



TIPQC
Tennessee Initiative for
Perinatal Quality Care

Emergency Room Cardiac Concerns in OB Care August 2024 Regional Meetings

Fostering the identification, screening, treatment and referral of OB patients to improve health outcomes for all mothers and infants in Tennessee.





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Project Co-Leader



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Medical Director

Agenda

TIPQC Overview

Review of Statewide Statistics

Identification & Screening for
cardiac concerns

Management of Hypertension

Referral for Cardiac Conditions

Q&A

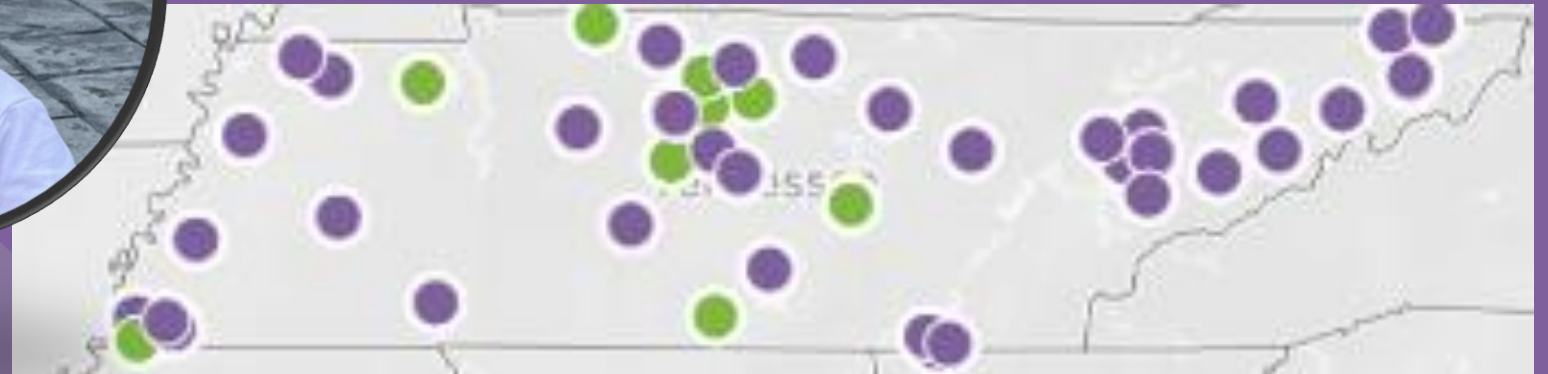
Our history

- The Tennessee Initiative for Perinatal Quality Care (TIPQC) is the state's perinatal quality improvement collaborative, founded in 2008 through a grant from the Governor's Office to engage hospitals, practitioners, payers, families, and communities in order to promote meaningful change, advance health equity, and improve the quality of care through pregnancy, delivery and beyond for all Tennessee families.
- 16 years, 30 projects
- **Additional Educational Opportunities**
 - QI coaching
 - Annual Meeting
 - Learning Sessions
 - Webinars
 - SIMS training
 - Networking & more



42 Hospitals* = 82% of Births

Involved in TIPQC improvement projects



Cardiac Conditions in Obstetric Care

AIM:

Decrease Severe Maternal Morbidity Among People with Cardiac Conditions & Decrease Pregnancy-Related Deaths Due to Cardiac Conditions (state surveillance monitoring) by 10% across the state by Summer 2026.

STATEWIDE AIM:

Improve care of patients with cardiac conditions in all participating hospital and/or urgent or emergency care setting by increasing screening and appropriate referrals for at least 90% of all birthing people thereby reducing NTSV C-sections & reduce preterm rates by 10% by the June 2026.

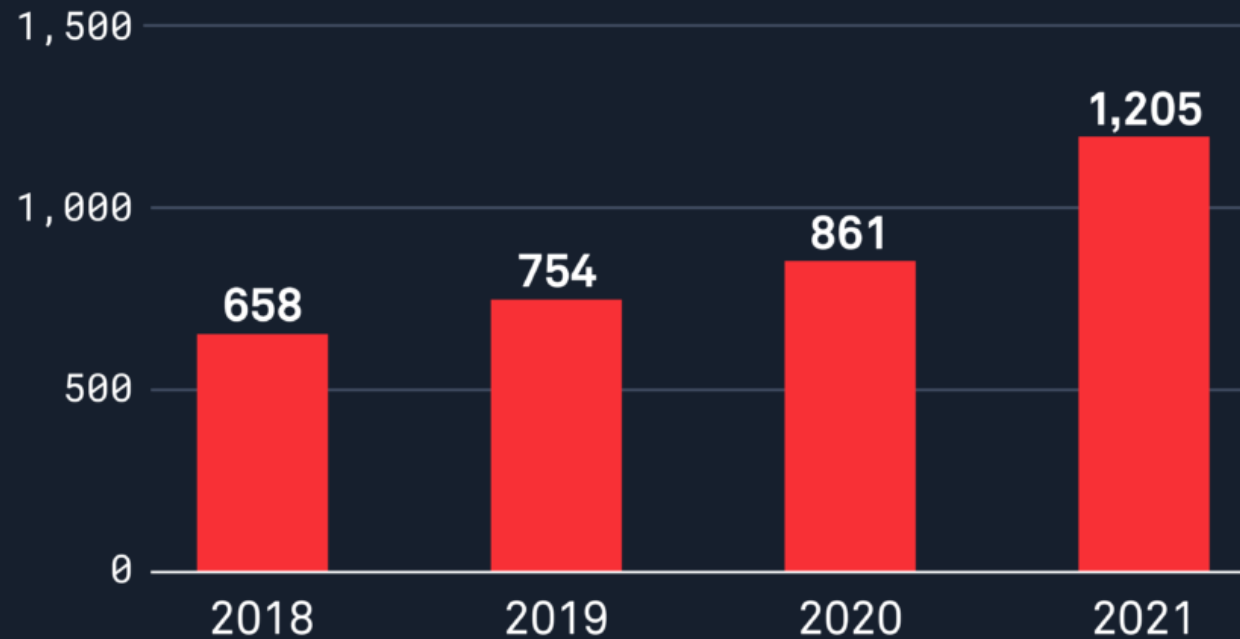


Maternal Mortality in the United States

U.S. maternal mortality increased sharply in 2021



U.S. deaths with maternal causes



Source: Centers for Disease Control and Prevention



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Maternal Mortality in Tennessee 2021

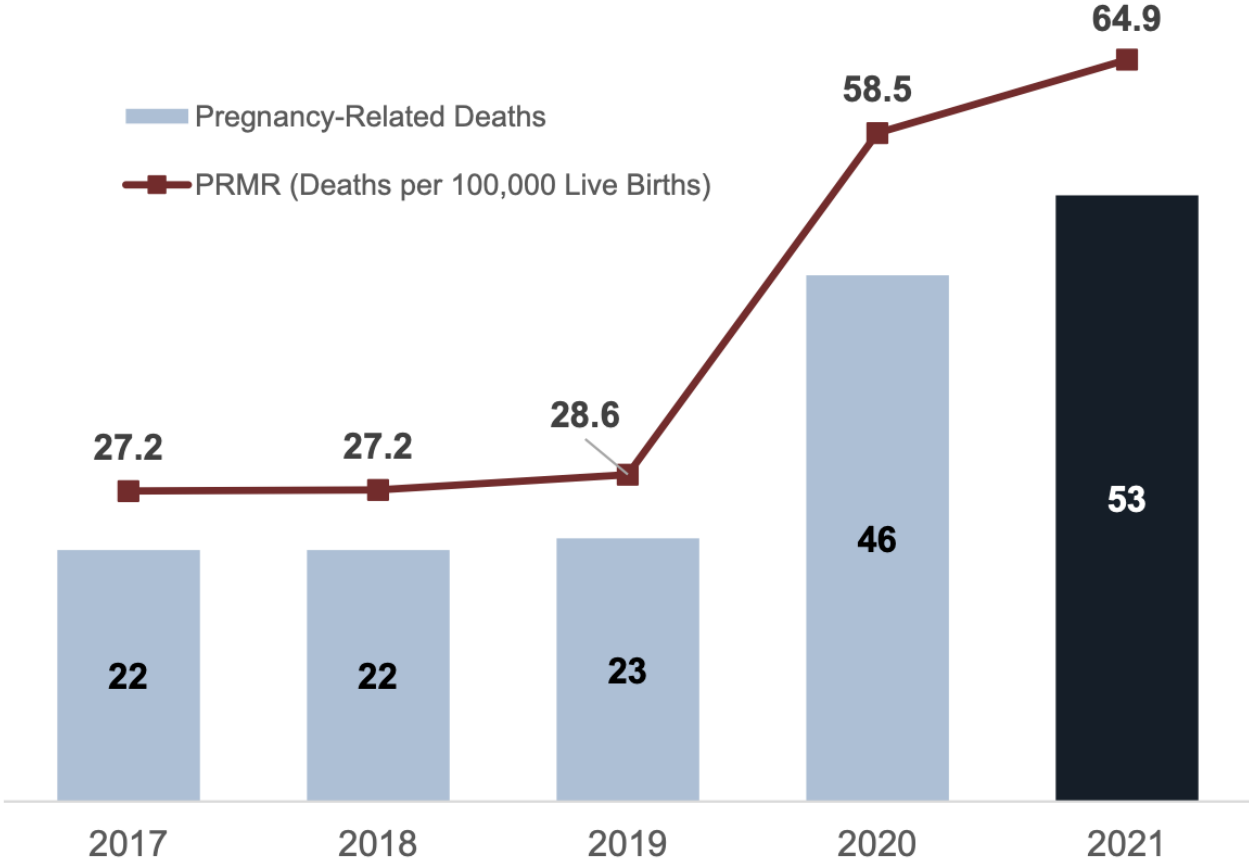
2023 Report to the Tennessee General Assembly

Tennessee Department of Health | Family Health and Wellness | October 2023



Statewide Statistics

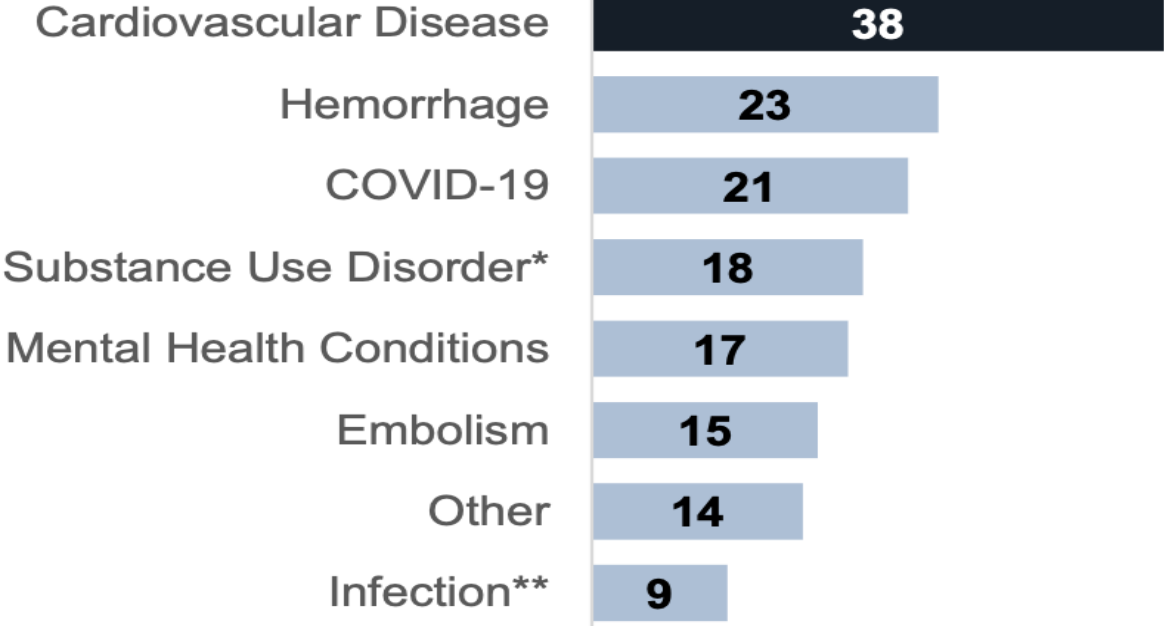
Tennessee Pregnancy Related Deaths



Pregnancy-related mortality ratio (PRMR) increased from 27.2 deaths per 100,000 live births in 2017 to 64.9 deaths per 100,000 live births in 2021. This increase may have occurred due to the increase of deaths from COVID-19, acute overdose, and the implementation of the Utah Criteria² when determining the pregnancy-relatedness of overdose deaths.

Tennessee Pregnancy Related Deaths

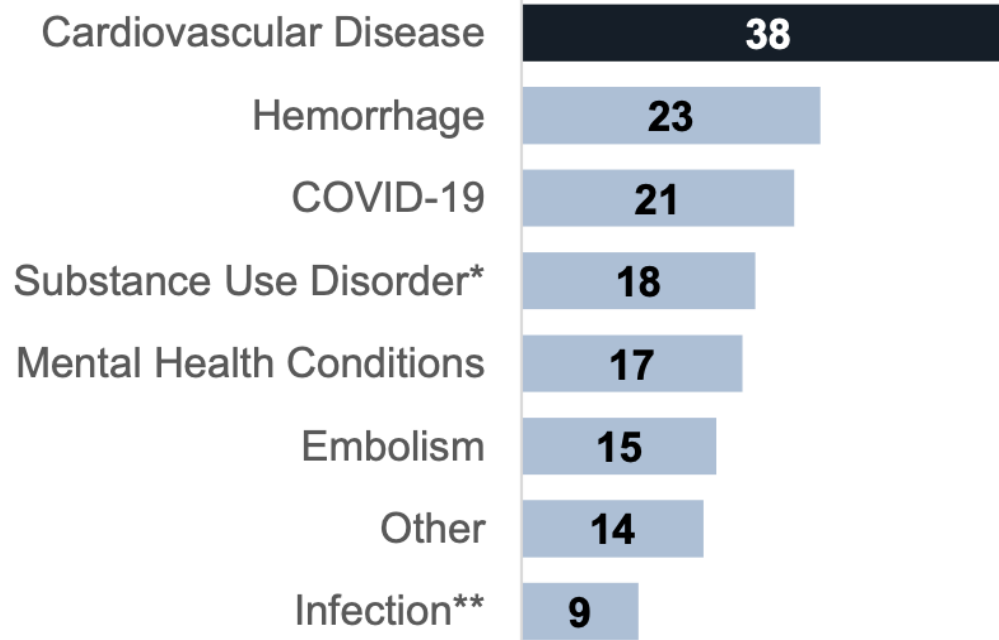
Cardiovascular disease is the leading underlying cause of pregnancy-related deaths, Tennessee, 2017-2021



Other: asthma, neurological disease, CVA, obesity, anesthesia complications, hematologic conditions, systemic lupus. * Utah Criteria2 implemented in 2020 review process

Tennessee Pregnancy Related Deaths

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Timing of Pregnancy Related Deaths: 2021

About 2 in 3 pregnancy-related deaths occurred during pregnancy through 42 days postpartum. The cause of death included **cardiovascular disease, hemorrhage, COVID-19, and mental health conditions.**



Preventability of Pregnancy Related Deaths: 2021



About four in five (79%) of all pregnancy-related deaths were determined to be preventable.



Two in five (40%) preventable pregnancy-related deaths were determined to have a good chance of being prevented.

Contributing Factors by Leading Underlying Causes of Death: 2021

Preeclampsia/Eclampsia



- Provider delay in treatment of the complications of preeclampsia including delay in appropriate care (i.e., initiation of magnesium sulfate, treatment of pulmonary edema, and treatment of Hypertension)

Cardiomyopathy



- Patients' history of substance use disorder
- Patients' history of multiple pregnancies, and no documentation of counseling for contraception
- Patients not adhering to prescribed medication regimens
- Patients had multiple co-morbidities





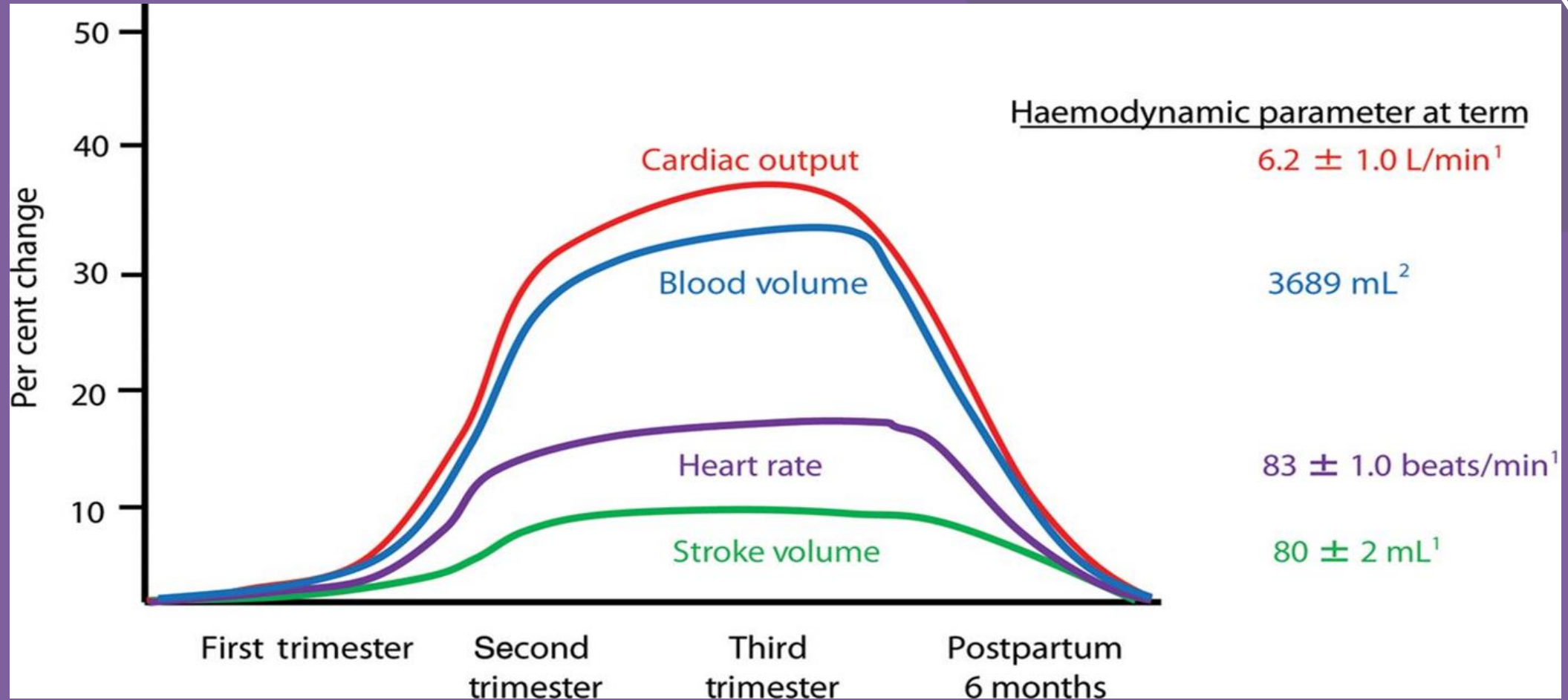
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Cardiovascular Physiology of Pregnancy

Cardiology Physiology

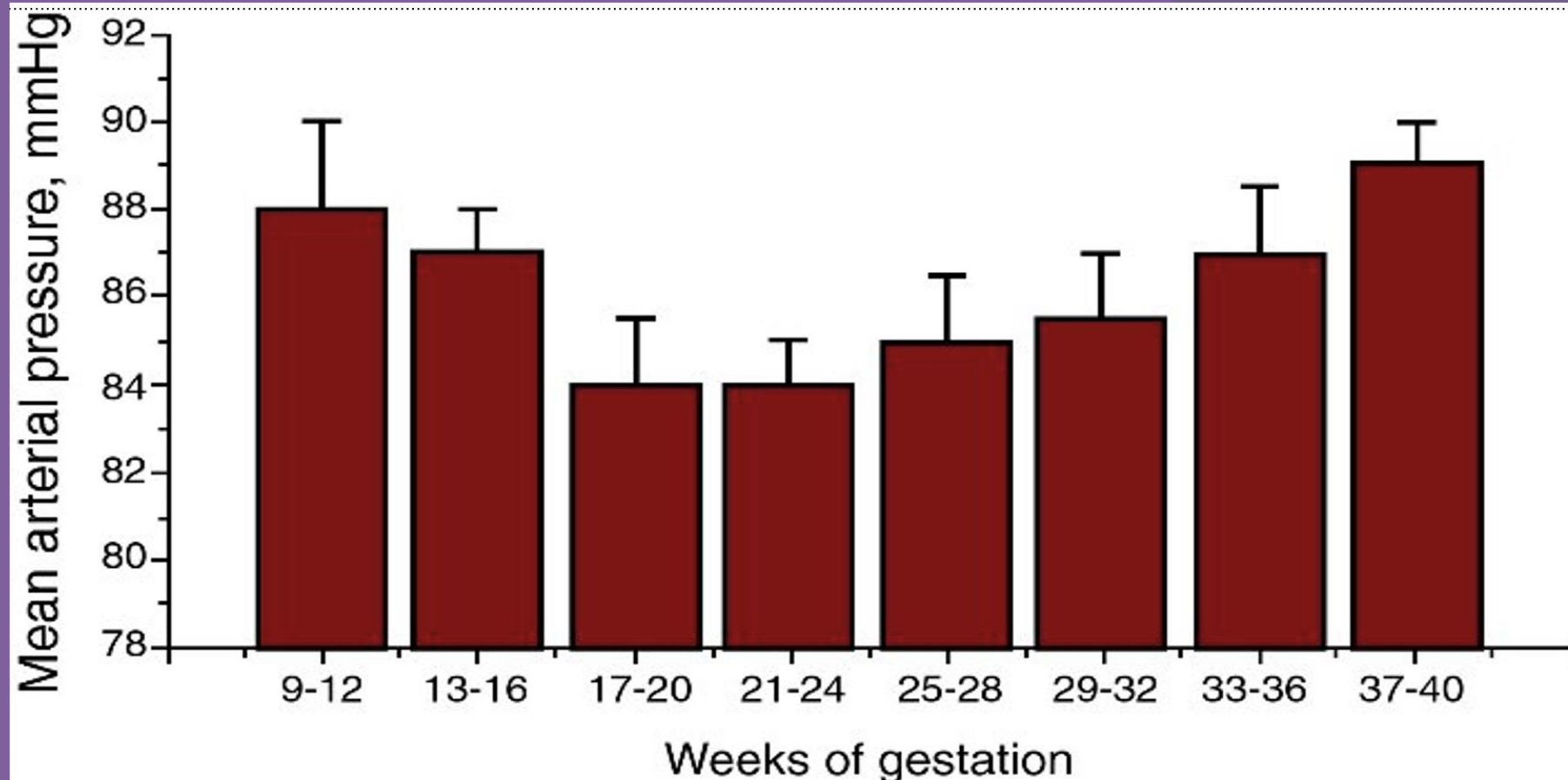
- Increase in blood volume of 30-50%
- Increase in cardiac output of 30-50%
 - Increase begins in the first trimester (7 weeks) peaks at 20-24 weeks gestation
- Heart rate increases by 10-20 bpm
- Systemic vascular resistance is decreased by 30%
- Hypercoagulable state
- Marked fluctuations in volume status during labor and delivery



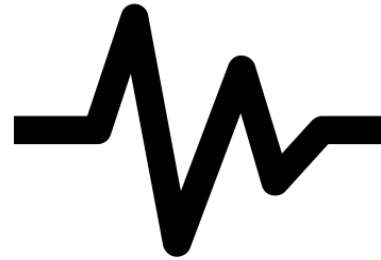
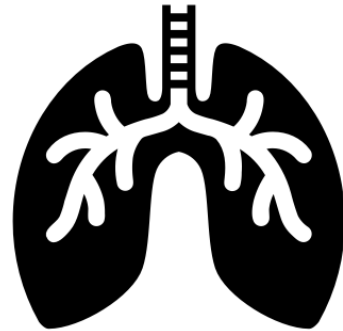
Blood Pressure in Pregnancy

- BPs will fall during 2nd and early 3rd trimester, return to baseline at term
 - Slight increase noted in labor
- Maternal positioning may influence measurement of BP
 - BP less when taken with patient on side
 - BP may improve initially in patients placed on bedrest
- Patients with pre-existing HTN will exhibit greater percentage drop in BP

Blood Pressure Changes in Pregnancy



Final Common Pathway



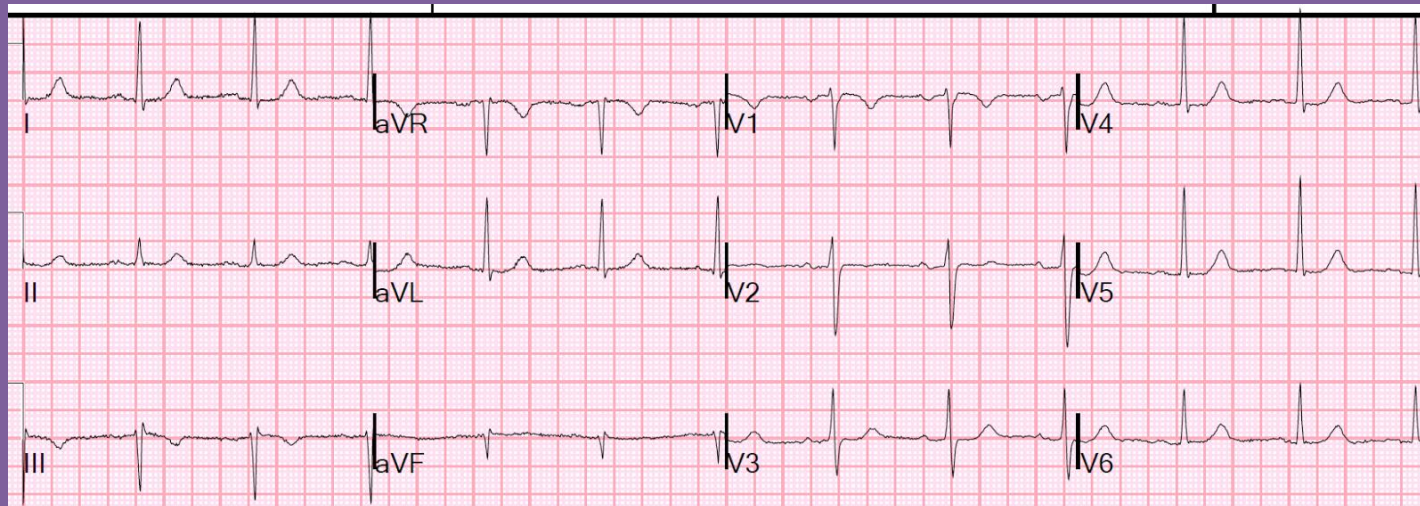
Common Pathways For All Types Of Cardiac Disease

Pulmonary edema

Arrhythmias

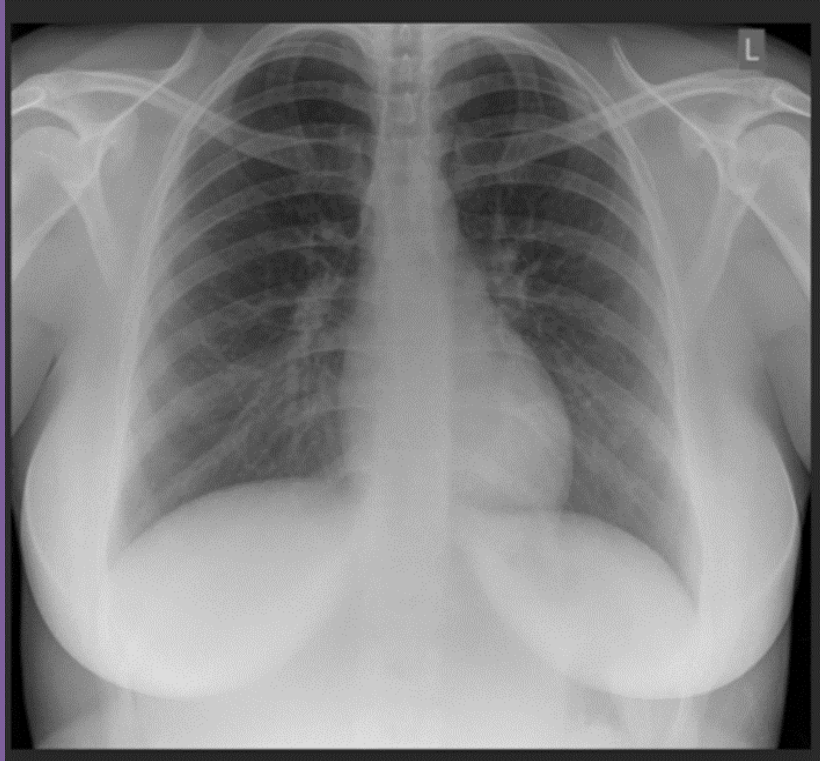
EKG Changes in Pregnancy

- Electrocardiogram
 - Mean QRS axis may shift to the left
 - Minor ST-T wave changes
 - Small Q waves with T-wave inversion in leads 3 and aVF
 - Extrasystoles and Super Ventricular Tachycardia are common

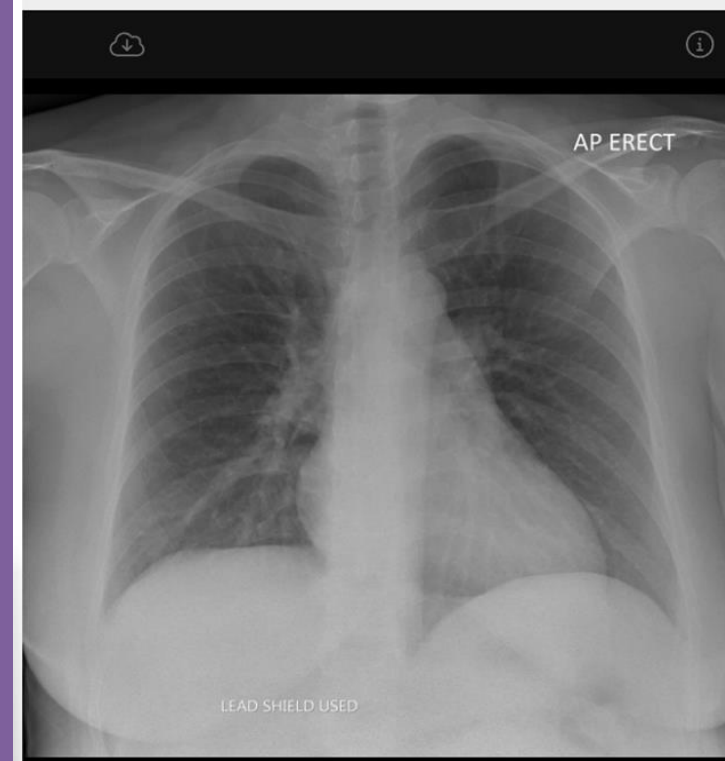


XRAY Changes in Pregnancy

Non-Pregnant



Pregnant



- Prominence of the pulmonary vasculature and/or flattened left heart border (due to increased blood volume and cardiac output)
- Elevation of the diaphragm
- The cardiac silhouette may appear more "horizontal"

POCUS: Application to Critically Ill Parturients

Heart & Lung Views

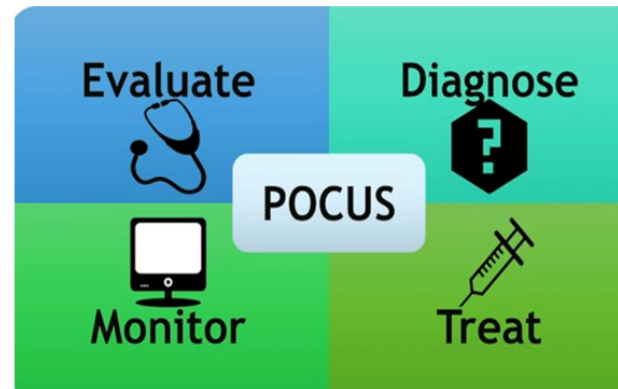
- Lung Apices
- Lung Bases
- LVOT
- 4 Chamber View
- IVC

Rapid and Easily Accessible

- LV systolic dysfunction
- Pulmonary Edema
- Pleural and Pericardial Fluid
- RV Enlargement
- Elev. Central Venous Pressure

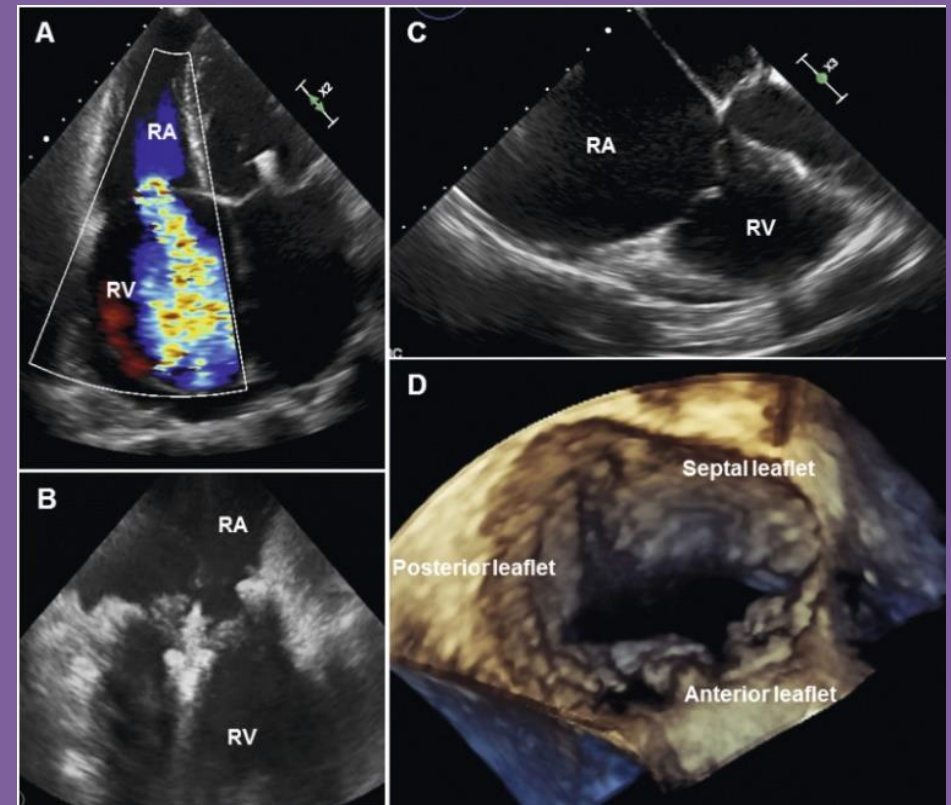
Preg related dz that can benefit from assessment

- Preeclampsia w/ SF
- Sepsis
- Cardiopulmonary Collapse
- COVID Pneumonia



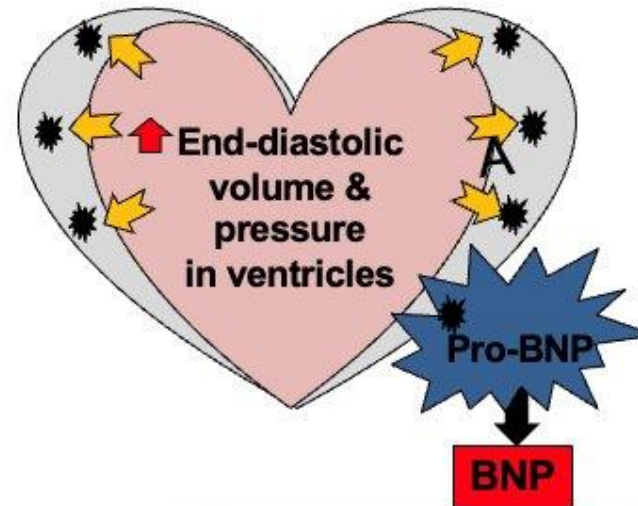
ECHO Changes in Pregnancy

- Cardiac Performance
 - ECHO shows increase in left ventricular shortening
 - Small pericardial effusions not uncommon
 - Increased incidence of mitral regurgitation



B Type Natriuretic Peptide (BNP)

Neurohormone secreted by the cardiac ventricles in response to ventricular volume expansion and pressure overload



Relaxes vascular smooth muscle

Inhibits renin-angiotensin-aldosterone system

Increases natriuresis and diuresis

Image Credit: Afshan Hameed, MD. Used with permission

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BNP in Pregnancy

- Pregnancy is a state of physiologic volume overload
- LV wall mass and the diastolic dimensions increase

Lev-Sagie A, Bar-Oz B, Salpeter L, Hochner-Celnikier D, Arad I and Nir A. Plasma Concentrations of N-Terminal Pro-B-Type Natriuretic Peptide in Pregnant Women near Labor and during Early Puerperium. *Clinical Chemistry*. October 2005; 51 (10):1909-10.

Katz R, Karliner JS, Resnik R. Effects of a natural volume overload state (pregnancy) on left ventricular performance in normal human subjects. *Circulation*. 1978;58(3 Pt 1):434-41.

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BNP Levels in Normal Pregnancy

- Median longitudinal BNP in 72 healthy pregnancies:
 - 1st trimester: 19.5 pg/mL
 - 2nd trimester: 18.0 pg/mL
 - 3rd trimester: 26.5 pg/mL
 - Postpartum: 18.5 pg/mL
- No statistically significant difference was noted in BNP levels throughout pregnancy and postpartum
- There is a statistically significant difference ($p < 0.001$) in BNP levels between non-pregnant 15 ± 9 pg/ml and normal healthy pregnant women 26 ± 21 pg/ml

Clinical Uses of BNP in Pregnancy

- Diagnosis of heart failure
 - In pregnant women with dilated CMP, higher BNP predicts adverse cardiovascular outcomes
- Asymptomatic left ventricular function
 - Useful to evaluate shortness of breath
- Predictor of cardiovascular outcome
 - In pregnant women with congenital heart disease, higher BNP levels are associated with poor outcomes

- Blatt A, Svirski R, Morawsky G, et al. Short and long-term outcome of pregnant women with preexisting dilated cardiomyopathy: An NTproBNP and echocardiography-guided study. *The Israel Medical Association journal : IMAJ*. Oct 2010;12(10):613-616.
- Tanous D, Siu SC, Mason J, et al. B-type natriuretic peptide in pregnant women with heart disease. *J Am Coll Cardiol*. Oct 5 2010;56(15):1247-1253.
- Kansal M, Hibbard JU, Briller J. Diastolic function in pregnant patients with cardiac symptoms. *Hypertens Pregnancy*. 2012;31(3):367-374.



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Identification & Screening

CA-PAMR Findings Contributing Factors & Quality Improvement Opportunities (2002-2006) for CVD

Health Care Provider Related

- Contributing Factors: (69% of all cases)
 - Delayed or inadequate response to clinical warning signs (61%)
 - Ineffective or inappropriate treatment (39%)
 - Misdiagnosis (37.5%)
 - Failure to refer or consult (30%)
- Quality Improvement Opportunities
 - Better recognition of signs and symptoms of CVD in pregnancy
 - Shortness of breath, fatigue
 - Tachycardia, blood pressure change, or low oxygen saturation
 - Improved management of hypertension

CA-PAMR Findings Contributing Factors & Quality Improvement Opportunities (2002-2006) for CVD

Patient Related

- Contributing factors: (70% of all cases)
 - Presence of underlying medical conditions (64%)
 - Obesity (31%)
 - Delays in seeking care (31%)
 - Lack of recognition of CVD symptoms (22%)
- Quality improvement opportunities
 - Education around when to seek care for worrisome symptoms
 - Support for improving modifiable risk factors, such as attaining healthier weight and discontinuing drug use

CA-PAMR Findings Preventability 2002-2006

- **24%** of ALL CVD pregnancy-related deaths (and 31% of cardiomyopathy deaths) were determined to be **potentially preventable**

Data Source: CA PAMR, Pregnancy-Related Deaths; 2002-2006 (N=257).

Hameed A, Lawton E, McCain CL, et al. Pregnancy-Related Cardiovascular Deaths in California: Beyond Peripartum Cardiomyopathy. *American Journal of Obstetrics and Gynecology* 2015; DOI: 10.1016/j.ajog.2015.05.008

CA-PAMR Conclusions

- Signs and symptoms of normal pregnancy/postpartum may mimic cardiac disease but should be interpreted with caution when severe and occur in the presence of vital sign abnormalities and underlying risk factors.
- Most CVD was not diagnosed until after the women gave birth or had died.
- Increased awareness and index of suspicion for potential cardiovascular disease diagnosis, preconception counseling, and referral to higher level of care may help prevent adverse maternal outcomes.

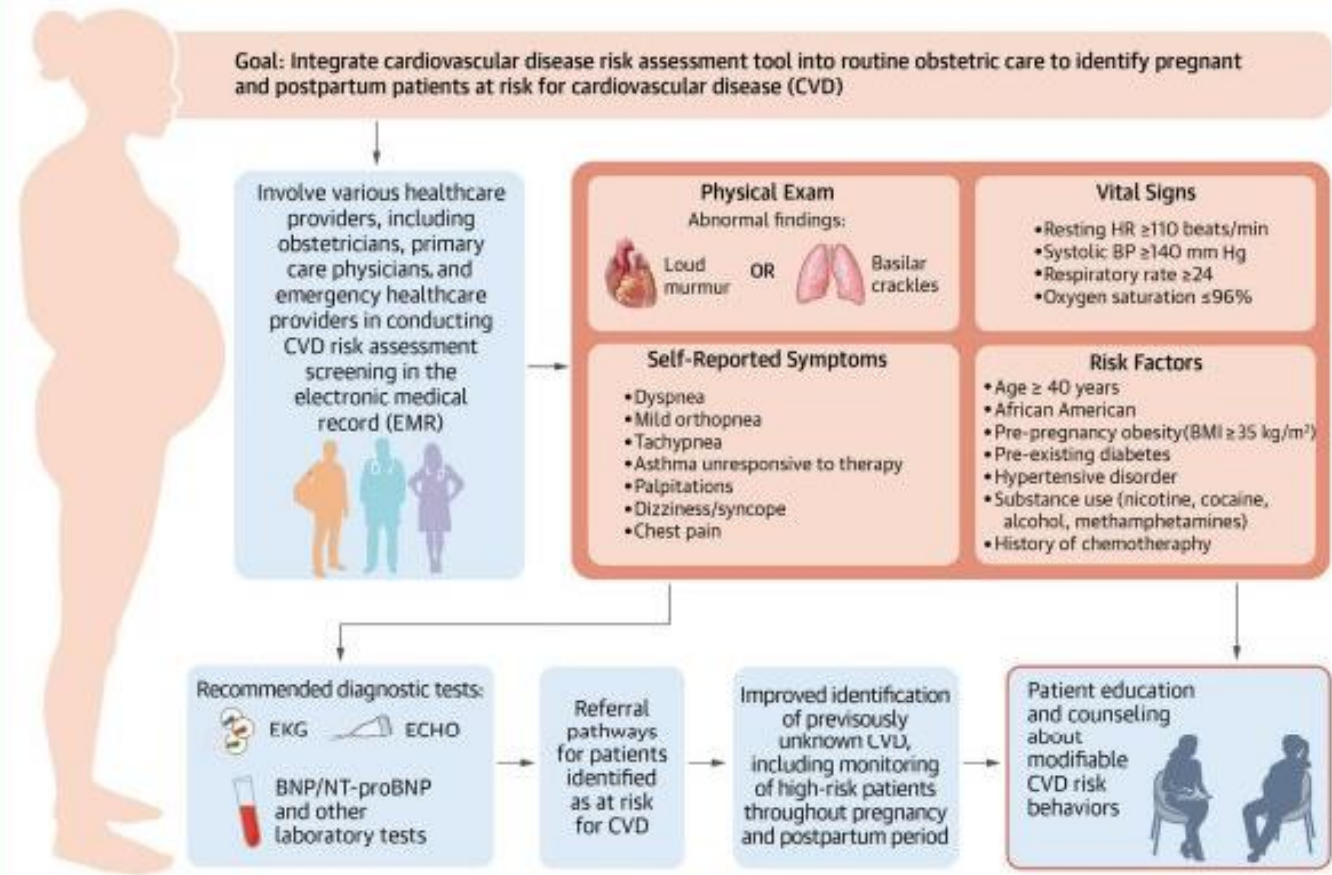
Data Source: CA PAMR, Pregnancy-Related Deaths; 2002-2006 (N=257).

Hameed A, Lawton E, McCain CL, et al. Pregnancy-Related Cardiovascular Deaths in California: Beyond Peripartum Cardiomyopathy. *American Journal of Obstetrics and Gynecology* 2015; DOI: 10.1016/j.ajog.2015.05.008

The Most Important Questions to Ask...



CENTRAL ILLUSTRATION Universal Cardiovascular Disease Risk Assessment in Pregnancy and Postpartum

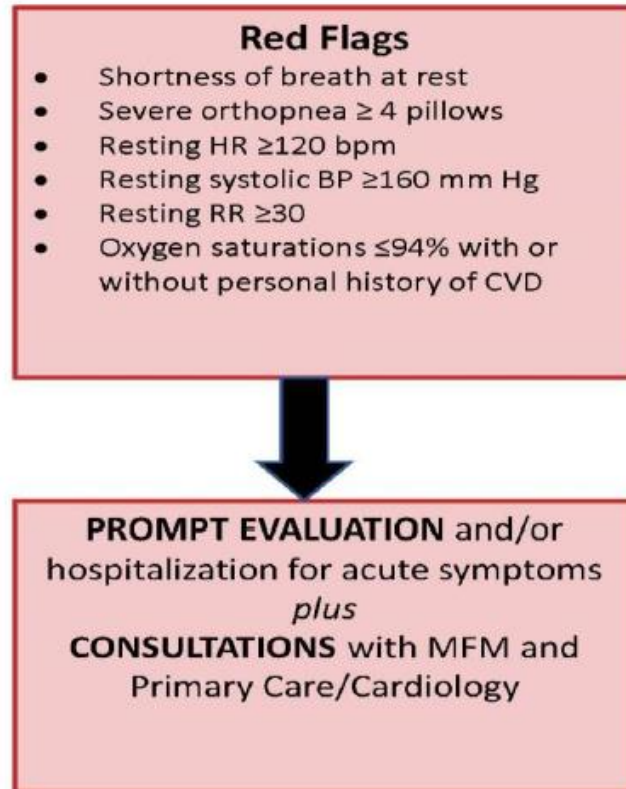


Hameed AB, et al. JACC Adv. 2024;3(8):101055.

The process of integrating cardiovascular disease (CVD) risk assessment begins by involving healthcare providers during the pregnancy and postpartum period to conduct and complete the risk assessment. This assessment captures patient symptom data, vital signs, physical exam data, and CVD risk factors. Based on the risk assessment output, patients could be identified as 'at risk' for CVD, and the algorithm recommends follow-up diagnostic tests and referral pathways, as well as continued patient education and counseling. EKG = electrocardiogram; ECHO = echocardiogram; BNP = B-type natriuretic peptide; NT-proBNP = N-terminal pro-brain natriuretic peptide.

CVD Screening

CVD ASSESSMENT ALGORITHM FOR PREGNANT and POSTPARTUM WOMEN

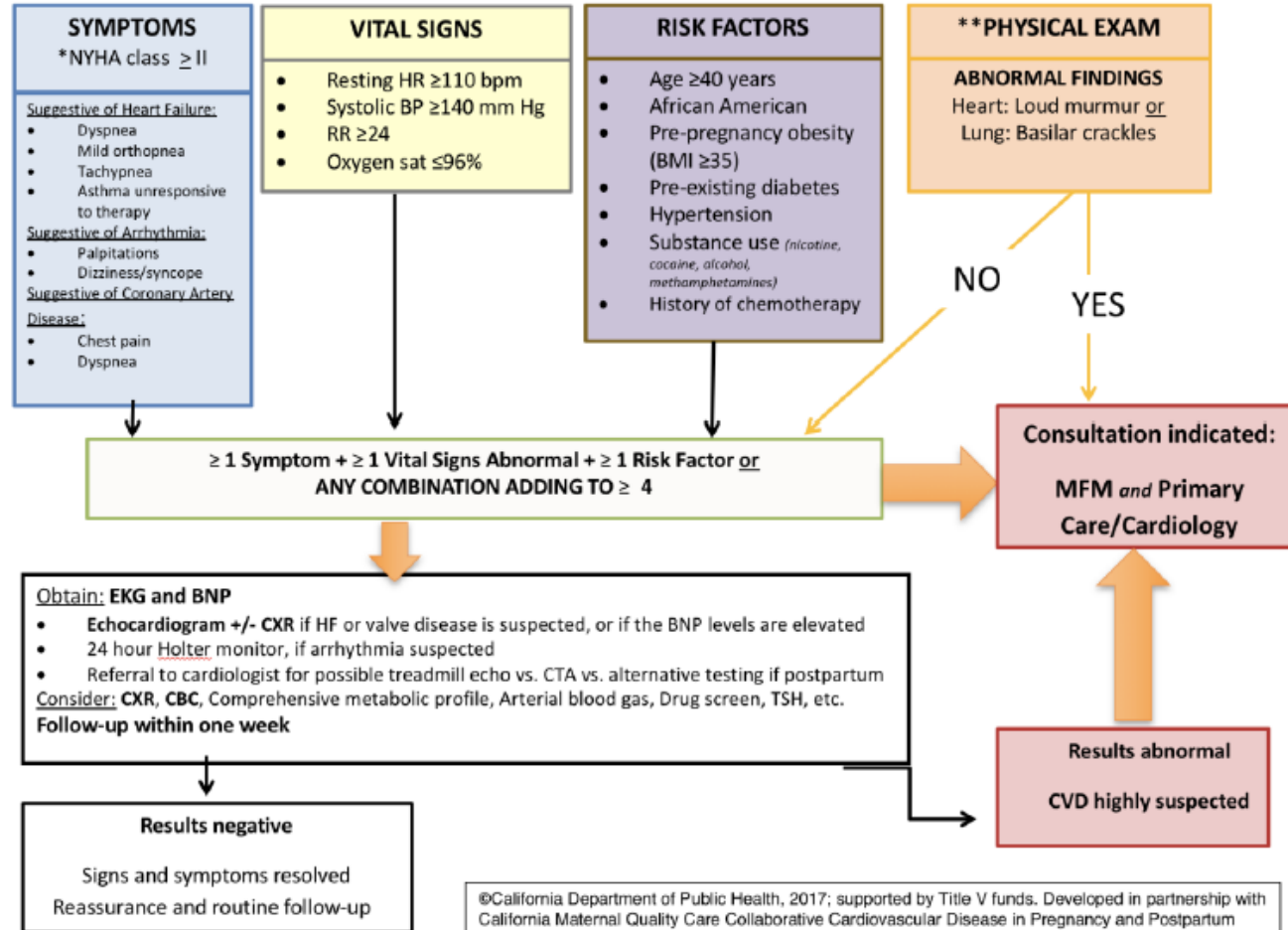


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CVD Screening

CARDIOVASCULAR DISEASE ASSESSMENT IN PREGNANT and POSTPARTUM WOMEN

(No Red Flags and/or no personal history of CVD, and hemodynamically stable)



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CVD Screening: Including history of pregnancy in ED assessment (Cerner)

ED Triage Part 2 - TESTING, VICKI

*Performed on: 04/10/2024 14:46 EDT

TRIAGE

Patient Arrived From: [Dropdown]
Reason for Visit: [Text Field] Pulls to Provider notes
Here for COVID-19 Testing? Yes No
Does the Patient have symptoms consistent with COVID-19? Yes No

Mode of Arrival:
 Personal Vehicle (POV)
 Emergency Medical Service (EMS)
 Police
 Other:

Treatment Prior to Arrival:
 Antiemetics Intubation Rapid Sequence Induction
 Aspirin IV SOLU MEDROL
 Finger stick Ketamine Splint
 Foley catheters Morphine Traction
 Fluid Nebulizer treatments Transport only
 Immobilization nitroglycerin Other:
 Immobilized on backboard Oxygen

Triage Note:
Segue UI [Dropdown] 9 [Dropdown]
[Text Area]

VS taken within 30 minutes:
 Yes No
Temp (TA) [Dropdown] Temp (O) [Dropdown] Temp (R) [Dropdown] Pulse [Dropdown] Resp [Dropdown] B/P and B/P Method [Dropdown] SpO2 [Dropdown] O2 L/M [Dropdown] O2/ Del [Dropdown] FS Glucose [Dropdown] If 500 or > [Dropdown]

Immunizations Current [Dropdown] Last Tetanus [Dropdown] Weight Method [Dropdown] Weight (lbs) [Dropdown] Weight (kg) [Dropdown] Height feet/inches [Dropdown] Height (in) [Dropdown] BMI [Dropdown] IBW [Dropdown]

Medical/Surgical Hx [Dropdown] Usual Source of Medical Care [Text Field]

Menstrual Status [Dropdown] LMP [Text Field] Pregnancy Status [Dropdown] Stated Due Date [Text Field]

Are you currently pregnant or have you been pregnant within the last year? Yes No
Have you been told you have or had high blood pressure while pregnant? Yes No

New Onset Neuro Symptoms Yes No Unable to obtain
Vitals Hx. [Text Field]

Is patient presenting with any of the following:
No Data Available
24 Hr Tmax: No Data Available
36 Hr Tmax: No Data Available

CVD Screening: Including history of pregnancy in ED assessment (Cerner)

Are you currently pregnant or have you been pregnant within the last year?

- Yes
- No

Have you been told you have or had high blood pressure while pregnant?

- Yes
- No

CVD Screening: Including history of pregnancy in ED assessment (EPIC)

Does the patient have shortness of breath with activity? <input checked="" type="radio"/> 1=Yes <input type="radio"/> 0=No	Is the patient's resting HR greater than or equal to 110 to 119 bpm? <input type="radio"/> 1=Yes <input type="radio"/> 0=No
Does the patient have shortness of breath at rest? <input type="radio"/> 4=Yes <input type="radio"/> 0=No	Is the patient's HR greater than or equal to 120bpm? <input type="radio"/> 4=Yes <input type="radio"/> 0=No
Does the patient have mild difficulty breathing when lying flat? <input type="radio"/> 1=Yes <input type="radio"/> 0=No	Is the patient's resting systolic BP greater than or equal to 140 mmHg? <input type="radio"/> 1=Yes <input type="radio"/> 0=No
Do the patient sleep on 4 or more pillows? <input type="radio"/> 4=Yes <input type="radio"/> 0=No	Is the patient's resting systolic BP greater than or equal to 160 mmHg? <input type="radio"/> 4=Yes <input type="radio"/> 0=No
Does the patient have rapid respirations? <input type="radio"/> 1=Yes <input type="radio"/> 0=No	Are the patient's respirations greater than or equal to 24? <input type="radio"/> 1=Yes <input type="radio"/> 0=No
If patient has asthma, is it unresponsive to therapy? <input type="radio"/> 1=Yes <input type="radio"/> 0=No or N/A	Are the patient's respirations greater than or equal to 30? <input type="radio"/> 4=Yes <input type="radio"/> 0=No
Does the patient have palpitations? <input type="radio"/> 1=Yes <input type="radio"/> 0=No	Is the patient's O2 sat 95-96%? <input type="radio"/> 1=Yes <input type="radio"/> 0=No
Does the patient have dizziness or syncope? <input type="radio"/> 1=Yes <input type="radio"/> 0=No	Is the patient's O2 sat less than 95% with or without personal hx of CVD? <input type="radio"/> 4=Yes <input type="radio"/> 0=No
Does the patient have chest pain? <input type="radio"/> 1=Yes <input type="radio"/> 0=No	
Does the patient have a cough? <input type="radio"/> 1=Yes <input type="radio"/> 0=No	

Cardiovascular Screening Tool

Completing Provider: _____

Date: _____

STEP 1: Enter a 1 for each of the following that are positive:

Vital Signs	Symptoms	Risk Factors
Resting HR \geq 110	Shortness of Breath	Age \geq 40
SBP \geq 140	Orthopnea	Non-Hispanic Black
Respiratory Rate \geq 24	Syncope	Pre-Pregnancy BMI \geq 35
SpO2 \leq 96%	Dizziness	Pre-existing Diabetes
	Palpitations	Chronic HTN
	Chest Pain	Hx of Chemotherapy
	Asthma unresponsive to therapy	<u>Substance use:</u> Nicotine, Cocaine, Alcohol, Methamphetamine, Opiates
Vitals Total Score:	Symptoms Total Score:	Risk Factors Total score:

STEP 2: Is each category's total score \geq 1? (Circle one) No Yes

STEP 3: Add scores: Vitals + Symptoms + Risk Factors = ____ \rightarrow **Total \geq 4?** (Circle one) No Yes

STEP 4: Heart and Lung Exam. Loud Murmur or Basilar Crackles? (Circle one) No Yes

**** If YES to Step 4, Order STAT MFM Consult** (MFM will handle ECHO, ECG, Cardiology referral)

STEP 5: If YES to Step 2 OR 3, Order: **BNP** **ECG** **ECHO**

If patient endorses palpitations, order: **TSH** **CBC** **ECG** (if not planned)

STEP 6: Scan into patient's chart

Follow up results:

If BNP or ECHO or ECG is abnormal, order: MFM Consult (if not already done)

If ECG showed arrhythmia, order: Holter Monitor

Transfer Checklist for Cardiac Concerns



The following checklist offers strategies for a clear pathway for transfer to higher level of care, regardless of insurance status.

WHO: People with cardiac concerns in pregnancy or postpartum

**All routine transfer information, PLUS:
Additional specific cardiac components:**

SBAR

- SITUATION
- MAIN cardiac CONCERNS
- Create a formal preceptorship agreement
- Main pregnancy concerns

Available ob/gyn services at current location:

- NICU PERINATAL MATERNITY LEVEL OF CARE (I/II/III)
- Maternal PERINATAL MATERNITY LEVEL OF CARE (I/II/III)

NEEDS for HIGHER LEVEL OF CARE

- ICU/CICU

Yes / No

- Currently intubated, intubation anticipated
- Current ECMO or anticipated need
- Hypertensive GTT ongoing or anticipated
- Specialty cardiac services needed (Transplant, interventional, IP)
- Specialty obstetrical services needed (MFM)
- NICU access needed (GA >22 weeks), what level?

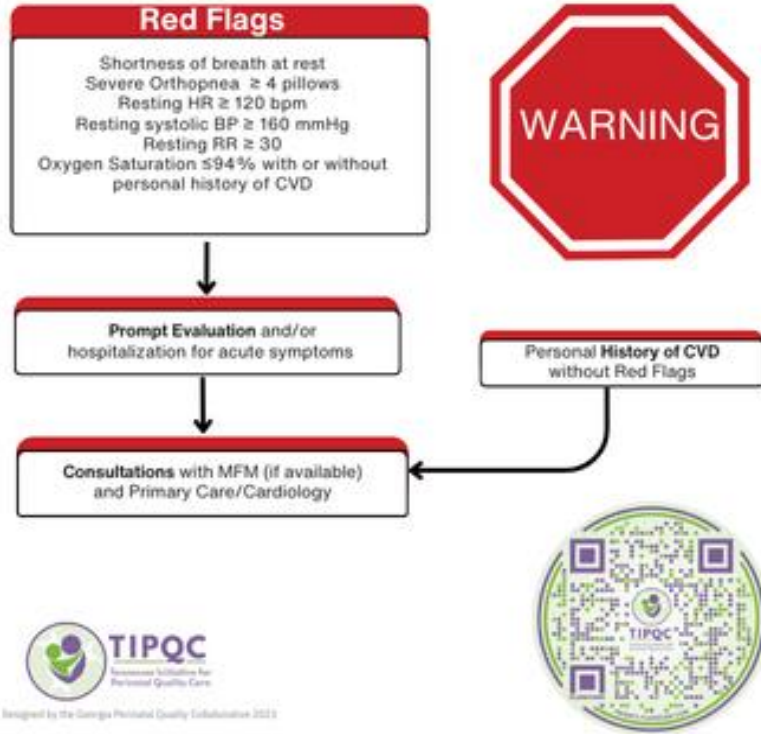
COMMUNICATION

- POINT PERSON at CURRENT LOCATION
- POINT PERSON AT accepting TRANSFER LOCATION



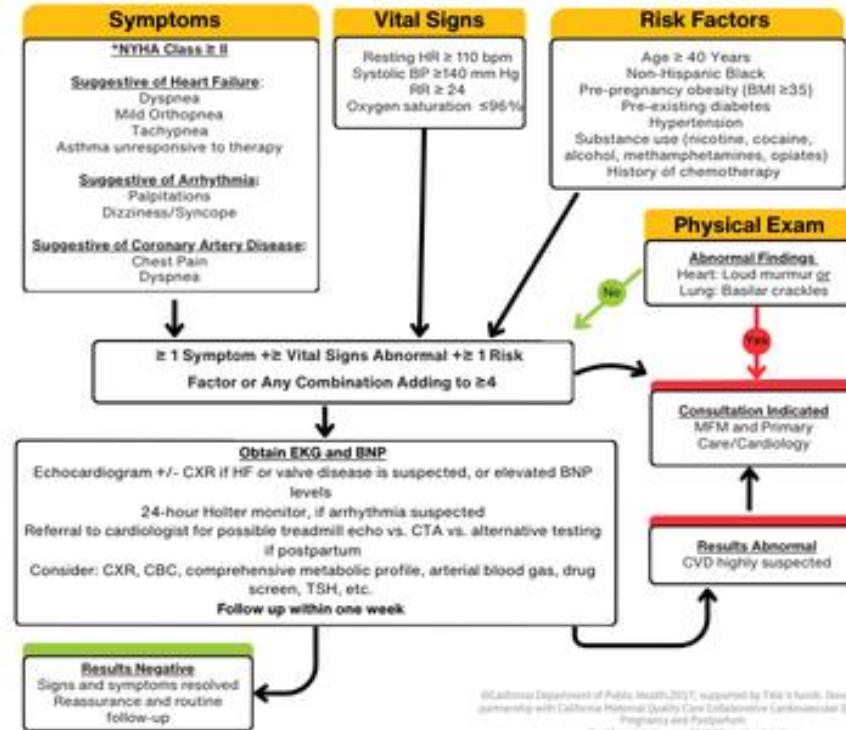
CVD Assessment

For *pregnant and postpartum* patients with **SEVERE** symptoms and/or personal history of CVD



CVD Assessment

For *pregnant and postpartum* patients with no red flags and/or no personal history of CVD, and hemodynamically stable





TIPQC

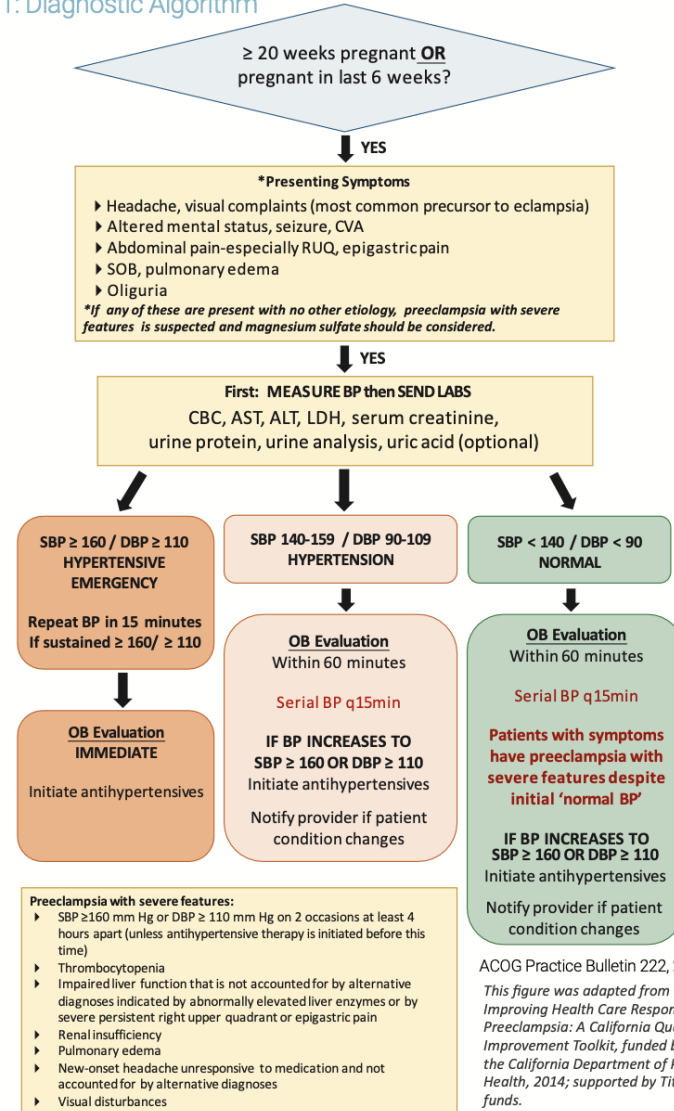
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Management of Hypertension

Hypertension in Pregnancy

Appendix E: Acute Treatment Algorithm

Part 1: Diagnostic Algorithm



ACOG Guidelines

Table 3. Antihypertensive Agents Used for Urgent Blood Pressure Control in Pregnancy

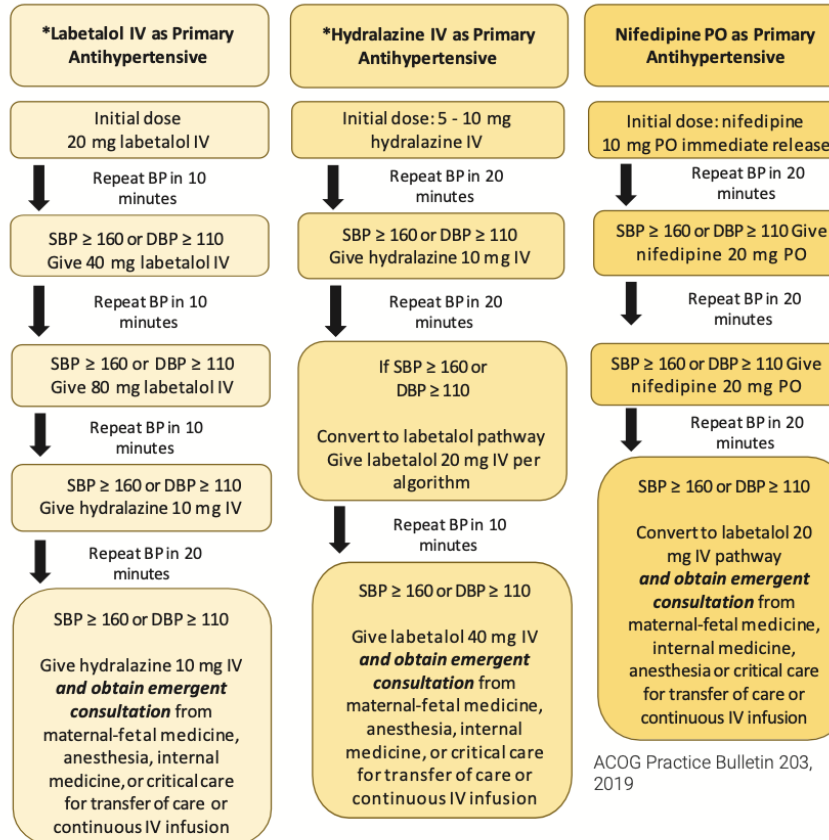
Drug	Dose	Comments	Onset of Action
Labetalol	10–20 mg IV, then 20–80 mg every 10–30 minutes to a maximum cumulative dosage of 300 mg; or constant infusion 1–2 mg/min IV	Tachycardia is less common with fewer adverse effects. Avoid in women with asthma, preexisting myocardial disease, decompensated cardiac function, and heart block and bradycardia.	1–2 minutes
Hydralazine	5 mg IV or IM, then 5–10 mg IV every 20–40 minutes to a maximum cumulative dosage of 20 mg; or constant infusion of 0.5–10 mg/hr	Higher or frequent dosage associated with maternal hypotension, headaches, and abnormal fetal heart rate tracings; may be more common than other agents.	10–20 minutes
Nifedipine (immediate release)	10–20 mg orally, repeat in 20 minutes if needed; then 10–20 mg every 2–6 hours; maximum daily dose is 180 mg	May observe reflex tachycardia and headaches	5–10 minutes

Abbreviations: IM, intramuscularly; IV, intravenously.

Part 2: Antihypertensive Treatment Algorithm for Hypertensive Emergencies

Treatment Recommendations for Sustained Systolic BP \geq 160 mm Hg or Diastolic BP \geq 110 mm Hg

*Antihypertensive treatment and magnesium sulfate should be administered simultaneously. If concurrent administration is not possible, antihypertensive treatment should be 1st priority.



ACOG Practice Bulletin 203, 2019

Target BP: 130-150/80-100 mm Hg

Once BP threshold is achieved:

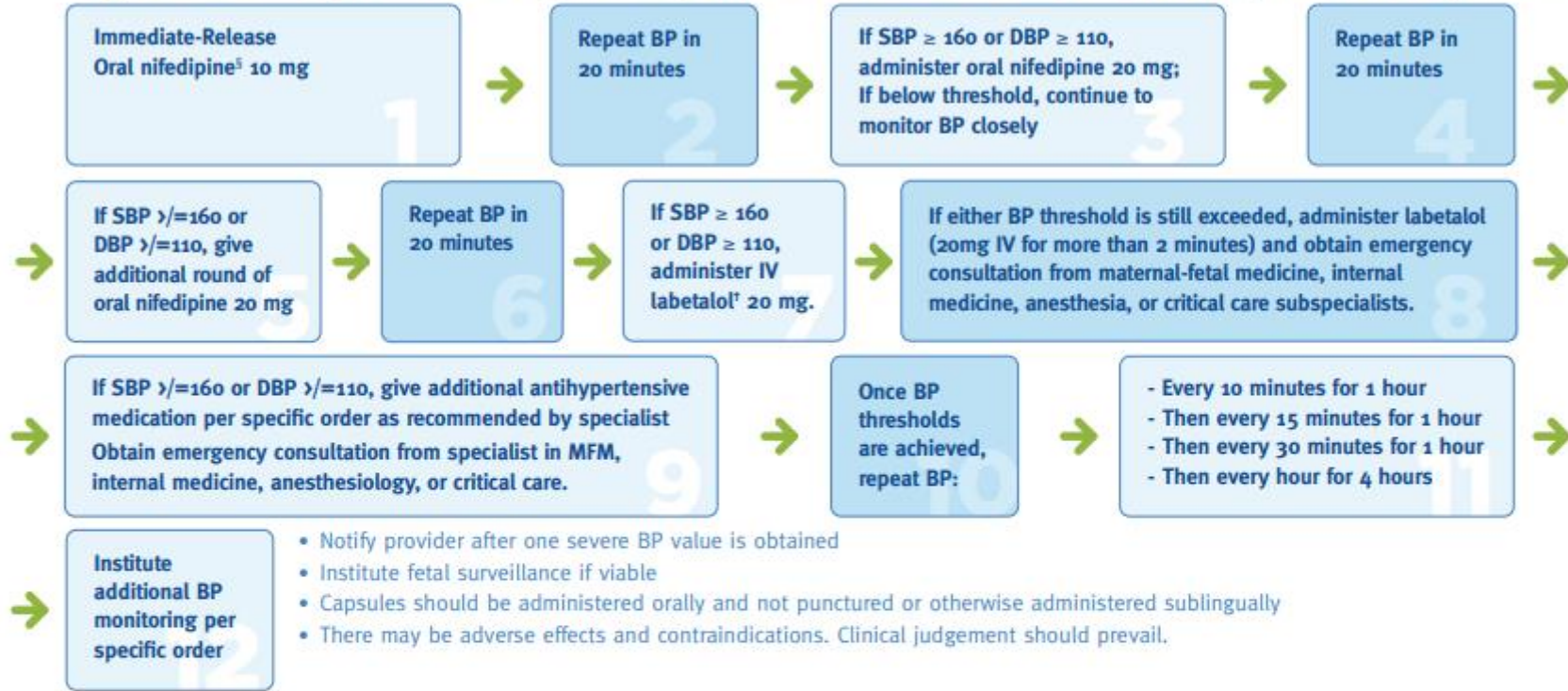
- ▶ Q10 min for 1 hr
- ▶ Q15 min for 1 hr
- ▶ Q30 min for 1 hr
- ▶ Q1hr for 4 hrs

*Intravenous hydralazine or labetalol should be given over 2 minutes. In the presence of sinus bradycardia or a history of asthma, hydralazine or nifedipine are preferred as initial agents. If maternal HR $>$ 110, labetalol is preferred.

This figure was adapted from the Improving Health Care Response to Preeclampsia: A California Quality Improvement Toolkit, funded by the California Department of Public Health, 2014; supported by Title V funds.

Immediate-Release Oral Nifedipine Algorithm EXAMPLE

Trigger: If severe elevations (SBP ≥ 160 or DBP ≥ 110) persist* for 15 min or more **OR** If two severe elevations are obtained within 15 min and tx is clinically indicated



- Notify provider after one severe BP value is obtained
- Institute fetal surveillance if viable
- Capsules should be administered orally and not punctured or otherwise administered sublingually
- There may be adverse effects and contraindications. Clinical judgement should prevail.

* Two severe readings more than 15 minutes and less than 60 minutes apart

⁵ Immediate-release oral nifedipine has been associated with an increase in maternal heart rate and may overshoot hypotension.

[†] **Avoid parenteral labetalol with active[‡] asthma, heart disease, or congestive heart failure; use with caution with history of asthma. May cause neonatal bradycardia.**

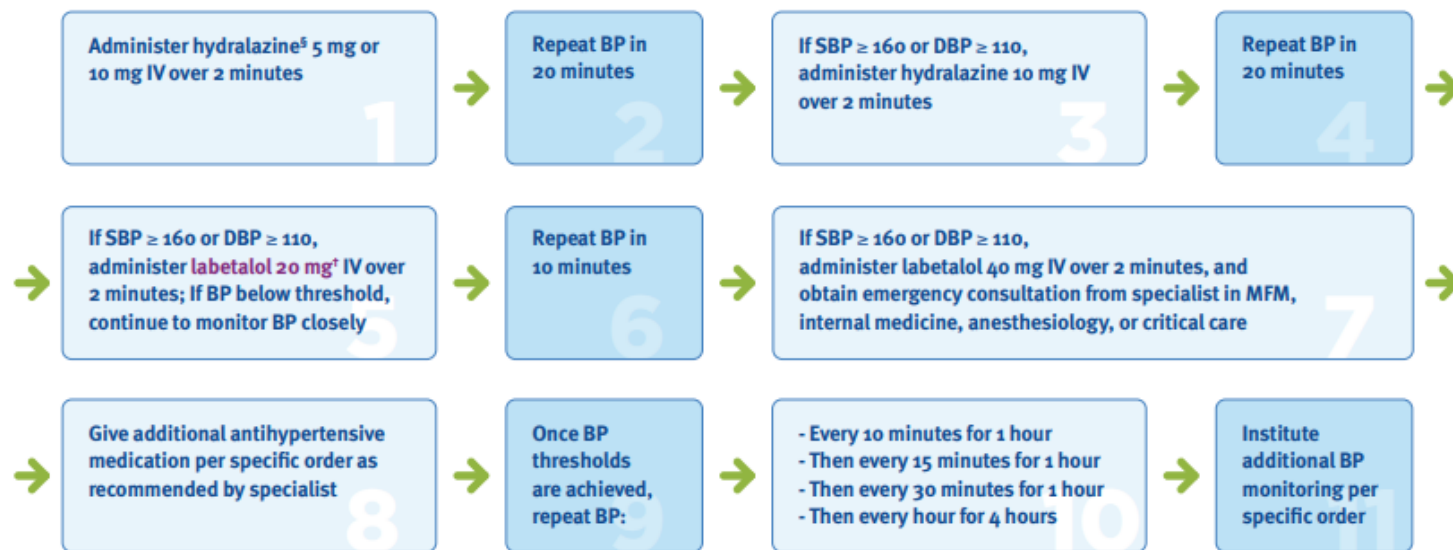
[‡] "Active asthma" is defined as:

- (A) symptoms at least once a week, or
- (B) use of an inhaler, corticosteroids for asthma during the pregnancy, or
- (C) any history of intubation or hospitalization for asthma.

Hydralazine Algorithm

EXAMPLE

Trigger: If severe elevations (SBP ≥ 160 or DBP ≥ 110) persist* for 15 min or more **OR** If two severe elevations are obtained within 15 min and tx is clinically indicated



- Notify provider after one severe BP value is obtained
- Institute fetal surveillance if viable
- Hold IV labetalol for maternal pulse under 60
- There may be adverse effects and contraindications.
- Clinical judgement should prevail.

* Two severe readings more than 15 minutes and less than 60 minutes apart

[†] **Avoid parenteral labetalol with active[‡] asthma, heart disease, or congestive heart failure; use with caution with history of asthma. May cause neonatal bradycardia.**

[‡] "Active asthma" is defined as:

- Ⓐ symptoms at least once a week, or
- Ⓑ use of an inhaler, corticosteroids for asthma during the pregnancy, or
- Ⓒ any history of intubation or hospitalization for asthma.

⁵ Hydralazine may increase risk of maternal hypotension.

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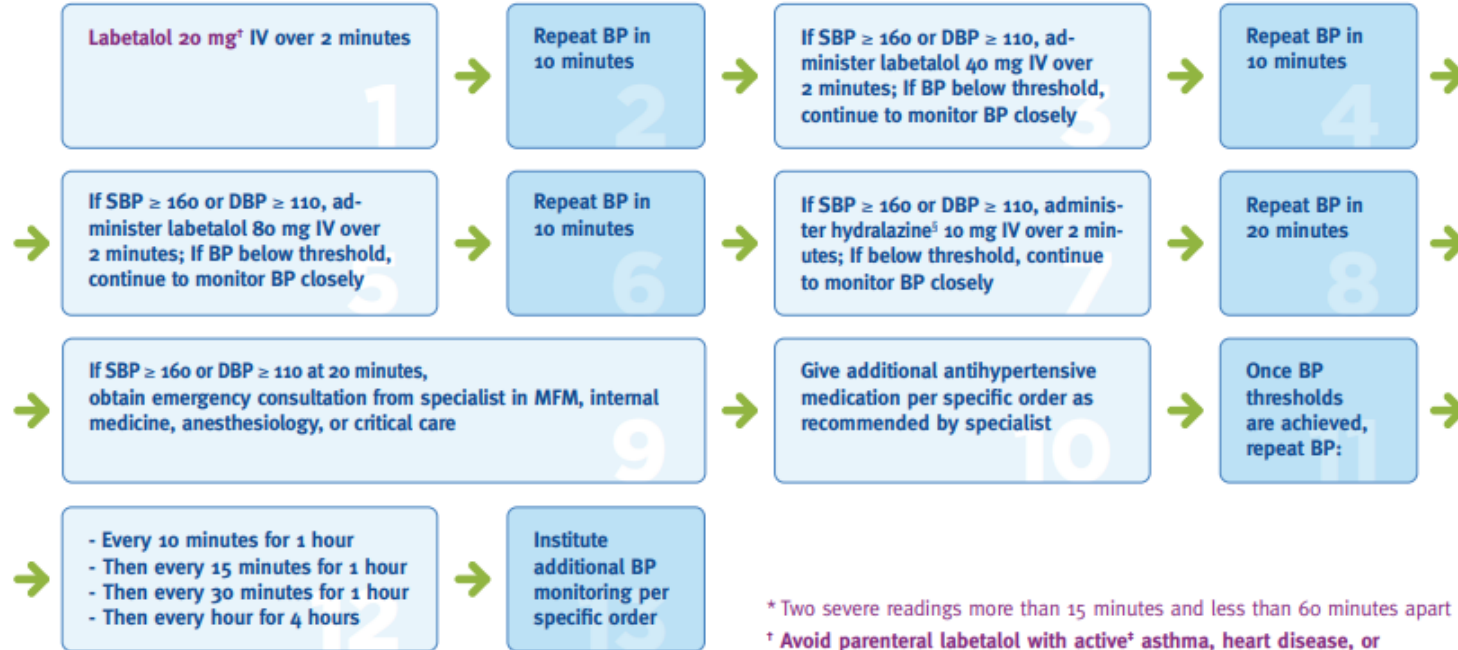
Revised February 2020



Labetalol Algorithm

EXAMPLE

Trigger: If severe elevations (SBP ≥ 160 or DBP ≥ 110) persist* for 15 min or more **OR** If two severe elevations are obtained within 15 min and tx is clinically indicated



- Notify provider after one severe BP value is obtained
- Institute fetal surveillance if viable
- Hold IV labetalol for maternal pulse under 60
- Maximum cumulative IV-administered dose of labetalol should not exceed 300 mg in 24 hours
- There may be adverse effects and contraindications. Clinical judgement should prevail.

* Two severe readings more than 15 minutes and less than 60 minutes apart

† **Avoid parenteral labetalol with active[‡] asthma, heart disease, or congestive heart failure; use with caution with history of asthma. May cause neonatal bradycardia.**

‡ "Active asthma" is defined as:

- Ⓐ symptoms at least once a week, or
- Ⓑ use of an inhaler, corticosteroids for asthma during the pregnancy, or
- Ⓒ any history of intubation or hospitalization for asthma.

§ Hydralazine may increase risk of maternal hypotension.

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Postpartum Preeclampsia Checklist

IF PATIENT < 6 WEEKS POSTPARTUM WITH:

- BP \geq 160/110 or
 - BP \geq 140/90 with unremitting headache, visual disturbances, epigastric pain
- Call for Assistance
 - Designate:
 - Team leader
 - Checklist reader/recorder
 - Primary RN
 - Ensure side rails up
 - Call obstetric consult; Document call
 - Place IV; Draw preeclampsia labs
 - CBC Chemistry Panel
 - PT Uric Acid
 - PTT Hepatic Function
 - Fibrinogen Type and Screen
 - Ensure medications appropriate given patient history
 - Administer seizure prophylaxis
 - Administer antihypertensive therapy
 - Contact MFM or Critical Care for refractory blood pressure
 - Consider indwelling urinary catheter
 - Maintain strict I&O — patient at risk for pulmonary edema
 - Brain imaging if unremitting headache or neurological symptoms

¹ "Active asthma" is defined as:

- (A) symptoms at least once a week, or
- (B) use of an inhaler, corticosteroids for asthma during the pregnancy, or
- (C) any history of intubation or hospitalization for asthma.

Magnesium Sulfate

Contraindications: Myasthenia gravis; avoid with pulmonary edema, use caution with renal failure

IV access:

- Load 4-6 grams 10% magnesium sulfate in 100 mL solution over 20 min
- Label magnesium sulfate; Connect to labeled infusion pump
- Magnesium sulfate maintenance 1-2 grams/hour

No IV access:

- 10 grams of 50% solution IM (5 g in each buttock)

Antihypertensive Medications

For SBP \geq 160 or DBP \geq 110

(See SMI algorithms for complete management when necessary to move to another agent after 2 doses.)

- Labetalol** (initial dose: 20mg); **Avoid parenteral labetalol with active asthma, heart disease, or congestive heart failure; use with caution with history of asthma**
- Hydralazine** (5-10 mg IV* over 2 min); **May increase risk of maternal hypotension**
- Oral Nifedipine** (10 mg capsules); Capsules should be administered orally, not punctured or otherwise administered sublingually

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

Note: If first line agents unsuccessful, emergency consult with specialist (MFM, internal medicine, OB anesthesiology, critical care) is recommended

Anticonvulsant Medications

For recurrent seizures or when magnesium sulfate contraindicated

- Lorazepam (Ativan):** 2-4 mg IV x 1, may repeat once after 10-15 min
- Diazepam (Valium):** 5-10 mg IV q 5-10 min

Part 3: Magnesium Dosing and Treatment Algorithm for Refractory Seizures

Magnesium: Initial Treatment

1. Loading Dose: 4-6 gm over 20-30 minutes (6 gm for BMI > 35)
2. Maintenance Dose: 1-2 gm per hour
3. Close observation for signs of toxicity
 - ▶ Disappearance of deep tendon reflexes
 - ▶ Decreased RR, shallow respirations, shortness of breath
 - ▶ Heart block, chest pain
 - ▶ Pulmonary edema
4. Calcium gluconate or calcium chloride should be readily available for treatment of toxicity

For recurrent seizures while on magnesium

1. Secure airway and maintain oxygenation
2. Give 2nd loading dose of 2-4 gm Magnesium over 5 minutes
3. If patient still seizing 20 minutes after 2nd magnesium bolus, consider one of the following:
 - ▶ Midazolam 1-2 mg IV; may repeat in 5-10 min
 - OR**
 - ▶ Diazepam 5-10 mg IV slowly; may repeat q15 min to max of 30 mg
 - OR**
 - ▶ Phenytoin 1,250 mg IV at a rate of 50 mg/min
 - ▶ Other medications have been used with the assistance of anesthesia providers such as:
 - Sodium thiopental
 - Sodium amobarbital
 - Propofol
4. Notify anesthesia
5. Notify neurology and consider head imaging

Seizures Resolve

1. Maintain airway and oxygenation
2. Monitor vital signs, cardiac rhythm/EKG for signs of medication toxicity
3. Consider brain imaging for:
 - ▶ Head trauma
 - ▶ Focal seizure
 - ▶ Focal neurologic findings
 - ▶ Other suspected neurologic diagnosis
4. Reassure patient with information, support
5. Debrief with team before shift end



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Referral for Cardiac Conditions

CVD Screen Positive: Next Steps

- When a patient has a **positive** cardiac screen but is **not being admitted**:
 - If not currently pregnant, but had a pregnancy within the past year, refer to PCP for continued monitoring
 - If currently pregnant, refer patient to MFM service (if available) or cardiology
 - Patient can call to schedule an appointment
- When a patient has a **positive** cardiac screen and **is being admitted**:
 - If currently pregnant, consult OB/MFM service.

Referral Card for Patients



**During your visit we noted that you
may need additional testing**



**Your patient has screened positive for possible CVD.
We suggest the following studies:
BNP, ECHO, & EKG and
a referral to a MFM (if available) or Cardiology
for further evaluation**



Key Clinical Pearls

- First presentation of cardiovascular disease may be during pregnancy or early postpartum.
- The highest risk period for CVD worsening is between 24-28 weeks or postpartum.
- CVD symptoms or vital sign abnormalities should not be ignored in pregnant/postpartum women.
- New onset or persistent asthma may be a sign of heart failure.
- Bilateral infiltrates on chest x-ray may be due to heart failure rather than pneumonia.

Hameed AB, Morton CH, and A Moore. Improving Health Care Response to Cardiovascular Disease in Pregnancy and Postpartum Developed under contract #11-10006 with the California Department of Public Health, Maternal, Child and Adolescent Health Division. Published by the California Department of Public Health, 2017.

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Key Clinical Pearls (continued)

- Pregnancy or postpartum women with significant risk factors should be counseled regarding future CVD risk.
- Women with known CVD should receive pre- & inter-conception counseling by an experienced perinatologist and cardiologist.
- Contraception choices should be tailored to the individual.
- Provider and patient education is essential.
- High index of suspicion, early diagnosis, appropriate referrals and follow up are the key elements to a successful outcome.



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**Postpartum Presentations Emergency Department
(ED), Primary Care Provider (PCP) or Obstetric (OB)
Setting**

Postpartum Presentations to the ED, PCP or OB Provider

- Symptoms of cardiac disease may be falsely attributed to the common symptoms in a normal pregnancy (i.e., shortness of breath, fatigue).
- Preexisting cardiovascular disease and/or new onset peripartum cardiomyopathy may initially present during pregnancy or in the post-partum period.

Postpartum Presentations to the ED, PCP or OB Provider

When a woman presents in the postpartum period with complaints of shortness of breath, ask if she has experienced:

- Worsened level of exercise tolerance
- Difficulty performing activities of daily living; Unexpected fatigue
- Symptoms that are deteriorating, especially chest pain, palpitations, or dizziness
- New onset of cough or wheezing
- Leg edema and if it is improving or deteriorating
- Inability to lay flat; if this is a change; how many pillows she uses to sleep
- Failure to lose weight or unusual weight gain, and how much
- A history of cardiac or pulmonary conditions
- A history of substance abuse and/or cigarette use
- Or has been seen by other providers or in other Emergency Departments since giving birth.

Postpartum Presentations to the ED, PCP or OB Provider

Key Points (1)

- Symptoms related to physiologic changes of pregnancy should be improving in the postpartum period.
- Any visits to Emergency Department for dyspnea should raise suspicion for cardiovascular disease.
- Women of childbearing age should be questioned about recent pregnancies, in addition to their last menstrual period (LMP).
- Postpartum dyspnea or new onset cough is concerning for cardiovascular disease.

Postpartum Presentations to the ED, PCP or OB Provider

Key Points (2)

- New onset asthma is rare in adults.
- Bilateral crackles on lung examination are most likely associated with Congestive Heart Failure (CHF).
- Improvement of dyspnea with bronchodilators does not confirm the diagnosis of asthma, as CHF may also improve with bronchodilators. Likewise, a lack of response to bronchodilators should prompt the entertainment of a diagnosis other than asthma.

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Thank you!

For your incredible work to improve the
lives of Tennesseans!

