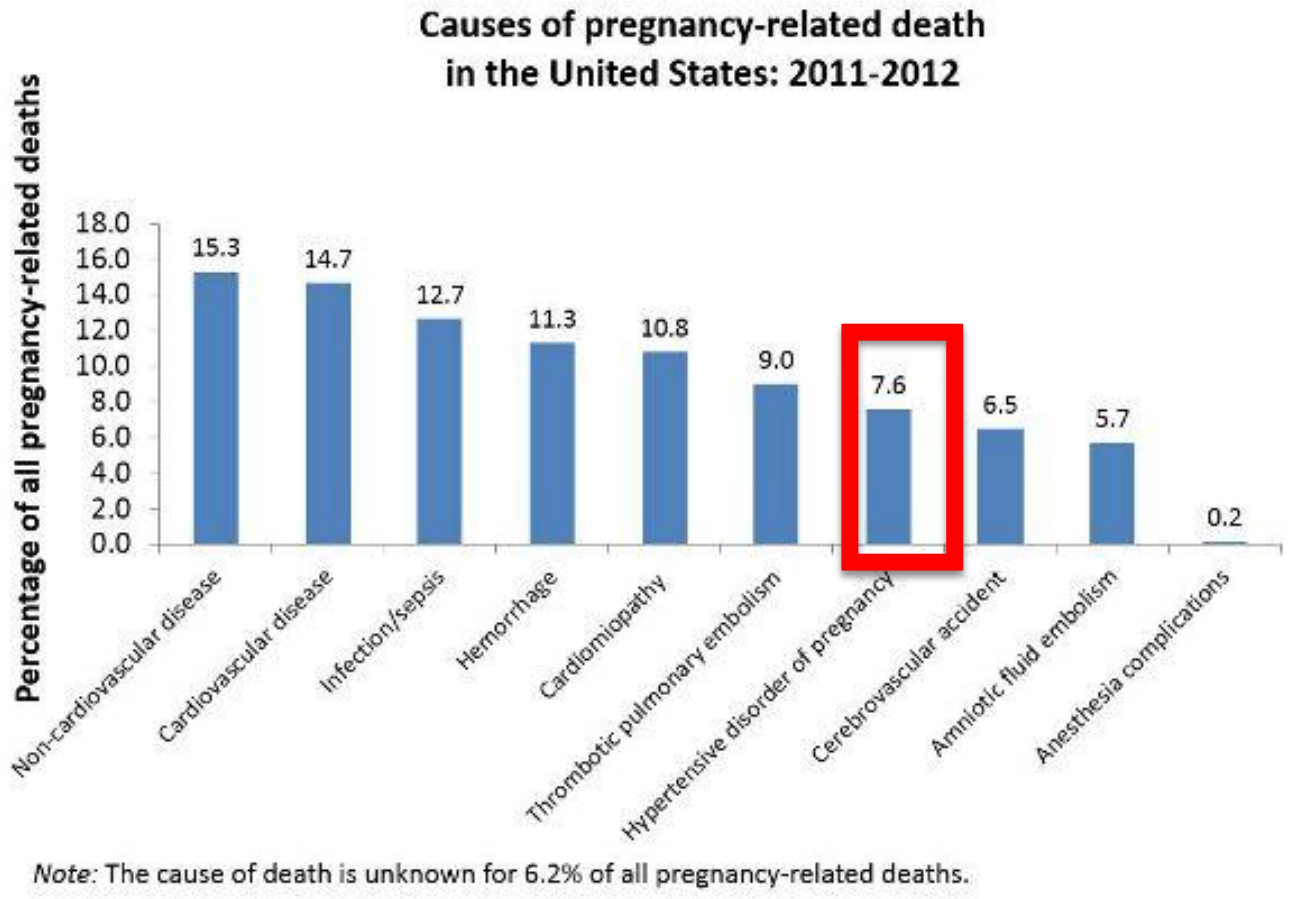

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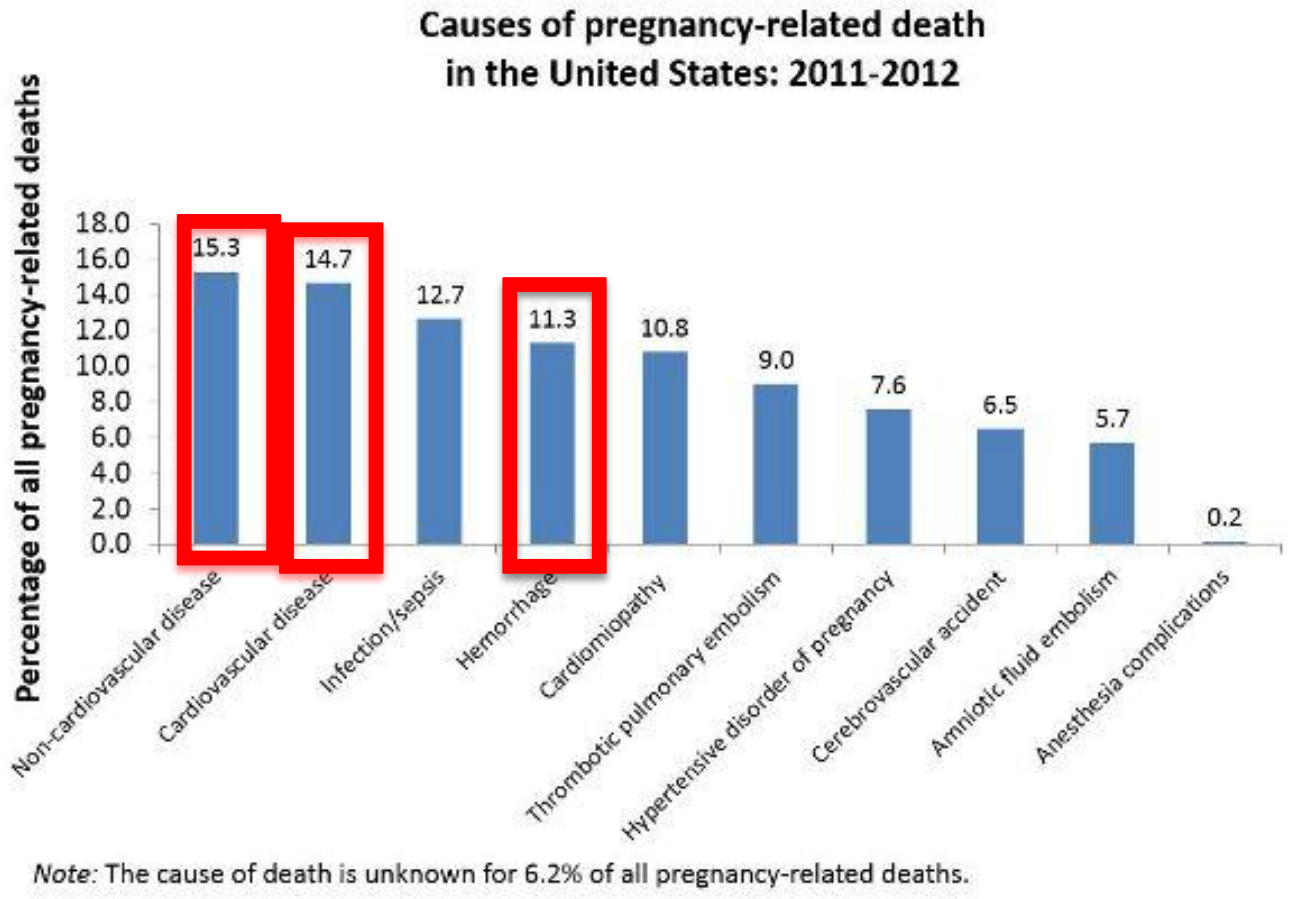

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Missed Opportunities are common

- California Pregnancy associated mortality reviews
- University of Illinois Regional Perinatal Network
- New York/ACOG District 2

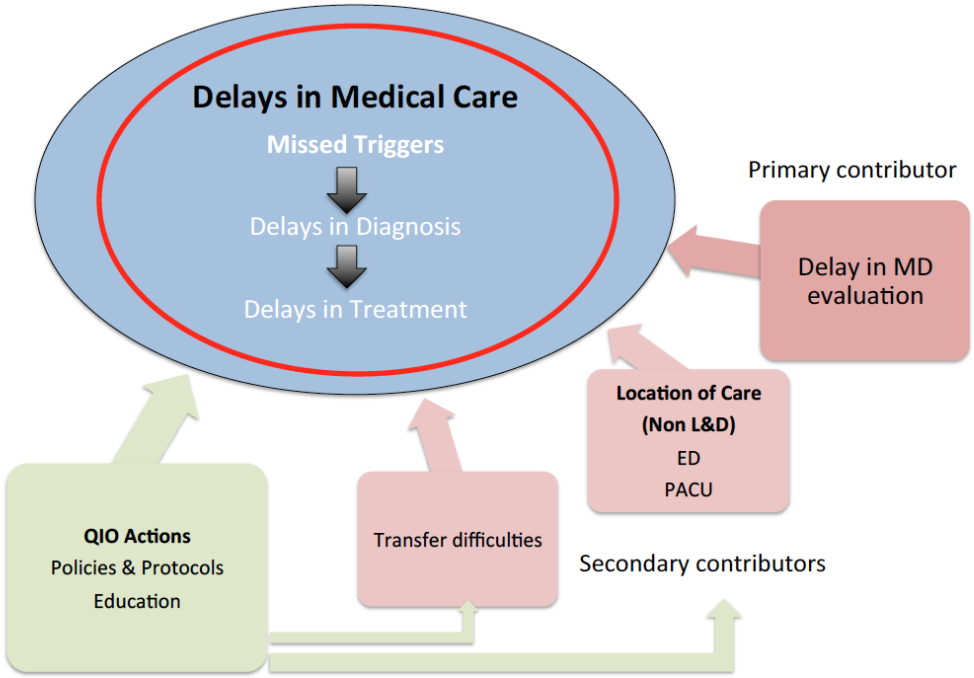
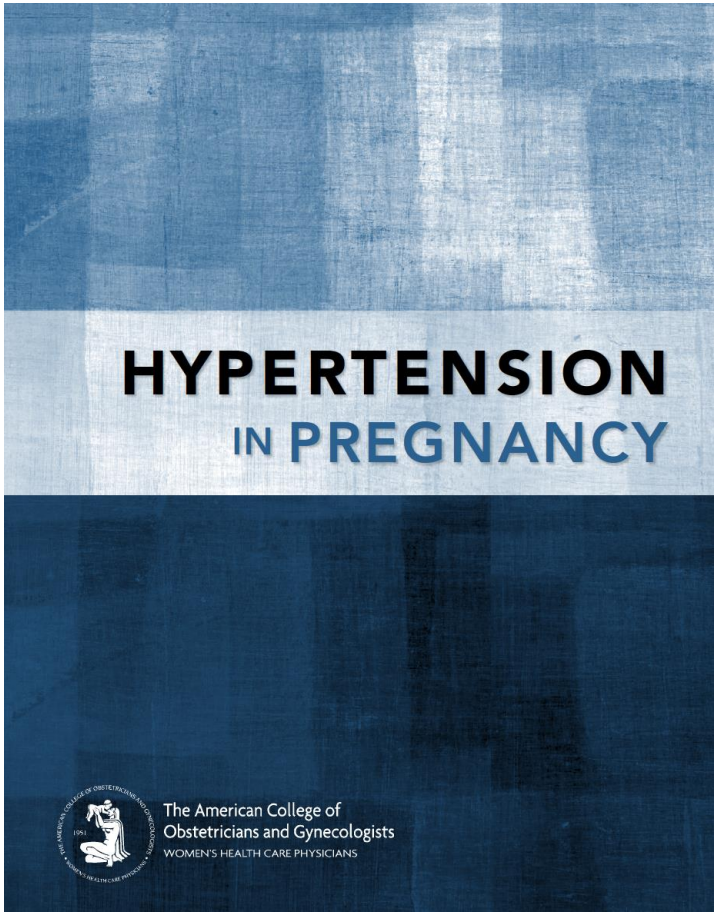


Figure 1: Major Themes in QIOs among Preeclampsia Deaths, CA-PAMR 2002-2004

New definitions



Classification of Hypertensive Disorders of Pregnancy

- Preeclampsia-Eclampsia
- Chronic Hypertension
- Chronic Hypertension with superimposed preeclampsia
- Gestational Hypertension

Preeclampsia

TABLE E-1. Diagnostic Criteria for Preeclampsia ⇦

Blood pressure	• Greater than or equal to 140 mm Hg systolic or greater than or equal to 90 mm Hg diastolic on two occasions at least 4 hours apart after 20 weeks of gestation in a woman with a previously normal blood pressure • Greater than or equal to 160 mm Hg systolic or greater than or equal to 110 mm Hg diastolic, hypertension can be confirmed within a short interval (minutes) to facilitate timely antihypertensive therapy
and	
Proteinuria	• Greater than or equal to 300 mg per 24-hour urine collection (or this amount extrapolated from a timed collection) or • Protein/creatinine ratio greater than or equal to 0.3* • Dipstick reading of 1+ (used only if other quantitative methods not available)
Or in the absence of proteinuria, new-onset hypertension with the new onset of any of the following:	
Thrombocytopenia	• Platelet count less than 100,000/microliter
Renal insufficiency	• Serum creatinine concentrations greater than 1.1 mg/dL or a doubling of the serum creatinine concentration in the absence of other renal disease
Impaired liver function	• Elevated blood concentrations of liver transaminases to twice normal concentration
Pulmonary edema	
Cerebral or visual symptoms	

* Each measured as mg/dL.

Preeclampsia

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Preeclampsia with severe features

BOX E-1. Severe Features of Preeclampsia (Any of these findings) ⇦

- Systolic blood pressure of 160 mm Hg or higher, or diastolic blood pressure of 110 mm Hg or higher on two occasions at least 4 hours apart while the patient is on bed rest (unless antihypertensive therapy is initiated before this time)
- Thrombocytopenia (platelet count less than 100,000/microliter)
- Impaired liver function as indicated by abnormally elevated blood concentrations of liver enzymes (to twice normal concentration), severe persistent right upper quadrant or epigastric pain unresponsive to medication and not accounted for by alternative diagnoses, or both
- Progressive renal insufficiency (serum creatinine concentration greater than 1.1 mg/dL or a doubling of the serum creatinine concentration in the absence of other renal disease)
- Pulmonary edema
- New-onset cerebral or visual disturbances

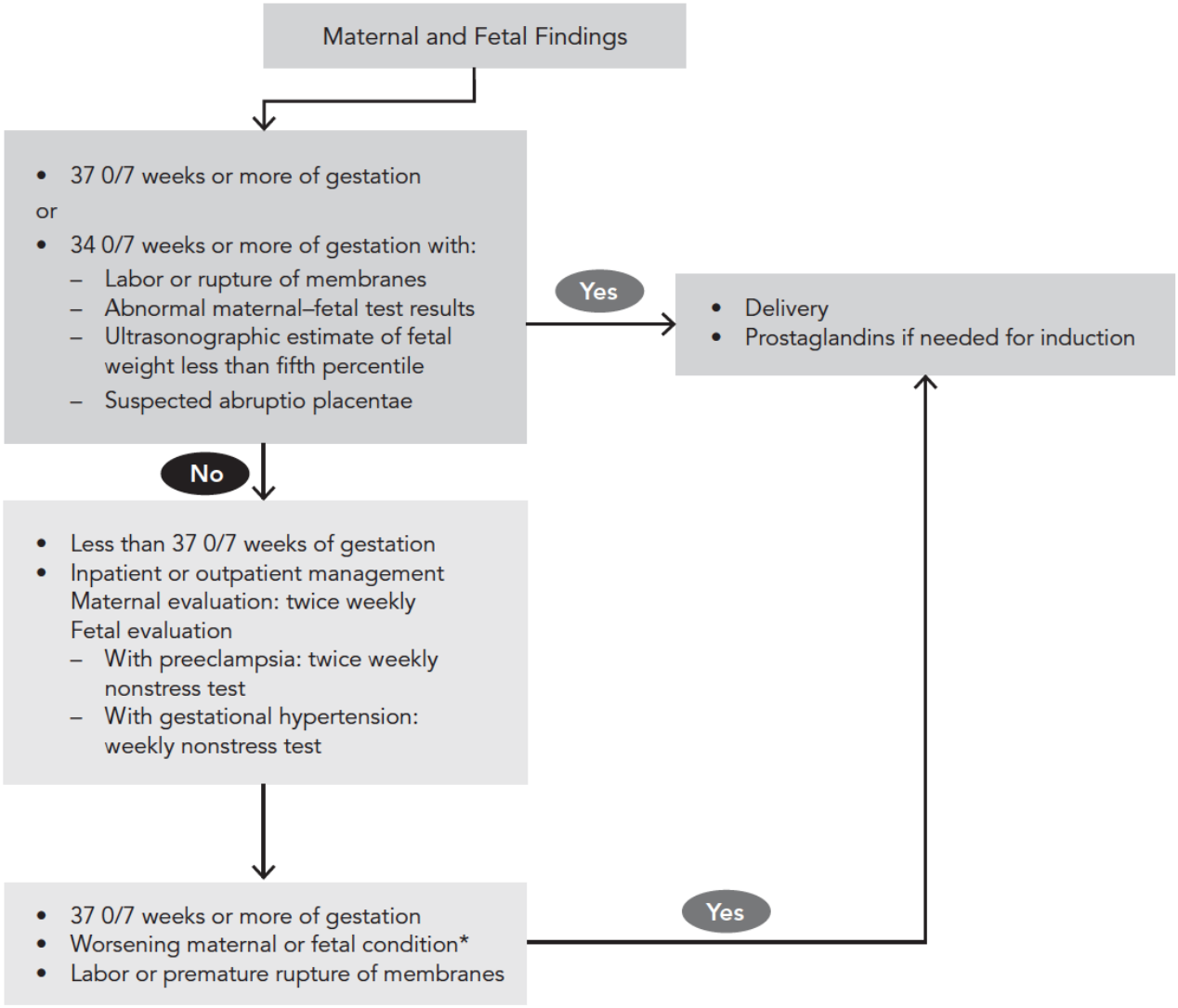

FIGURE 5-1. Management of mild gestational hypertension or preeclampsia without severe features. ⇦

Expectant Management of Preeclampsia with Severe Features

- Delivery at 34 weeks 0 days
- Delivery promptly with:
  - Pulmonary edema
  - Renal failure
  - Abruption
  - Severe thrombocytopenia
  - DIC
  - Persistent cerebral symptoms
  - Non-reassuring fetal testing
  - Fetal demise regardless of gestational age

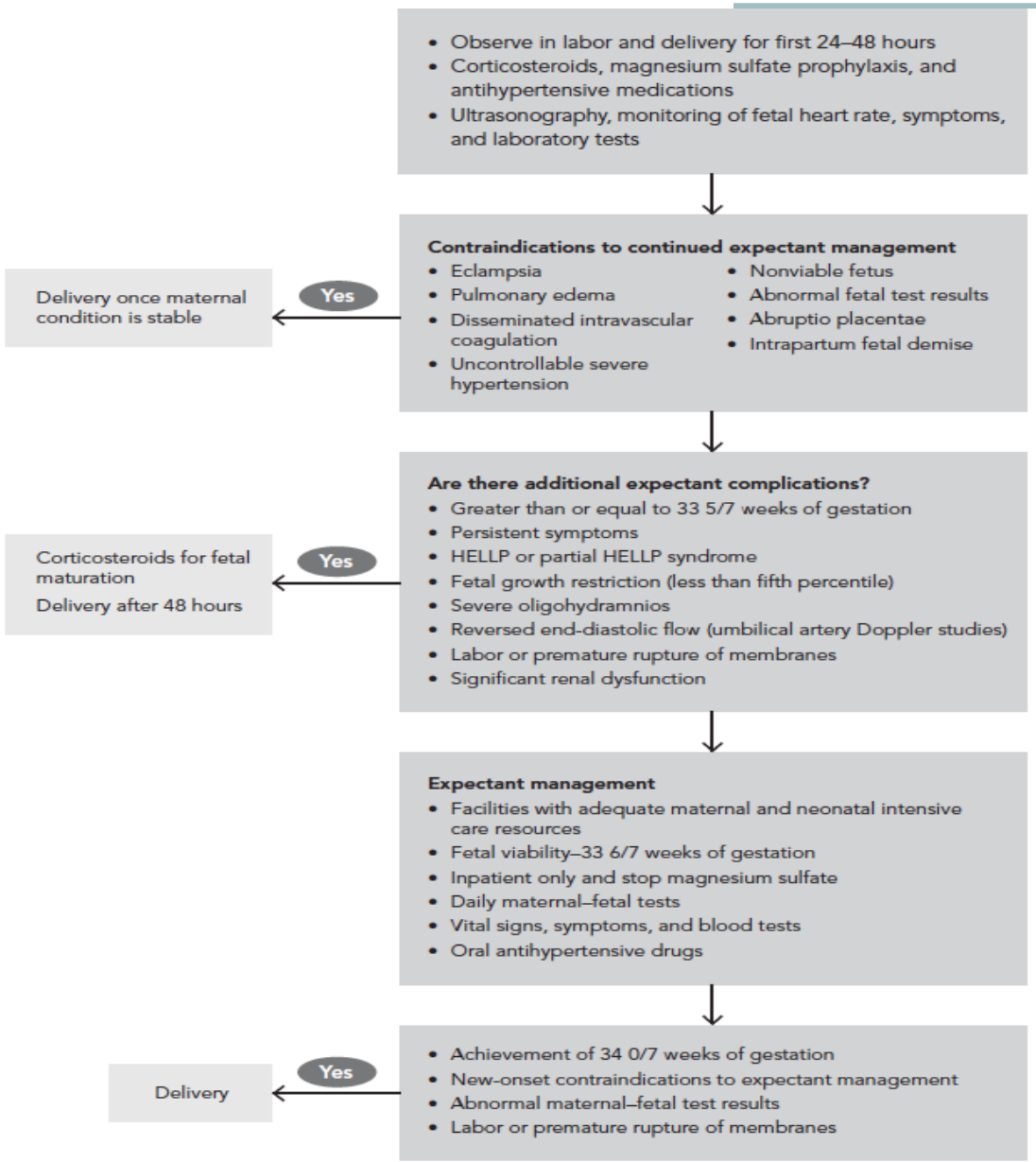

FIGURE 5-2. Management of severe preeclampsia at less than 34 weeks of gestation. ⇦

Abbreviation: HELLP, hemolysis, elevated liver enzymes, and low platelet count.

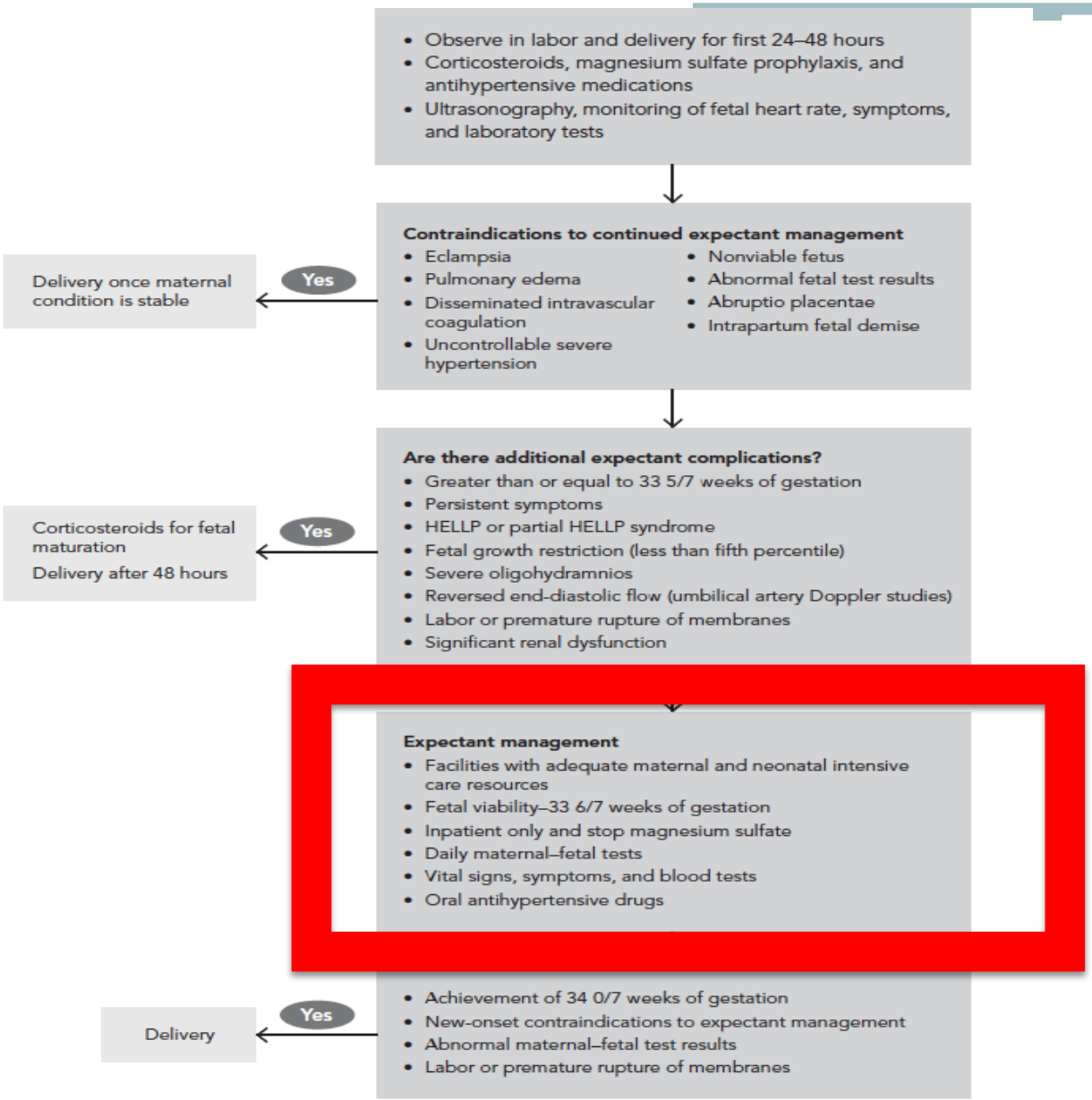

FIGURE 5-2. Management of severe preeclampsia at less than 34 weeks of gestation. ⇦

Abbreviation: HELLP, hemolysis, elevated liver enzymes, and low platelet count.

Indications for delivery during expectant management

- Maternal Indications
  - Recurrent severe hypertension
  - Recurrent symptoms of severe preeclampsia
  - Progressive renal insufficiency
  - Persistent thrombocytopenia
  - Pulmonary edema
  - Aburption
  - Labor or Rupture of membranes

Indications for delivery during expectant management

- Fetal Indications
  - Gestational age >34 0/7 weels
  - Severe fetal growth restriction <5%
  - Persistent oligohydramnios (DVP <2cm)
  - BPP 4/10 or less on two occasionals 6 hours apart
  - Reversed end-diastolic flow on dopplers
  - Recurrent variable or late decelerations during NST
  - Fetal death

Management of HTN (emergency)

TABLE 7-1. Antihypertensive Agents Used for Urgent Blood Pressure Control in Pregnancy ⇦

Drug	Dose	Comments
Labetalol	10–20 mg IV, then 20–80 mg every 20–30 min to a maximum dose of 300 mg or Constant infusion 1–2 mg/min IV	Considered a first-line agent Tachycardia is less common and fewer adverse effects Contraindicated in patients with asthma, heart disease, or congestive heart failure
Hydralazine	5 mg IV or IM, then 5–10 mg IV every 20–40 min or Constant infusion 0.5–10 mg/h	Higher or frequent dosage associated with maternal hypotension, headaches, and fetal distress—may be more common than other agents
Nifedipine	10–20 mg orally, repeat in 30 minutes if needed; then 10–20 mg every 2–6 hours	May observe reflex tachycardia and headaches

Abbreviations: IM, intramuscularly; IV, intravenously.

Tools for Improving Safety for Preeclampsia

- Education (providers and patients)
- Protocols
- Checklists
- Simulation
- Debriefings
- Maternal Early Warning Systems

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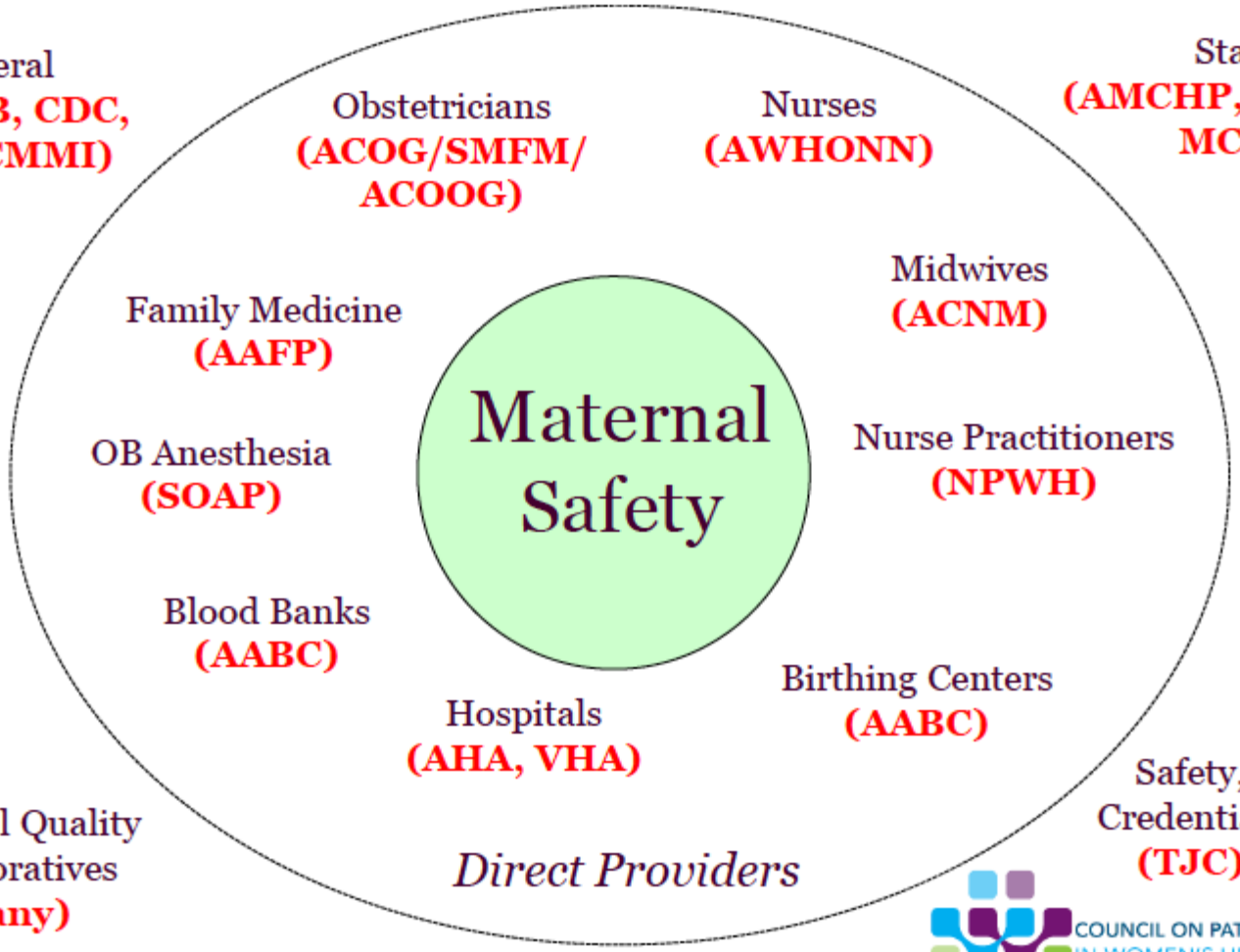

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PATIENT SAFETY BUNDLE

Hypertension

READINESS

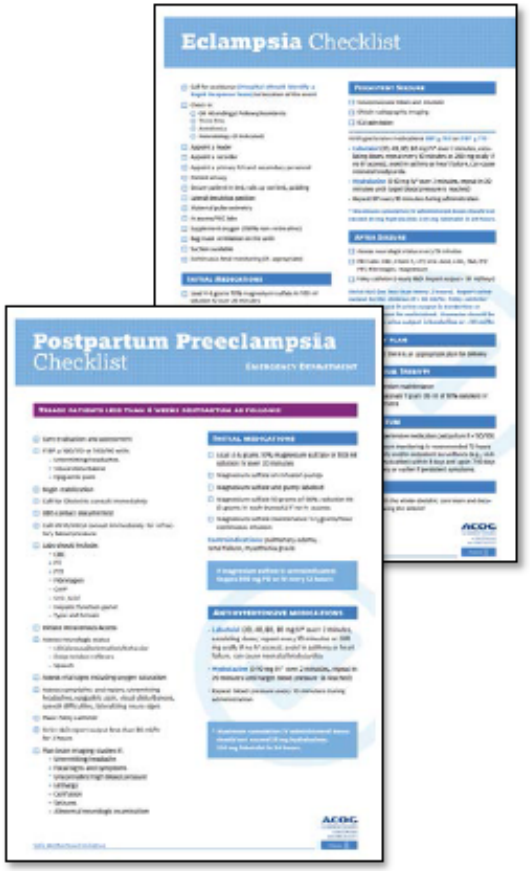
Every Unit

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

RECOGNITION & PREVENTION

Every Patient

- Standard protocol for measurement and assessment of BP and urine protein for all pregnant and postpartum women
- Standard response to maternal early warning signs including listening to and investigating patient symptoms and assessment of labs (e.g. CBC with platelets, AST and ALT)
- Facility-wide standards for educating prenatal and postpartum women on signs and symptoms of hypertension and preeclampsia



ACOG District II Safe Motherhood Initiative

COUNCIL ON PATIENT SAFETY IN WOMEN'S HEALTH CARE

safe health care for every woman

“Readiness”

- System based plan for every unit
- Criteria and plan for escalation
  - Who and how
  - Initiate emergency diagnostics and therapeutics
- Plan for rapid stabilization and transport

PREECLAMPSIA EARLY RECOGNITION TOOL (PERT)

Preeclampsia Early Recognition Tool (PERT)

ASSESS	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
Systolic BP (mm HG)	100-139	140-159	≥160
Diastolic BP (mm HG)	50-89	90-105	≥105
HR	61-110	111-129	≥130
Respiration	11-24	25-30	<10 or >30
SOB	Absent	Present	Present
O2 Sat (%)	≥95	91-94	≤90
Pain: Abdomen or Chest	None	•Nausea, vomiting •Chest pain •Abdominal pain	•Nausea, vomiting •Chest pain •Abdominal pain
Fetal Signs	•Category I •Reactive NST	•Category II •IUGR •Non-reactive NST	•Category III
Urine Output (ml/hr)	≥50	30-49	≤30 (in 2 hrs)
Proteinuria (Level of proteinuria is not an accurate predictor of pregnancy outcome)	Trace	•> +1** •≥300mg/24 hours	
Platelets	>100	50-100	<50
AST/ALT	<70	>70	>70
Creatinine	<0.8	0.9-1.1	>1.2
Magnesium Sulfate Toxicity	•DTR +1 •Respiration 16-20	•Depression of patellar reflexes	•Respiration <12

GREEN = NORMAL
Proceed with protocol

YELLOW = WORRISOME
Increase assessment frequency

# Triggers	TO DO
1	•Notify provider
≥2	•Notify charge RN •In-person evaluation •Order labs/tests •Anesthesia consult •Consider magnesium sulfate •Supplemental oxygen

**Physician should be made aware of worsening or new-onset proteinuria

RED = SEVERE

Trigger: 1 of any type listed below	TO DO
1 of any type	• Immediate evaluation • Transfer to higher acuity level • 1:1 staff ratio
Awareness Headache Visual	• Consider Neurology consult • CT Scan • R/O SAH/intracranial hemorrhage
BP	• Labetalol/hydralazine in 30 min • In-person evaluation • Magnesium sulfate loading or maintenance infusion
Chest Pain	• Consider CT angiogram
Respiration SOB O2 SAT	• O2 at 10 L per rebreather mask • R/O pulmonary edema • Chest x-ray

11.8.13.v1

Adapted from the Modified Obstetric Early Warning System (MEOWS) in "Saving Mothers Lives: Reviewing maternal deaths to make motherhood safer (2003-2005). The Seventh Report of the Confidential Enquiries into Maternal Deaths in the United Kingdom 2007

“Recognition and Prevention”

- Protocol for measurement and assessment of blood pressures
- Standard Response (MEWS or MEOWS)
- Educate pregnant and postpartum women

CMQCC CALIFORNIA MATERNAL QUALITY CARE COLLABORATIVE

California Department of PublicHealth

PATIENT CARE AND TREATMENT RECOMMENDATIONS

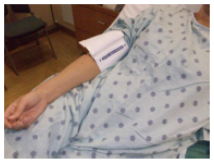
ACCURATE BLOOD PRESSURE MEASUREMENT

Kristi Gabel, RNC-OB, C-EFM, MSN, CNS, Sutter Roseville Medical Center

BACKGROUND

The current method used most often in the hospital setting for accurate measurement of blood pressure is the oscillatory method, or automated blood pressure machine, which tends to underestimate both systolic and diastolic readings by as much as 10 mm Hg[1,2] In the clinic setting and physician offices, blood pressure measurement is often used with the aneroid (mechanical type with a dial) sphygmomanometer. Refer to Table 1 for steps in obtaining accurate blood pressure measurement and Figure 1 for recommended cuff sizes.

Table 1: Steps for Obtaining Accurate Blood Pressure Measurements[3]

Step 1: Prepare equipment	a. Mercury sphygmomanometer is gold standard, can use validated equivalent automated equipment b. Check cuff for any defaults c. Obtain correct size cuff: width of bladder 40% of circumference and encircle 80% of arm (See Figure 1)
Step 2: Prepare the patient: 	a. Use a sitting or semi-reclining position with back supported and arm at heart level b. Patient to sit quietly for 5 minutes prior to measurement c. Bare upper arm of any restrictive clothing d. Patients feet should be flat, not dangling from examination table or bed, and her legs uncrossed e. Assess any recent (within previous 30 minutes) consumption of caffeine or nicotine. If blood pressures are at the level that requires treatment, consumption of nicotine or caffeine should not lead to delays in instituting appropriate anti-hypertensive therapies
Step 3: Take measurement	a. Support patients arm at heart level, seated in semi-fowlers position b. For ausculatory measurement: use first audible sound (Kortokoff I) as systolic pressure and use disappearance of sound (Kortokoff V) as diastolic pressure c. Read to the nearest 2 mm Hg d. Instruct the patient not to talk e. At least one additional readings should be taken within 15 minutes f. Use the highest reading g. If greater than or equal to 140/90, repeat within 15 minutes and if still elevated, further evaluation for preeclampsia is warranted. **Do not reposition patient to either side to obtain a lower BP. This will give you a false reading.**
Step 4: Record Measurement	Document BP, patient position, and arm in which taken

Adapted from Peters RM (2008) High blood pressure in pregnancy. Nursing for Women's Health, Oct/Nov, pp. 410-422. Photo courtesy of and printed with permission by Kristi Gabel, RNC-OB, C-EFM, MSN, CNS, Sutter Roseville Medical Center 2013.

Standardized Measurement of Blood pressures

Appropriate Cuff Size

Figure 1: Recommended cuff sizes

Arm Circumference (cm)	Cuff Size
22-26	"Small Adult": 12x22cm
27-34	"Adult": 16x30cm
35-44	"Large Adult": 16x36cm
45-52	"Adult Thigh": 16x42cm

Photo courtesy of and printed with permission by Kristi Gabel, RNC-OB, C-EFM, MSN, CNS, Sutter Roseville Medical Center 2013.

“Response”

- Standardized protocols for management and treatment of HTN, Eclampsia, postpartum presentations
- Checklists
- Practiced simulations

Protocols for Hypertensive Emergency

CMQCC CALIFORNIA MATERNAL QUALITY CARE COLLABORATIVE

California Department of PublicHealth

CMQCC PREECLAMPSIA TOOLKIT
PREECLAMPSIA CARE GUIDELINES
CDPH-MCAH Approved: 12/20/13

CLINICAL PEARLS

Compiled by the Preeclampsia Task Force

ACUTE TREATMENT:

- Antihypertensive medications administered within 1 hour and ideally as soon as possible upon arrival at a healthcare facility for blood pressures of 160 systolic, and/or 105-110 diastolic or greater is a critical initial step in decreasing morbidity and mortality.
- Magnesium sulfate therapy for seizure prophylaxis should be administered to any patients with:
  - Severe preeclampsia with subjective neurological symptoms such as headache or blurry vision or right upper quadrant or epigastric abdominal pain AND
  - Should be considered in patients with preeclampsia without severe features (mild).
- Magnesium sulfate is the approved initial therapy for an eclamptic seizure.
- Algorithms for acute treatment of severe hypertension and eclampsia should be readily available or preferably posted in all labor and delivery units.
- Early post-discharge follow-up should be the norm for all patients diagnosed with preeclampsia/eclampsia. The Task Force recommends that follow-up occur within 3-7 days if blood pressure medication was used during the labor and delivery or postpartum and within 7-14 days if the diagnosis of preeclampsia was made but no medication was used. Current ACOG guidelines recommend for women in whom gestational hypertension, preeclampsia, or superimposed preeclampsia is diagnosed, that BP be monitored in the hospital or that equivalent outpatient surveillance be performed for at least 72 hours postpartum and again 7-10 days after delivery or earlier in women with symptoms.[15]
- Postpartum patients presenting with hypertension, preeclampsia or eclampsia to the Emergency Department should be either assessed by or admitted to an obstetrical service. If they are treated in the Emergency Department and discharged, adequate follow-up must be arranged with an obstetrical provider.
- All institutions should consider preparing a severe preeclampsia/eclampsia box of medications and supplies needed for the treatment of preeclampsia (see Appendix, S, pg. 124) that includes at a minimum the following: Magnesium sulfate (including tubing, syringes and needles), labetalol, hydralazine and calcium gluconate. Additional medications such as second-line antihypertensives should be institution specific.

The following protocol should be initiated if the systolic blood pressure is ≥ 160 mmHg OR the diastolic blood pressure is ≥ 110 mmHg.

___ Notify physician

___Administer hydralazine, 5 mg IV over 2 minutes

___ Repeat blood pressure in 15 minutes

___ If either blood pressure threshold is still exceeded, administer hydralazine 10 mg IV over 2 minutes.

___ Repeat blood pressure in 15 minutes

____If either blood pressure threshold is still exceeded, administer **labetalol**, 20 mg IV over 2 minutes

____ Repeat blood pressure in 10 minutes

____If either blood pressure criteria is still exceeded, administer labetalol 40 mg IV over 2 minutes and obtain emergency maternal-fetal medicine, internal medicine or anesthesia consultation.

The American College of
Obstetricians and Gynecologists
WOMEN'S HEALTH CARE PHYSICIANS

COMMITTEE OPINION

Number 629 • April 2015

(Replaces Committee Opinion 526, May 2012)

Committee on Patient Safety and Quality Improvement
Committee on Professional Liability

This document reflects emerging concepts on patient safety and is subject to change. The information should not be construed as dictating an exclusive course of treatment or procedure to be followed.

Clinical Guidelines and Standardization of Practice to Improve Outcomes

ABSTRACT: Protocols and checklists have been shown to reduce patient harm through improved standardization and communication. Implementation of protocols and guidelines often is delayed because of lack of health care provider awareness or difficult clinical algorithms in medical institutions. However, the use of checklists and protocols clearly has been demonstrated to improve outcomes and their use is strongly encouraged. Checklists and protocols should be incorporated into systems as a way to help practitioners provide the best evidence-based care to their patients.

A CHECKLIST FOR CHECKLISTS

Development → Drafting → Validation

Development

- ❑ Do you have clear, concise objectives for your checklist?

Is each item:

- ❑ A critical safety step and in great danger of being missed?
- ❑ Not adequately checked by other mechanisms?
- ❑ Actionable, with a specific response required for each item?
- ❑ Designed to be read aloud as a verbal check?
- ❑ One that can be affected by the use of a checklist?

Have you considered:

- ❑ Adding items that will improve communication among team members?
- ❑ Involving all members of the team in the checklist creation process?

Drafting

Does the Checklist:

- ❑ Utilize natural breaks in workflow (pause points)?
- ❑ Use simple sentence structure and basic language?
- ❑ Have a title that reflects its objectives?
- ❑ Have a simple, uncluttered, and logical format?
- ❑ Fit on one page?
- ❑ Minimize the use of color?

Is the font:

- ❑ Sans serif?
- ❑ Upper and lower case text?
- ❑ Large enough to be read easily?
- ❑ Dark on a light background?

- ❑ Are there fewer than 10 items per pause point?
- ❑ Is the date of creation (or revision) clearly marked?

Validation

Have you:

- ❑ Trialed the checklist with front line users (either in a real or simulated situation)?
- ❑ Modified the checklist in response to repeated trials?

Does the checklist:

- ❑ Fit the flow of work?
- ❑ Detect errors at a time when they can still be corrected?

- ❑ Can the checklist be completed in a reasonably brief period of time?
- ❑ Have you made plans for future review and revision of the checklist?

Please note: A checklist is NOT a teaching tool or an algorithm

Surgical Safety Checklist

Ben Taub Hospital: OBSTERICAL USE ONLY

In the event of an emergent case, do not delay proceeding in an expeditious manner to complete this checklist; defer checklist until the appropriate clinical time.

SIGN – IN

Surgeon completes during Time Out, with attending present

- Indication and categorization (urgent, scheduled) of surgery confirmed ☐ Yes ☐ No
- Consent signed with correct attending identified and all appropriate procedures documented ☐ Yes ☐ No
- All team members have been introduced by name and role ☐ Yes ☐ No
- Patient and team members have verified her identity, surgical site & procedure ☐ Yes ☐ No
- Known Allergy? ☐ Yes ☐ No
- Has Antibiotic Prophylaxis been given within the last 60 minutes? ☐ Yes ☐ No ☐ Not Indicated
- Fire Safety Assessment complete ☐ Yes ☐ No
- Review current hemoglobin/hematocrit, platelets
- Medications currently being administered and plan for intra-op and post-operative dosing is discussed ☐ Yes ☐ No
- Airway and risk of aspiration have been evaluated and appropriate equipment is available ☐ Yes ☐ No
- If risk of blood loss >1000cc for cesarean delivery, blood products are readily available ☐ Yes ☐ No (review patient specific risks of PPH/uterine atony and devise the plan)
- Surgeon: Review critical and unexpected steps, operative duration, anticipated complications and patient – specific concerns (examples: arrest of descent may need a vaginal hand and/or consideration of dorsal lithotomy position)
- Anesthesia: Review patient - specific concerns (including regional versus general anesthesia plan)
- Nursing Staff: Review patient - specific concerns, equipment, supplies, sterility
- All essential imaging studies have been reviewed (placental location, characterization verified) ☐ Yes ☐ No
- Fetal lie verified (Leopold's maneuver sufficient) ☐ Yes ☐ No
- Discuss: Is Neonatology needed at delivery? ☐ Yes ☐ No
- Team discusses post-operative recovery location, duration and anticipated post-op complications

SIGN – OUT

Nurse Verbally Confirms with the surgeon and anesthesia providers

- Instrument, Sponge and Needle counts are correct ☐ Yes ☐ No
- Specimens are labeled and pathology request complete ☐ Yes ☐ No
- Equipment and/or supply concerns have been escalated to charge nurse ☐ Yes ☐ No

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- **SURGEON, ANESTHESIA PROFESSIONALS AND NURSE REVIEW THE KEY CONCERNS FOR RECOVERY AND MANAGEMENT OF THIS PATIENT**
- Team discusses post-operative recovery location, duration and anticipated post-op complications

10/2015: Modified for Ben Taub Obstetric use from the WHO Surgical Safety Checklist (1st Edition)

ACOG District II Safe Motherhood Initiative

Toolboxes and Safety Bundles

COUNCIL ON PATIENT SAFETY IN WOMEN'S HEALTH CARE
safe health care for every woman

Friday, June 26, 2015
1:00 p.m. Eastern
Dial In: 888.863.0985
Conference ID: 52266760

Safety Action Series

Severe Hypertension Patient Safety Bundle

Severe Hypertension in Pregnancy Checklist

Trigger for initiating this checklist is a SBP ≥160 or DBP ≥110

- ☐ Initiate magnesium sulfate for seizure prophylaxis (if not already initiated)
- ☐ Load 4-6 grams 10% magnesium sulfate in 100 ml solution IV over 20 minutes
- ☐ Magnesium sulfate on infusion pump
- ☐ Magnesium sulfate and pump labeled
- ☐ Magnesium sulfate 10 grams of 50% solution IM (5 grams in each buttock) if no IV access
- ☐ Magnesium sulfate maintenance 1-2 grams/hour continuous infusion

Contraindications: pulmonary edema, renal failure, myasthenia gravis

Antihypertensive medications

- **Labetalol** (20, 40, 80, 80 mg IV* over 2 minutes, escalating doses, repeat every 10 minutes or 300 mg orally if no IV access); avoid in asthma or heart failure, can cause neonatal bradycardia
- **Hydralazine** (5-10 mg IV* over 2 minutes, repeat in 20 minutes until target blood pressure is reached)
- Repeat blood pressure every 10 minutes during administration

***Maximum cumulative IV administered doses should not exceed 25 mg hydralazine; 220 mg labetalol in 24 hours.**

If first line agents are unsuccessful, recommend emergency consultation with a specialist (e.g., MFM, internal medicine, OB anesthesiology, critical care) for second line management decisions

Anticonvulsant medications

(for recurrent seizures or when magnesium is contraindicated):

- **Lorazepam** (2-4 mg IV x 1, may repeat x 1 after 10-15 minutes)
- **Diazepam** (5-10 mg IV every 5-10 minutes to maximum dose of 30 mg)
- **Phenytoin** (15-20 mg/kg IV x 1, may repeat 10 mg/kg IV after 20 minutes if no response); avoid with hypotension, may cause cardiac arrhythmias
- **Keppra** (500 mg IV or orally, may repeat in 12 hours); dose adjustment needed if renal impairment

- ☐ Antenatal corticosteroids (If <34 weeks of gestation)
- ☐ Re-address VTE prophylaxis requirement
- ☐ Plan brain imaging studies if:
  - unremitting headache
  - focal signs and symptoms
  - uncontrolled high blood pressure
  - lethargy
  - confusion
  - seizures
  - abnormal neurologic examination

Postpartum

- **Antihypertensive therapy** is suggested for women with persistent postpartum hypertension, SBP of 150 mm Hg or DBP of 100 mm or higher on at least two occasions that are at least 4 hours apart. Persistent SBP of 160 mm Hg or DBP of 110 mm Hg or higher should be treated within 1 hour.
- **Blood pressure monitoring** is recommended 72 hours after delivery and/or outpatient surveillance (e.g., visiting nurse evaluation) within 3 days and again 7-10 days after delivery or earlier if persistent symptoms.

Simulations

“Reporting and Systems Learning”

- Huddles for high risk patients
- Monitor outcomes and process metrics
- Debriefings

Maternal Early Warning Systems

- Goal of identifying patients early who have high risk of morbidity/mortality and improving outcomes
- Two types of systems:
  - Triggering (one parameter triggers system)
  - Scoring (different parameters contribute)

Friedman et al. Maternal Early Warning Systems. Obstet Gynecol Clinics N Amer 2015

Pediatric Early Warning Systems

- Duncan et al

Table 1
The Pediatric Early Warning Score system

Score	2	1	0	1	2
Age-specific items					
<3 mo					
HR	<90	90–109	110–150	151–180	>180
RR	<20	20–29	30–60	61–80	>80
SBP	<50	50–59	60–80	81–100	>100
3–12 mo					
HR	<80	80–99	100–150	151–170	>170
RR	<20	20–24	25–50	51–70	>70
SBP	<70	70–79	80–100	99–120	>120
1–4 y					
HR	<70	70–89	90–120	121–150	>150
RR	<15	15–19	20–40	41–60	>60
SBP	<75	75–89	90–110	111–125	>125
4–12 y					
HR	<60	60–69	70–110	111–130	>130
RR	<12	12–19	20–30	31–40	>40
SBP	<80	80–90	90–120	120–130	>130
>12 y					
HR	<50	50–59	60–100	101–120	>120
RR	<8	8–12	12–16	15–24	>24
SBP	<86	85–101	100–130	131–150	>150
General items					
Pulses	Absent	Doppler	Present	Bounding	
O2 saturation (%)	<85	85–95	>95		
Capillary refill	CRT >3	2–3	CRT <2		
LOC	<7	7–11	12–15		
Oxygen therapy	>50% or >4 L/min	Any <50% or <4 L/min	None		
Bolus fluid		Any	None		
Temperature	<35	35–<36	36	>38.5–<40	>40

National Early Warning System

Table 2
NEWS

Physiologic Parameters	3	2	1	0	1	2	3
Respiration rate	≤8		9–11	12–20		21–24	≥25
Oxygen saturation	≤91	92–93	94–95	≥96			
Any supplemental oxygen		Yes		No			
Temperature	≤35.0		35.1–36.0	36.1–38.0	38.1–39.0	≥39.1	
Systolic blood pressure	≤90	91–100	101–110	111–219			≥220
Heart rate	≤40		41–50	51–90	91–110	111–130	≥131
Level of consciousness				A			V, P, or U

Maternal Early Warning System

- Concern that other systems are not applicable to pregnant women
- 2007 Saving Mothers Lives report from the Confidential inquiries into Maternal and Child Health in the United Kingdom

Table 3
A modified early obstetric warning system

Physiologic Parameters	Yellow Alert	Red Alert
Respiration rate	21–30	<10 or >30
Oxygen saturation		<95
Temperature	35–36	<35 or >38
Systolic blood pressure	150–160 or 90–100	<90 or >160
Diastolic blood pressure	90–100	>100
Heart rate	100–120 or 40–50	>120 or <40
Pain score	2–3	
Neurologic response	Voice	Unresponsive, pain

OBSTETRICS

Existing models fail to predict sepsis in an obstetric population with intrauterine infection

Justin R. Lappen, MD; Melissa Keene, MD; Marybeth Lore, MD; William A. Grobman, MD, MBA; Dana R. Gossett, MD

OBJECTIVE: Multiple scoring systems exist to identify inpatients who are at risk for clinical deterioration. None of these systems have been evaluated in an obstetric population. We examined the Systemic Inflammatory Response syndrome (SIRS) and Modified Early Warning score (MEWS) criteria in pregnant women with chorioamnionitis.

STUDY DESIGN: This was an 18-month retrospective analysis of patients with chorioamnionitis. SIRS and MEWS scores were calculated; clinical outcomes were ascertained, and test characteristics were calculated for the primary outcome of sepsis, intensive care unit transfer, or death.

RESULTS: Nine hundred thirteen women with chorioamnionitis were identified. Five women experienced sepsis; there was 1 death. Five hundred seventy-five of the 913 women (63%) met SIRS criteria (95% confidence interval, 59.8–66.2%; positive predictive value, 0.9%). Ninety-two of the 913 women (10.3%) had a MEWS score of ≥5 (95% confidence interval, 8.3–12.2%; positive predictive value, 0.05%).

CONCLUSION: SIRS and MEWS criteria do not identify accurately patients who are at risk for intensive care unit transfer, sepsis, or death among pregnant women with intrauterine infection and should not be used in an obstetric setting.

Key words: chorioamnionitis, intensive care unit, MEWS, sepsis

Cite this article as: Lappen JR, Keene M, Lore M, et al. Existing models fail to predict sepsis in an obstetric population with intrauterine infection. Am J Obstet Gynecol 2010;203:573.e1-5.

MEWS

- The National Partnership for Maternal Safety

Table 1. The Maternal Early Warning Criteria

Systolic BP (mm Hg)	<90 or >160
Diastolic BP (mm Hg)	>100
Heart rate (beats per min)	<50 or >120
Respiratory rate (breaths per min)	<10 or >30
Oxygen saturation on room air, at sea level, %	<95
Oliguria, mL/hr for ≥2 hours	<35
Maternal agitation, confusion, or unresponsiveness; Patient with preeclampsia reporting a non-remitting headache or shortness of breath	

BP, blood pressure.

These triggers cannot address every possible clinical scenario that could be faced by an obstetric clinician and must not replace clinical judgment. As a core safety principle, bedside nurses should always feel comfortable to escalate their concerns at any point.

7 Use of maternal early warning trigger (MEWT) tool reduces maternal morbidity

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OBJECTIVE: To determine if implementation of a MEWT tool can reduce maternal morbidity.

STUDY DESIGN: A previously published internally developed MEWT tool was prospectively applied to 6 pilot sites in a large system with 29 maternity units. The tool's primary goal is timely assessment and management of patients suspected of clinical deterioration. The tool addresses 4 areas: sepsis, cardiopulmonary dysfunction, hypertension, and hemorrhage (HEM). Triggers sustained for >30 min were defined as SEVERE (required 1 abnl value): HR>130 bpm, RR>30/min., MAP<55 mmHg, O2 saturation<90%, nurse concern or NON-SEVERE (required 2 abnl values): Temp>38 or <36°C, BP>155/105 mmHg or <85/45 mmHg, HR>110 or <50 bpm, RR>24 or <10/min, O2 sat<93%, FHR>160 bpm, altered mental status, and disproportionate pain. Outcome measures were sepsis, HEM, transfusion(TX), hysterectomy(HYS), eclampsia, composite morbidity(CM), severe maternal morbidity(SMM) and ICU transfer. Two periods were analyzed: 24 months pre-MEWT and 11 months post-MEWT. Data analyzed using z-ratios for significant difference between two independent proportions. Non-Pilot sites were evaluated to determine similarities or differences between Pilot MEWT and Non-Pilot sites.

RESULTS: Use of MEWT tool resulted in significant reductions in CM, eclampsia, and use of D&C. As desired, sepsis identification and ICU transfers increased. HYS, HEM, TX and SMM declined non-significantly post-MEWT. At Non-Pilot sites CM significantly increased. In Non-Pilot sites all outcome parameters trended

Table 1.

	Pre-MEWT	Post-MEWT	Trend	p	Pre-Non-Pilot	Post-Non-Pilot	Trend	p
Deliveries	24221	10701			95718	44638		
Composite Morbidity	(4.5%)	(3.9%)	↓	<0.0001	4.5%	4.9%	↑	<0.001
Eclampsia/1000	2.02	0.37	↓	<0.001	1.12	1.06	↓	0.5
D&C	0.41%	0.26%	↓	=0.03	0.29%	0.39%	↑	<0.01
Hemorrhage	2.94%	2.65%	↓	=0.14	3.2%	3.3%	↑	=0.11
Transfusion	0.7%	0.6%	↓	=0.5	0.7%	0.84%	↑	<0.01
Hysterectomy/1000	2.2	1.7	↓	=0.2	2.1	2.2	↑	=0.9
CDC SMM	1.95%	1.75%	↓	=0.3	2.42%	2.52%	↑	=0.5
Sepsis/1000	0.78	1.3	↑	=0.14	0.26	0.38	↑	=0.2
ICU Transfer/1000	5.0	5.3	↑	=0.7	3.0	3.0		=0.9

OBSTETRICS

Modified obstetric early warning scoring systems (MOEWS): validating the diagnostic performance for severe sepsis in women with chorioamnionitis

Sian E. Edwards, MBChB; William A. Grobman, MD, MBA; Justin R. Lappen, MD; Cathy Winter, RM; Robert Fox, MD; Erik Lenguerrand, PhD; Timothy Draycott, MD

OBJECTIVE: We sought to compare the predictive power of published modified obstetric early warning scoring systems (MOEWS) for the development of severe sepsis in women with chorioamnionitis.

STUDY DESIGN: This was a retrospective cohort study using prospectively collected clinical observations at a single tertiary unit (Chicago, IL). Hospital databases and patient records were searched to identify and verify cases with clinically diagnosed chorioamnionitis during the study period (June 2006 through November 2007). Vital sign data (heart rate, respiratory rate, blood pressure, temperature, mental state) for these cases were extracted from an electronic database and the single worst composite recording was identified for analysis. Global literature databases were searched (2014) to identify examples of MOEWS. Scores for each identified MOEWS were derived from each set of vital sign recordings during the presentation with chorioamnionitis. The performance of these MOEWS (the primary outcome) was then analyzed and compared using their sensitivity, specificity, positive and negative predictive values, and receiver-operating characteristic curve for severe sepsis.

RESULTS: Six MOEWS were identified. There was wide variation in design and pathophysiological thresholds used for clinical alerts. In all, 913 women with chorioamnionitis were identified from the clinical database. In all, 364 cases with complete data for all physiological indicators were included in analysis. Five women developed severe sepsis, including 1 woman who died. The sensitivities of the MOEWS in predicting the severe deterioration ranged from 40–100% and the specificities varied even more ranging from 4–97%. The positive predictive values were low for all MOEWS ranging from <2–15%. The MOEWS with simpler designs tended to be more sensitive, whereas the more complex MOEWS were more specific, but failed to identify some of the women who developed severe sepsis.

CONCLUSION: Currently used MOEWS vary widely in terms of alert thresholds, format, and accuracy. Most MOEWS have not been validated. The MOEWS generally performed poorly in predicting severe sepsis in obstetric patients; in general severe sepsis was overdetected. Simple MOEWS with high sensitivity followed with more specific secondary testing is likely to be the best way forward. Further research is required to develop early warning systems for use in this setting.

Key words: chorioamnionitis, early warning systems, patient safety, sepsis

Cite this article as: Edwards SE, Grobman WA, Lappen JR, et al. Modified obstetric early warning scoring systems (MOEWS): validating the diagnostic performance for severe sepsis in women with chorioamnionitis. Am J Obstet Gynecol 2015;212:536.e1-8.

Baylor/Ben Taub MEWS

- Standardized process of checking vitals and timing of reporting “MEWS” level triggers
- Standardized timing of physician notifications
- Scripted nursing/MD communication
- Common recognized response: physician to bedside within 15 minutes
- Upper level resident or attending evaluated the patient
- Nurse and physician must communicate the plan

Our Outcomes

- Time to normalization of vital signs 370 min → <90 minutes
- Improvement in communication
- Dramatic change in:
  - events with MD at bedside
  - Interventions
  - Diagnoses

Questions?