



Maternal Webinar Series:

"Addressing the Cardiovascular Contribution  
to Maternal Mortality"

August 6, 2024

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Women'sHealth



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# Improvement Advisor

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JENNIFER BOLAND



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# Resources and Opportunities



# Maternal Updates



- Next GaPQC Maternal Webinar Tuesday, September 3<sup>rd</sup> at 2:00 PM EST  
Dr. Deirdre Mattina – Guest Speaker
- **Data**
  - Q1 Jan – March – submission due by April 30<sup>th</sup>
  - Q2 April – June – submission due by July 31<sup>st</sup> **Extended to Friday, August 9th due to the transition to SimpleQI**
  - Q3 July –Sept. – submission due by October 31<sup>st</sup>
  - Q4 Oct. – Dec. – submission due by January 31<sup>st</sup>
- **AIM SMM Review Form Learning Sprint**
  - August 15<sup>th</sup> at 12 PM – Chart Abstraction Best Practices for SMM Review: The How
  - August 22<sup>nd</sup> at 12 PM – Lessons Learned from SMM Chart Review
  - August 29<sup>th</sup> at 12 PM – Integrating Equity into SMM Chart Reviews

<https://us02web.zoom.us/meeting/register/tZMufu-hqjlpEtwNH7DGda1mNh4KKOgrR92y>
- **Maternal Health Learning & Innovation Center “Practicing Equity in Authentic Community Engagement”**
  - August 14<sup>th</sup> at 1:00 pm EST <https://unc.zoom.us/meeting/register/tJwvcOuupjlvGta9xAPccs5zsDPmGa6XN-Jy#/registration>
- **Maternal Health ECHO**
  - August 21<sup>st</sup>:** Cardio-OB: Addressing Cardiac Health for women in the CSRA

# AIM for Safer Birth Podcast



## SEASON 2

### JUMP TO EPISODES:

1. [The Season of “The One Thing”](#)
2. [You Can’t Get There from Here: Rural Maternity Care in the U.S](#)

AIM Safer Birth Podcast Season 2 is here! The host Christie Allen, Senior Director of Quality Improvement and Programs, will discuss topics including community birth, quality improvement, patient engagement, and rural perinatal health.

<https://saferbirth.org/aim-podcast-2/>



# Maternal Early Warning System Implementation Resource Kit (MEWSIRK)



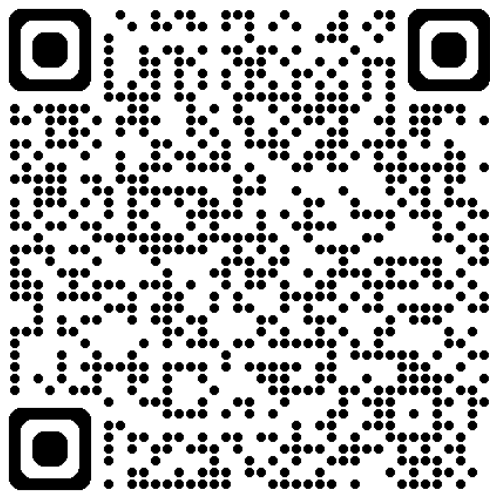
► Free and available at  
[www.saferbirth.org](http://www.saferbirth.org)







American  
Heart  
Association.



## The Role of Maternal Health in Cardiovascular Health

Pregnancy related deaths in the U.S. have risen 140% over the last three decades and cardiovascular disease is the leading cause of death. In this learning module, interdisciplinary experts, guided by the overarching goals to improve women's cardiovascular health and eliminate maternal health disparities, identify, and explain the increased cardiovascular risk and contributing comorbidities that affect pregnant and recently pregnant individuals. These trends disproportionately affect women of color.

Claim CE and ABIM MOC Credit

Register for free learning module. >



<https://professional.heart.org/en/education/role-of-cardiovascular-health-in-maternal-health>



American  
Heart  
Association.



## Addressing Health Disparities

This course aims to guide an understanding of holistic community solutions that can increase equity and improve systems of care.

Open Access

Health Equity

Courses

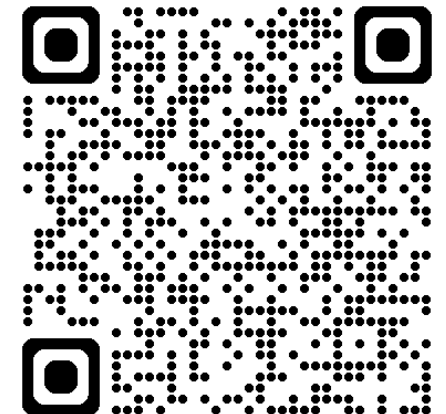
Access Now

### About this Course

Most of us are aware that health disparities in the United States are disproportionately caused by several factors. Some of these factors include socioeconomic status, race and ethnicity. As we examine communities having increased prevalence and incidence of cardiovascular disease (CVD), addressing health disparities are integral to these problematic trends.

This course aims to guide an understanding of holistic community solutions that can improve access to care between primary and specialist and individual knowledge of health.

<https://education.heart.org/productdetails/addressing-health-disparities>







Northeast Georgia Health System  
CENTER FOR SIMULATION AND INNOVATION  
675 White Sulphur Road, Building B  
Gainesville, GA 30501

## Join Us for the Obstetric Patient Safety (OPS) Workshop - 3rd Edition

### Hospitals in Georgia,

send your obstetric and emergency department staff  
for a comprehensive learning experience.

Don't miss this opportunity to improve patient safety and outcomes. Enhance  
your skills in managing obstetric emergencies through simulation and debriefing.

- Learning Outcomes:**
- Identify high-risk factors for obstetric emergencies.
  - Demonstrate effective management of pregnant and postpartum individuals during obstetric emergencies.
  - Engage in role-playing simulations with a multidisciplinary team.

Workshop Dates:	June 5	September 18 and 19
	July 25	October 24
	August 19	December 4 and 5

For Registration and Inquires Contact: Tasha Murchison at [Tasha.Murchison@nghs.com](mailto:Tasha.Murchison@nghs.com)

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Physicians, this activity was planned and implemented in accordance with the accreditation requirements and policies of the Accreditation Council for Continuing Medical Education (ACCME) through the joint providership of AffinityCE and AWHONN. AffinityCE is accredited by the ACCME to provide continuing medical education for physicians. AffinityCE designates this live activity for a maximum of 10.75 AMA PRA Category 1 Credits™. Physicians, physician assistants, and nurse practitioners should claim only the credit commensurate with the extent of their participation in the activity.

<sup>1</sup> This program is supported by the Health Resources and Services Administration (HRSA) of the U.S. Department of Health and Human Services (HHS) as part of an award totaling \$5,170,233 with zero percentage financed with non-governmental sources. The contents are those of the author(s) and do not necessarily represent the official views of, nor an endorsement, by HRSA, HHS, or the U.S. Government

## Key Driver Diagram: Maternal Cardiac Conditions

**GOAL:** To reduce severe morbidity/mortality related to maternal cardiac conditions in Georgia.

**SMART AIM:** By 02/6/2026, **National Wear Red Day**, to reduce harm related to existing and pregnancy related cardiac conditions through the 4<sup>th</sup> trimester by **20%**

### Key Drivers

**Readiness: EVERY UNIT** - Implementation of standard processes for optimal care of cardiac conditions in pregnancy and post-partum.

**Recognition & Prevention: EVERY PATIENT** - Screening and early diagnosis of cardiac conditions in pregnancy and post-partum.

**Response: EVERY UNIT** - Care management for every pregnant or postpartum woman with cardiac conditions in pregnancy and post-partum.

**Reporting/System Learning: EVERY UNIT** - Foster a culture of safety and improvement for care of women with cardiac conditions in pregnancy and post-partum.

**Respectful, Equitable, and Supportive Care — EVERY UNIT/PROVIDER/TEAM MEMBER** - Inclusion of the patient as part of the multidisciplinary care team.

### Interventions

- ☐ Train all obstetric care providers to perform a basic Cardiac Conditions Screen.
  - ☐ Establish a protocol for rapid identification of potential pregnancy-related cardiac conditions in all practice settings to which pregnant and postpartum people may present.
  - ☐ Develop a patient education plan based on the pregnant and postpartum person's risk of cardiac conditions.
  - ☐ Establish a multidisciplinary "Pregnancy Heart Team" or consultants appropriate to their facility's designated Maternal Level of Care to design coordinated clinical pathways for people experiencing cardiac conditions in pregnancy and the postpartum period. **S1**
  - ☐ Establish coordination of appropriate consultation, co-management and/or transfer to appropriate level of maternal or newborn care.
  - ☐ Develop trauma-informed protocols and training to address health care team member biases to enhance quality of care
  - ☐ Develop and maintain a set of referral resources and communication pathways between obstetric providers, community-based organizations, and state and public health agencies to enhance quality of care. \*
- ☐ Obtain a focused pregnancy and cardiac history in all care settings, including emergency department, urgent care, and primary care.
  - ☐ In all care environments assess and document if a patient presenting is pregnant or has been pregnant within the past year. **S2**
  - ☐ Assess if escalating warning signs for an imminent cardiac event are present.
  - ☐ Utilize standardized cardiac risk assessment tools to identify and stratify risk.
  - ☐ Conduct a risk-appropriate work-up for cardiac conditions to establish diagnosis and implement the initial management plan.
- ☐ Facility-wide standard protocols with checklists and escalation policies for management of cardiac symptoms.
  - ☐ Facility-wide standard protocols with checklists and escalation policies for management of people with known or suspected cardiac conditions.
  - ☐ Coordinate transitions of care including the discharge from the birthing facility to home and transition from postpartum care to ongoing primary and specialty care.
  - ☐ Offer reproductive life planning discussions and resources, including access to a full range of contraceptive options in accordance with safe therapeutic regimens. \*
  - ☐ Provide patient education focused on general life-threatening postpartum complications and early warning signs, including instructions of who to notify if they have concerns, and time and date of a scheduled postpartum visit. **S3**
- ☐ For pregnant and postpartum people at high risk for a cardiac event, establish a culture of multidisciplinary planning, admission huddles and post-event debriefs.
  - ☐ Perform multidisciplinary reviews of serious complications (e.g. ICU admissions for other than observation) to identify systems issues. **S4**
  - ☐ Monitor outcomes and process data related to cardiac conditions, with disaggregation by race and ethnicity due to known disparities in rates of cardiac conditions experienced by Black and Indigenous pregnant and postpartum people. **Process Measures – 1-5**
- ☐ Screen for structural and social drivers of health that might impact clinical recommendations or treatment plans and provide linkage to resources that align with the pregnant or postpartum person's health literacy, cultural needs, and language proficiency.
  - ☐ Engage in open, transparent, and empathetic communication with pregnant and postpartum people and their identified support network to understand diagnoses, options, and treatment plans.
  - ☐ Include each pregnant or postpartum person and their identified support network as respected members of and contributors to the multidisciplinary care team. **\*S5**



**Kathryn J. Lindley, MD, FACC**  
Vanderbilt University Medical Center  
Associate Professor of Medicine  
Associate Professor of Obstetrics and Gynecology

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# Addressing the Cardiovascular Contribution to Maternal Mortality

Kathryn J. Lindley, MD, FACC

Samuel S. Riven Director, Women's Heart Center

Associate Professor of Medicine

Associate Professor of Obstetrics and Gynecology



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Women's Heart Center



# No Financial Disclosures



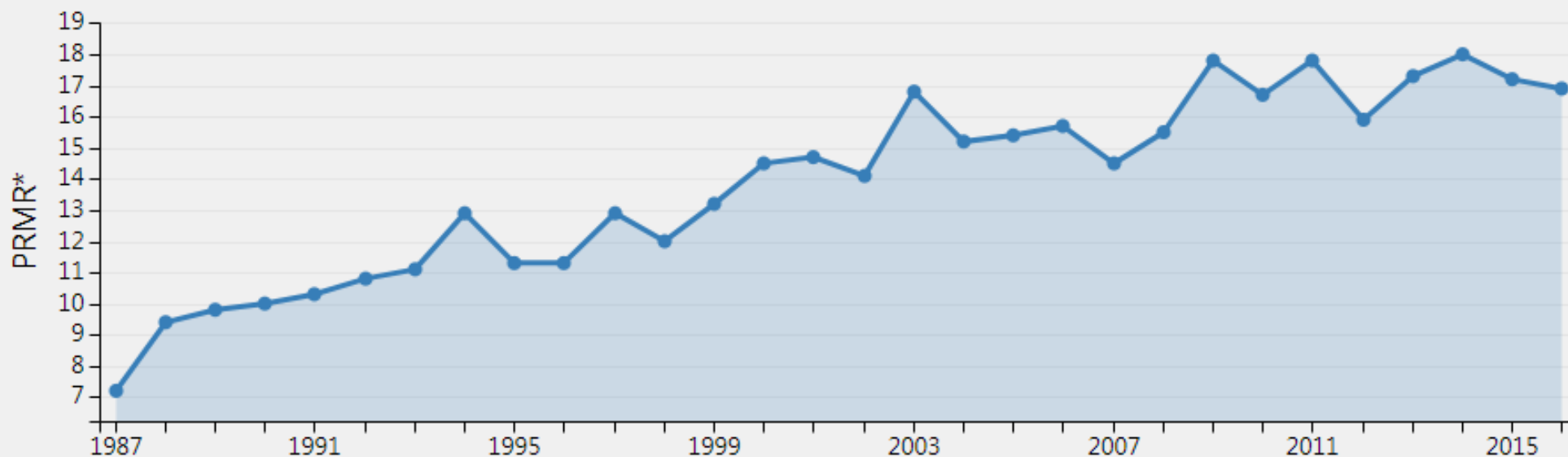
# Objectives

- Understand the use of common risk stratification schema to identify pregnant patients with high risk cardiovascular conditions
- Understand strategies for identifying cardiovascular emergencies in obstetric patients
- Understand the importance of team-based care for the pregnant patient with cardiovascular disease



# Maternal Mortality in America

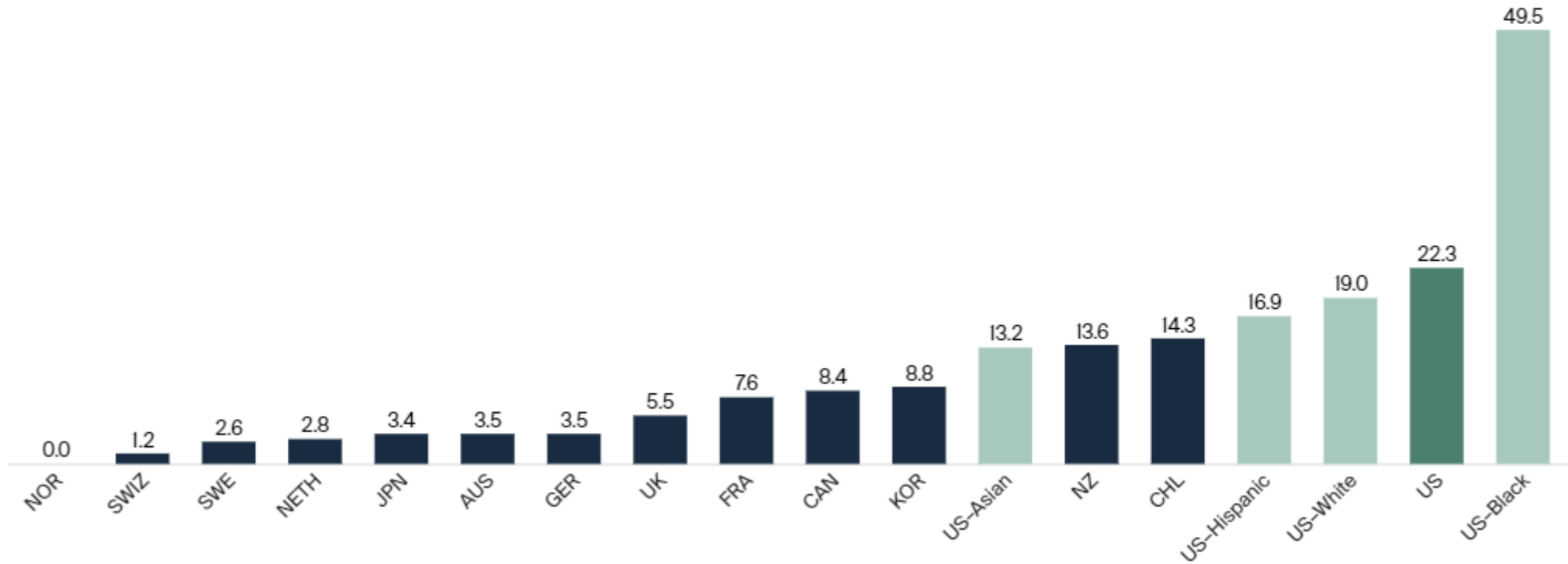
Trends in pregnancy-related mortality in the United States: 1987-2016



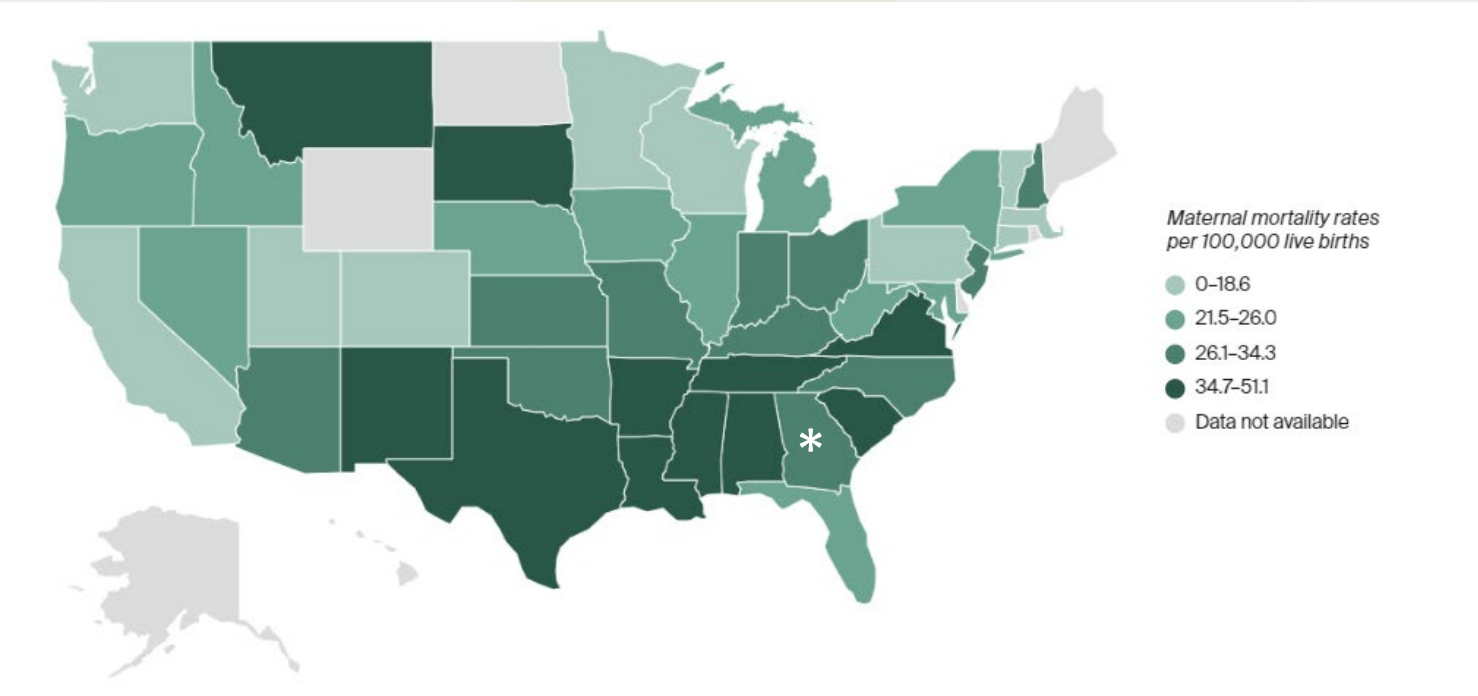
\*Number of pregnancy-related deaths per 100,000 live births per year

# The United States continues to have the highest maternal death rate, with the rate for Black women by far the highest of any group.

*Maternal deaths per 100,000 live births*



# Georgia has the 15<sup>th</sup> highest maternal mortality rate in the U.S.



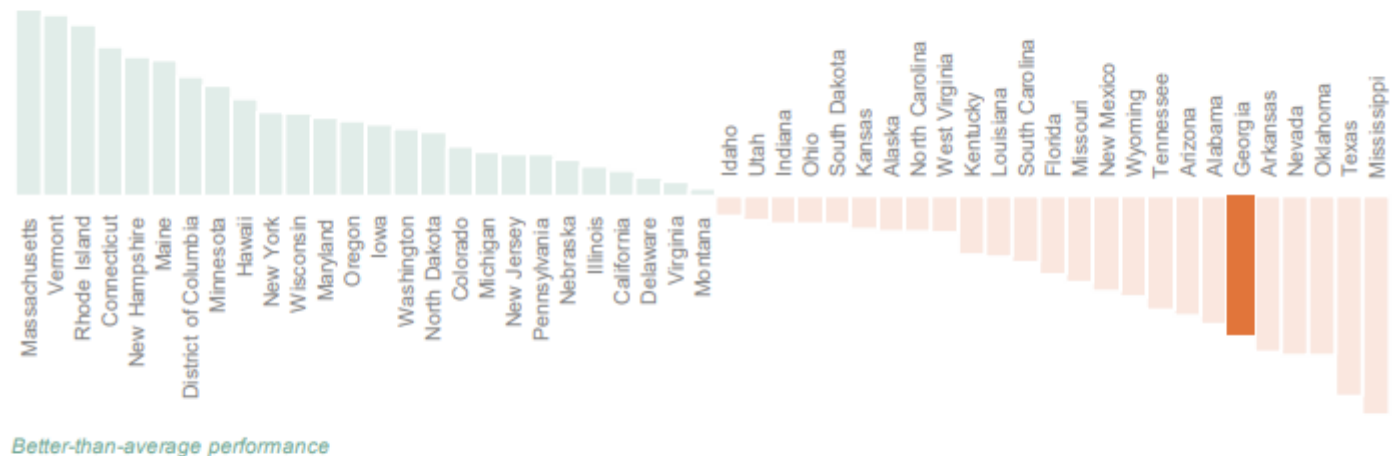
Maternal Mortality Rates, 2020-2022

State	Mortality Rate	Rank
TN	51.1	1
MS	44.6	2
LA	42.6	3
VA	42.3	4
AL	40.3	5
NM	40.1	6
AR	37.5	7
MT	36.1	8
SD	35.8	9
SC	35.7	10
TX	34.7	11
AZ	34.3	12
IN	34	13
NC	33.4	14
GA	33	15

# How well is the health care system in Georgia working for women?

Georgia ranks #46 overall.

Worse-than-average performance



## Georgia ranks

33

of 51

on Health and  
Reproductive  
Care Outcomes

Maternal and all-cause women's  
mortality + Infant mortality +  
Physical and mental health status

50

of 51

on Coverage,  
Access, and  
Affordability

Insurance coverage +  
Provider accessibility +  
Health care affordability

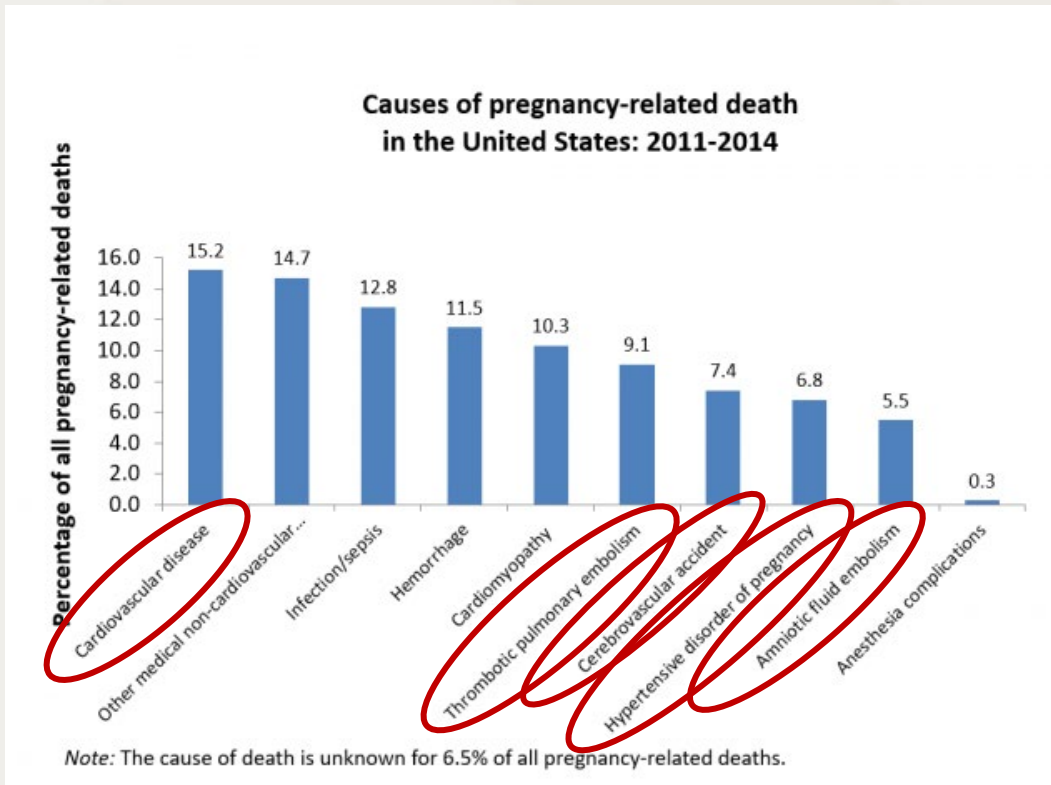
40

of 51

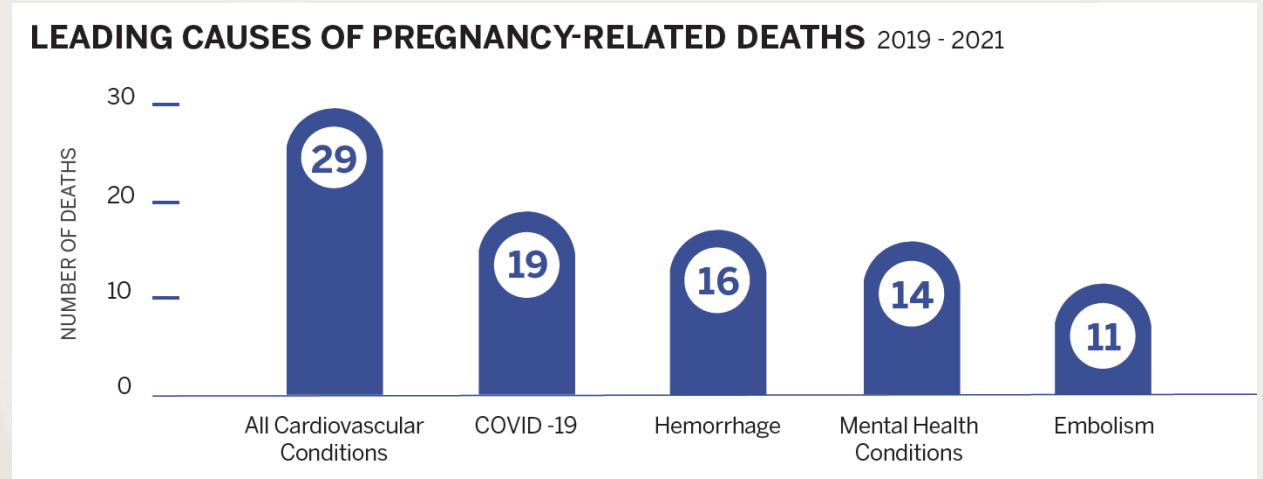
on Health Care  
Quality and  
Prevention

Low-risk cesarean birth rate +  
Preventive care use +  
Pre- and postpartum care +  
Mental health care screening

# Cardiovascular Disease is the LEADING CAUSE of Maternal Mortality



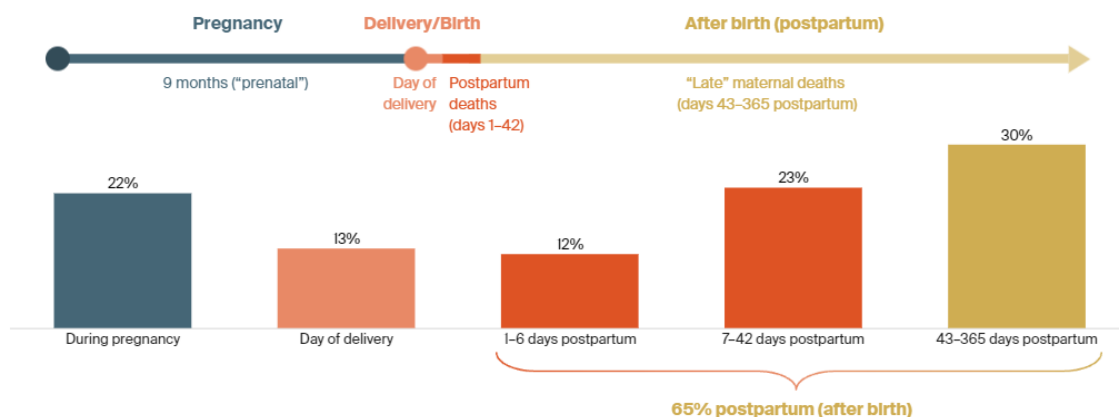
## Maternal Mortality in Georgia



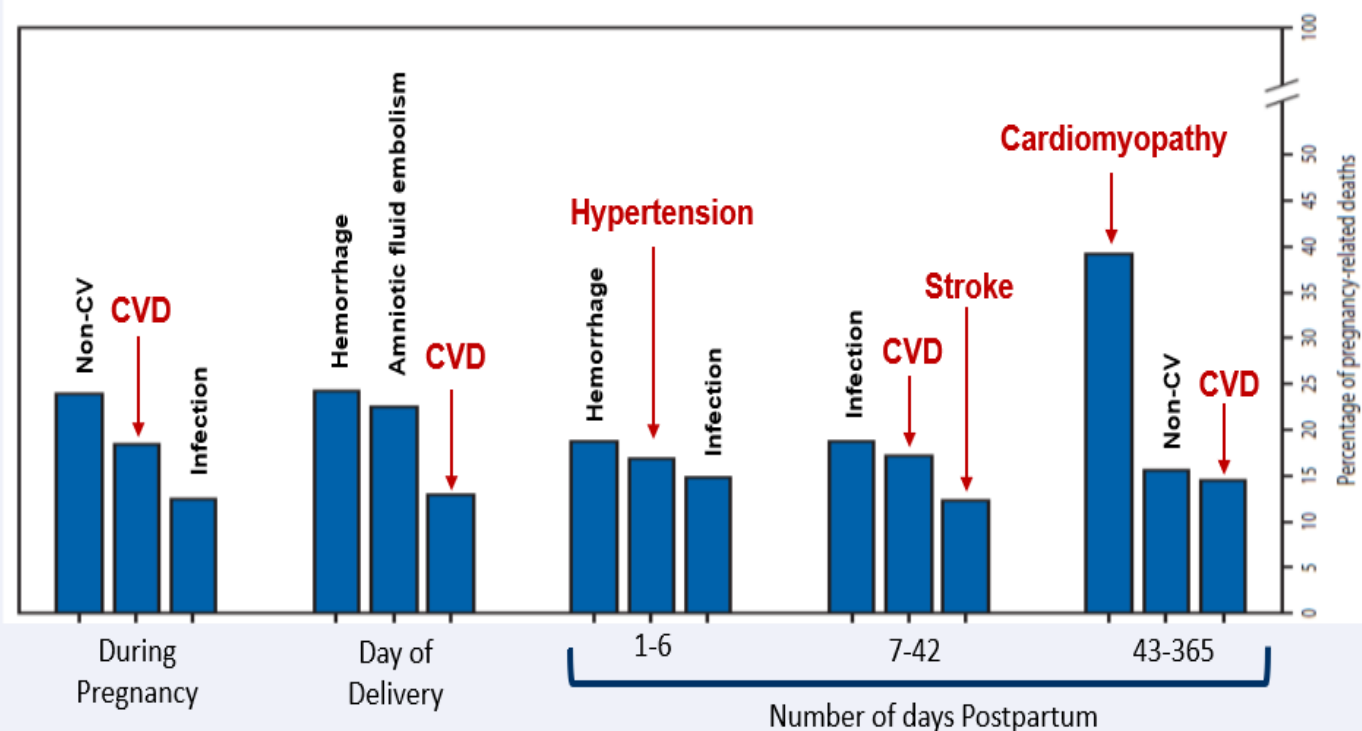
# Timing of Maternal Deaths

Two-thirds of U.S. pregnancy-related deaths occur during the postpartum period.

Distribution of pregnancy-related deaths by timing of death in relation to pregnancy, 2017–2019



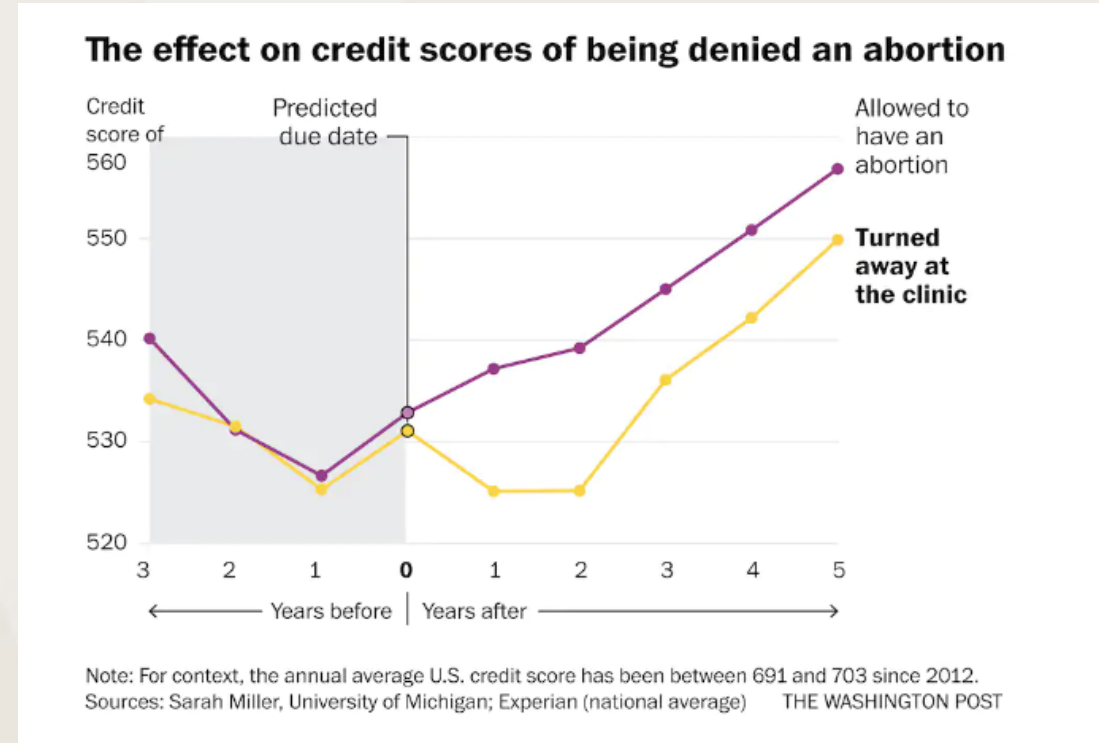
## Maternal Morbidity by Etiology & Time Relative to Delivery





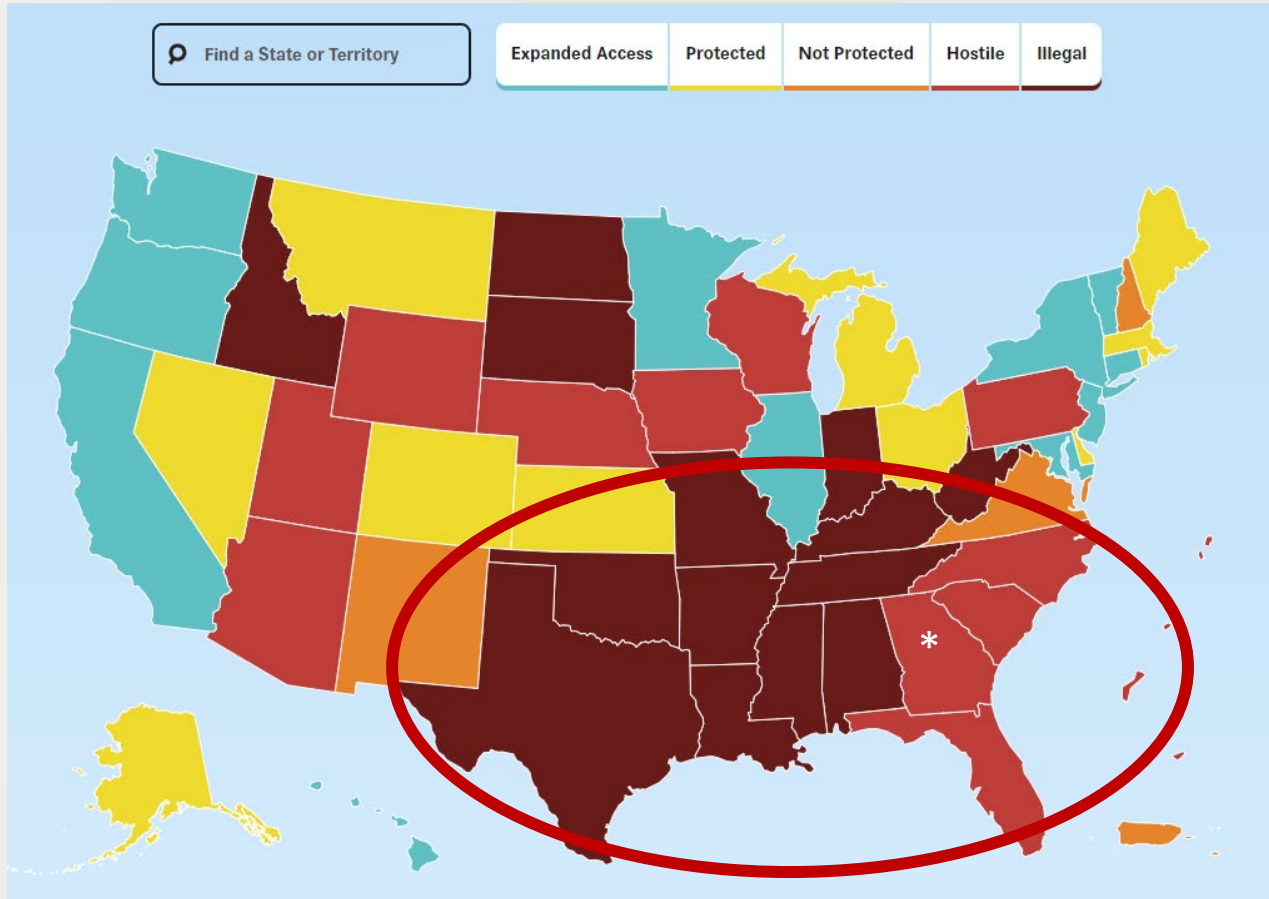
# Implications of Abortion Bans (to name a few)

- Anticipated Increase in Maternal Mortality
  - 21% Total Increase
  - 33% Increase among Black women
- Increase in poverty for women
- Increase in racial and geographic health and economic disparities

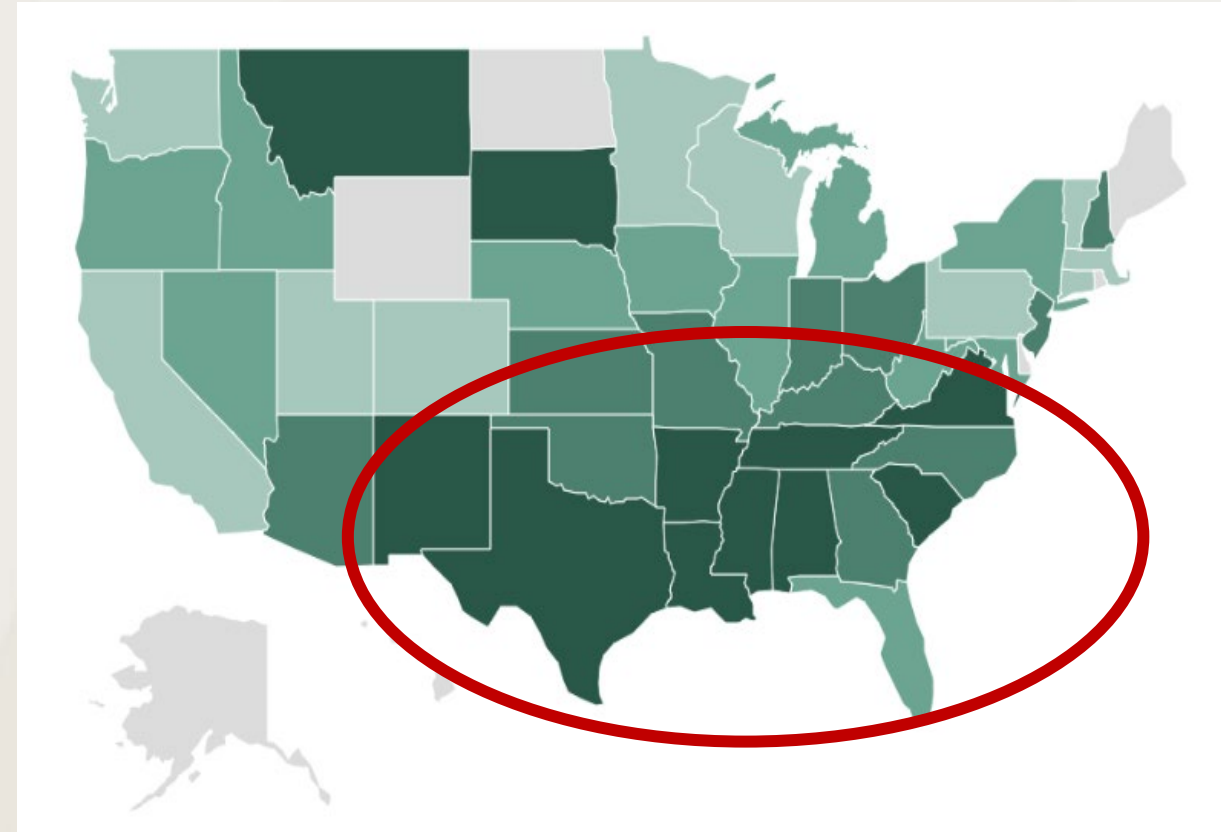


# Abortion Access in the United States

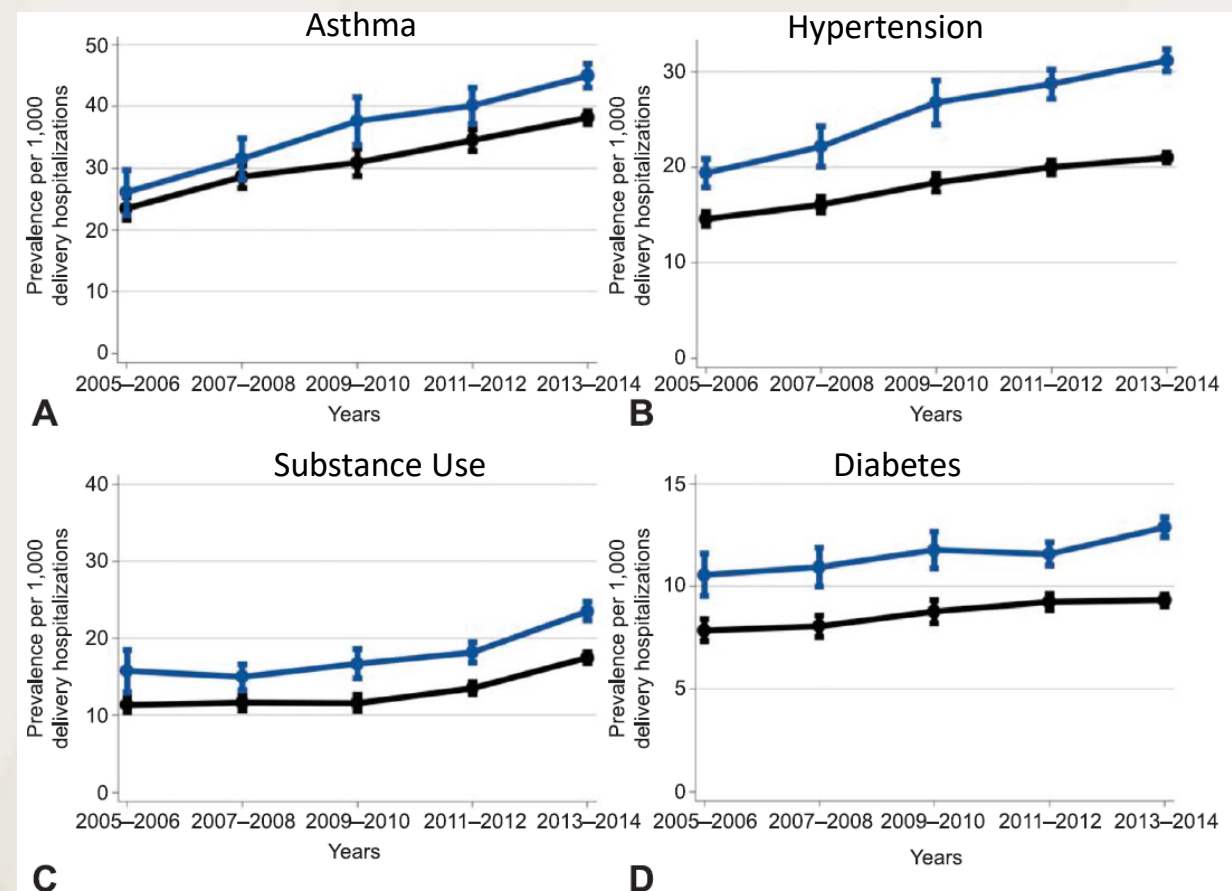
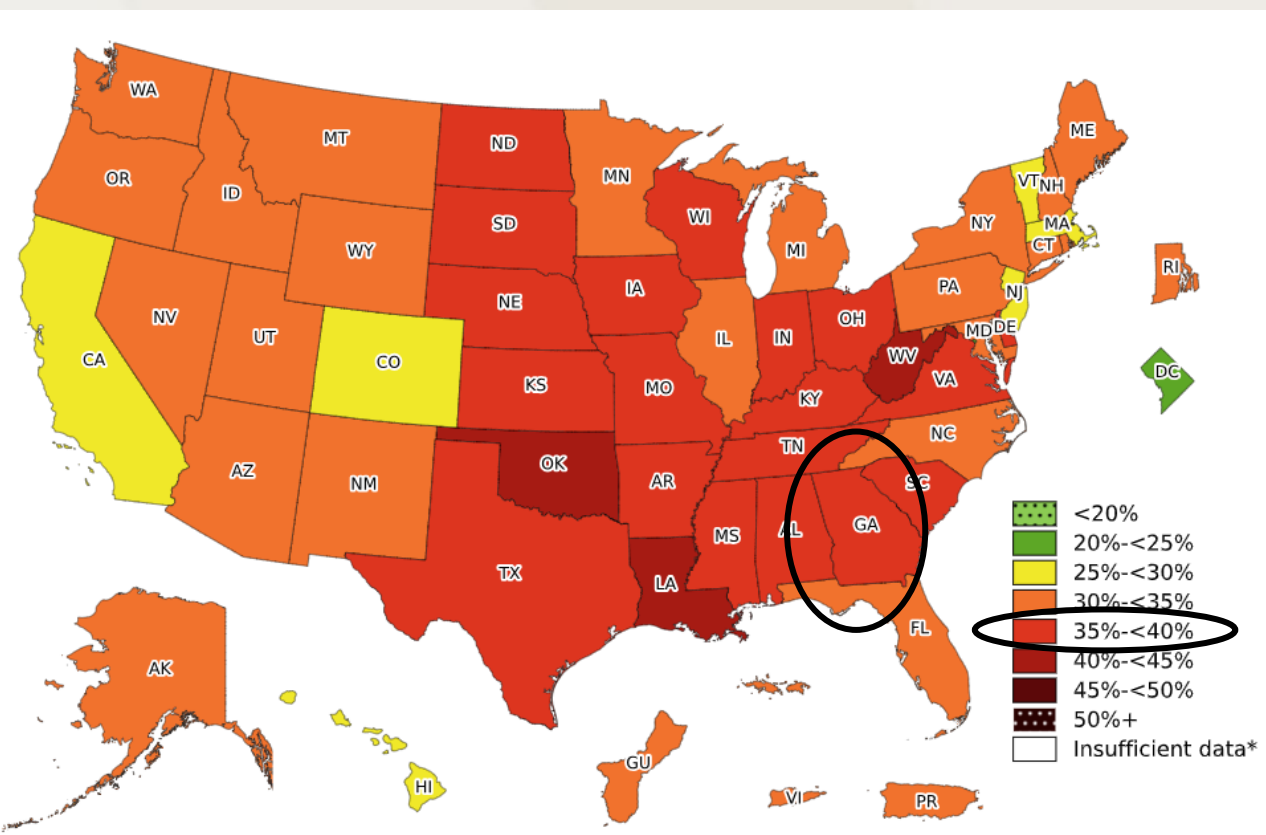
Abortion Access



Maternal Mortality



# Rising Burden of Chronic Disease



# How to identify the highest risk patients?



# Pregnancy Outcomes in Women With Heart Disease

## The CARPREG II Study

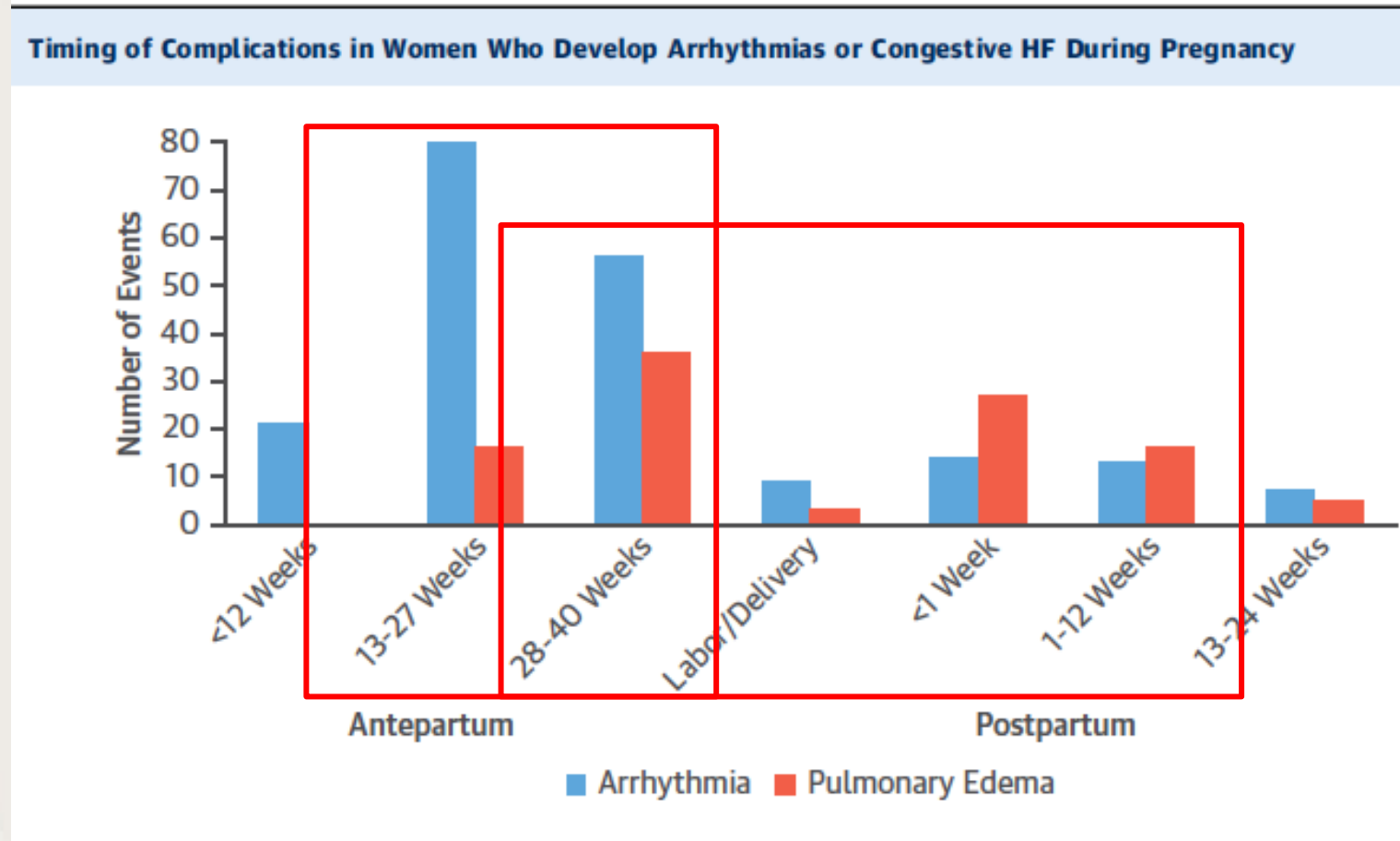
Candice K. Silversides, MD, MS,<sup>a,b</sup> Jasmine Grewal, MD,<sup>c</sup> Jennifer Mason, RN,<sup>a,b</sup> Mathew Sermer, MD,<sup>a,b</sup> Marla Kiess, MD,<sup>c</sup> Valerie Rychel, MD,<sup>d</sup> Rachel M. Wald, MD,<sup>a,b</sup> Jack M. Colman, MD,<sup>a,b</sup> Samuel C. Siu, MD, SM, MBA<sup>a,b,e</sup>

Cardiac diagnosis	
Congenital heart disease	1,235 (63.7)
Acquired heart disease	443 (22.9)
Isolated cardiac arrhythmias	260 (13.4)
High-risk cardiac lesions	
High-risk left-sided valve disease/LVOT obstruction	294 (15.2)
At least mild systemic ventricular systolic dysfunction	263 (13.6)
Pulmonary hypertension	58 (3.0)
High-risk aortopathy	52 (2.7)
Mechanical heart valve	43 (2.2)
Coronary artery disease	38 (2.0)

**TABLE 2** Incidence of Adverse Cardiac Event Rates During Pregnancy (N = 1,938)

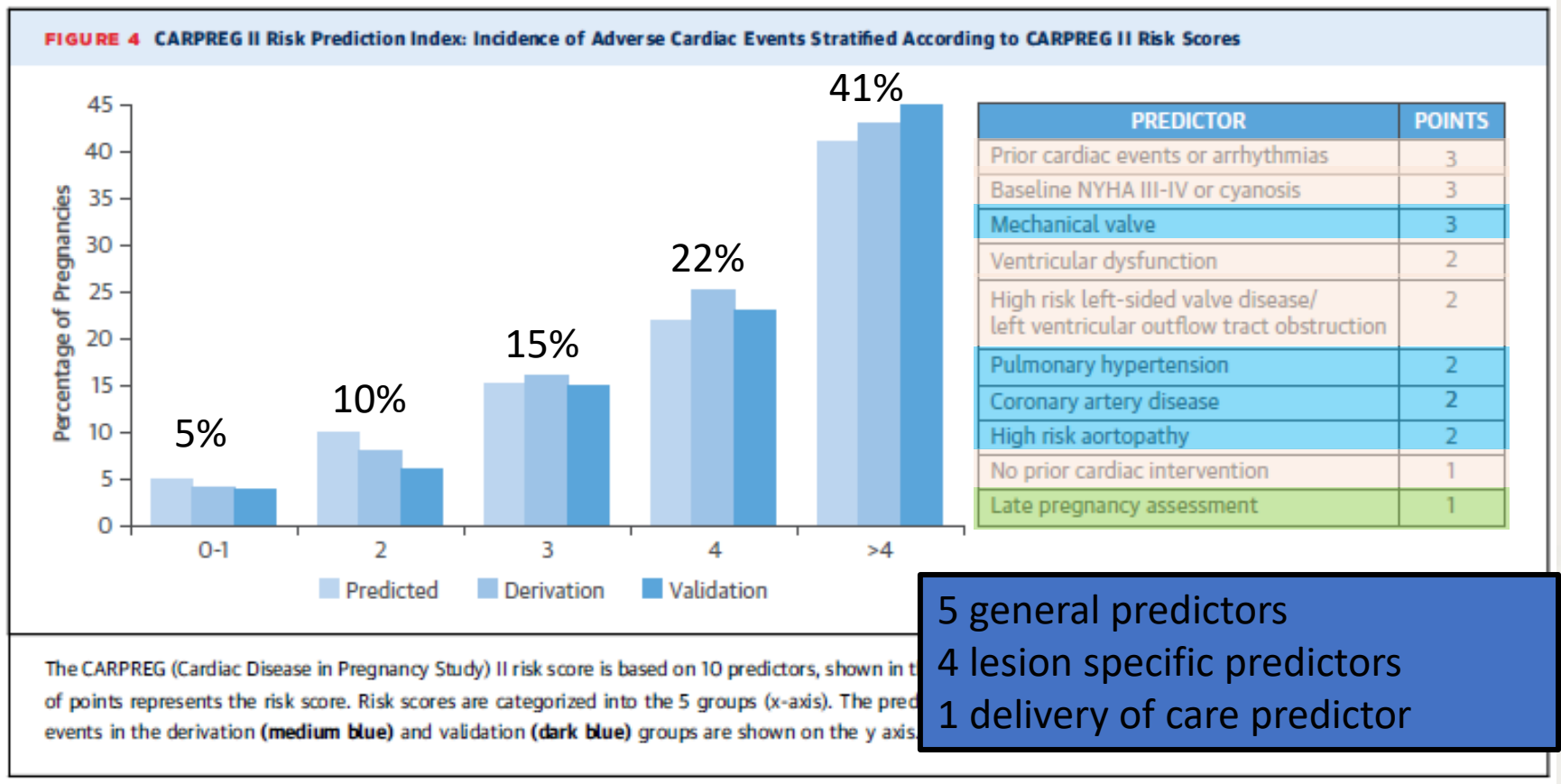
Any maternal cardiac events	307 (15.8)
Maternal cardiac death	6 (0.3)
Maternal cardiac arrest	8 (0.4)
Arrhythmias	181 (9.3)
Any left- or right-sided HF	120 (6.2)
Left-sided HF	106 (5.5)
Right-sided HF	19 (1.0)
Stroke	13 (0.7)
Myocardial infarction	8 (0.4)
Dissection	7 (0.4)
Cardiac thromboembolism	6 (0.3)

# CARPREG II Complications





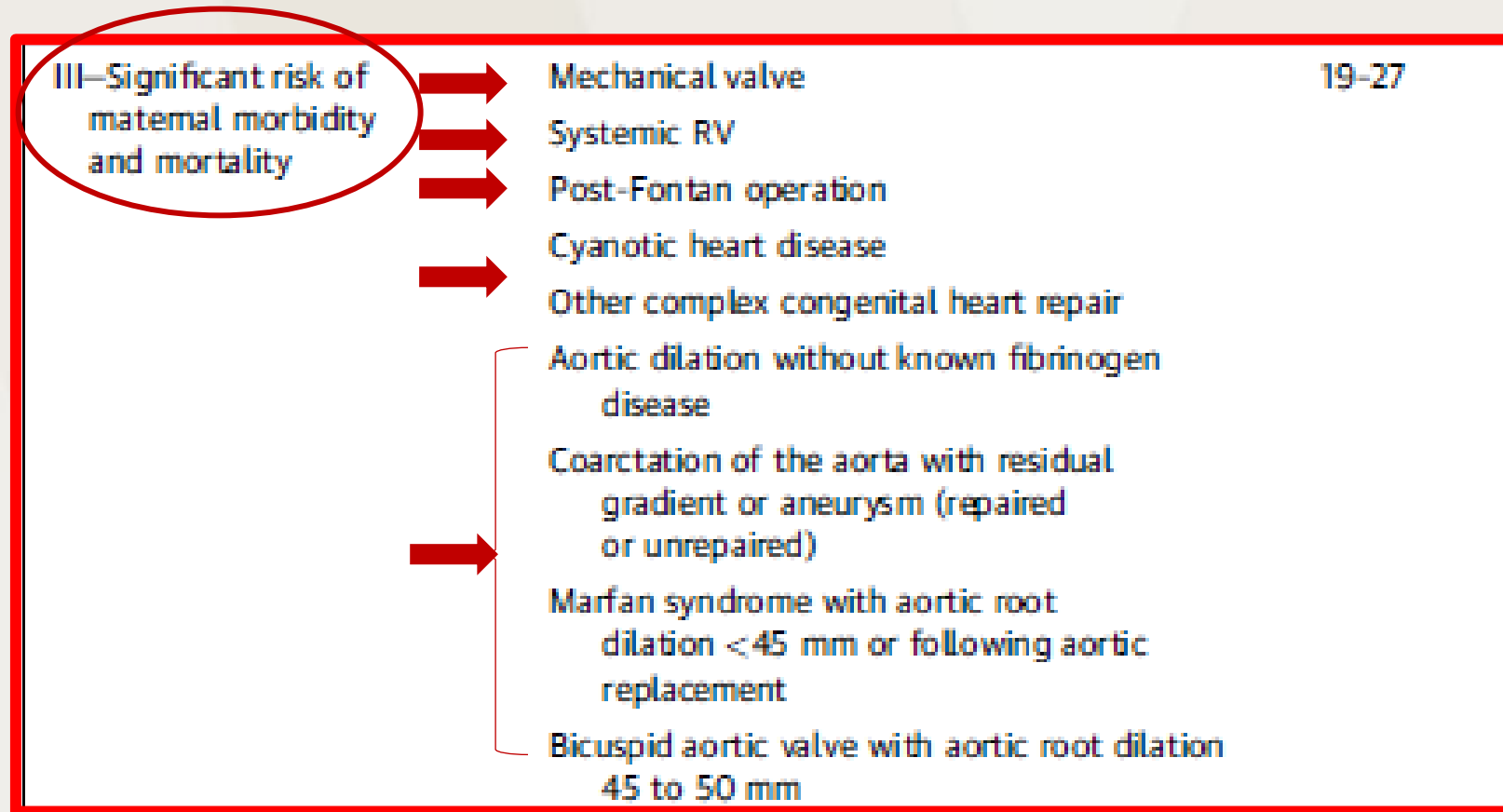
# CARPREG II Risk Model



# Modified World Health Organization (mWHO)

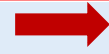
TABLE 3 Modified WHO Risk Stratification Model		
Modified WHO Class	Conditions	Predicted Risk, %
I—No higher risk than the general population	Uncomplicated, small or mild lesions including pulmonary stenosis, VSD, PDA, and mitral valve prolapse with no more than trivial mitral regurgitation Successfully repaired simple lesions including ostium secundum ASD, VSD, PDA, and TAPVD Isolated PVCs and PACs	2.5–5
II—Small increased risk of maternal morbidity and mortality	Unoperated ASD Repaired tetralogy of Fallot Most arrhythmias Coarctation of the aorta without significant gradient or aneurysm (repaired or unrepaired) Long QT syndrome	5.7–10.5
II to III	Mild LV impairment Hypertrophic cardiomyopathy Marfan syndrome without aortic dilation Heart transplant Native or tissue valve disease not considered WHO class IV Bicuspid aortic valve without aortic dilatation	10–19
III—Significant risk of maternal morbidity and mortality	Mechanical valve Systemic RV Post-Fontan operation Cyanotic heart disease Other complex congenital heart repair Aortic dilation without known fibrinogen disease Coarctation of the aorta with residual gradient or aneurysm (repaired or unrepaired) Marfan syndrome with aortic root dilation <45 mm or following aortic replacement Bicuspid aortic valve with aortic root dilation 45 to 50 mm	19–27
IV—Pregnancy contraindicated	Pulmonary arterial hypertension of any cause Severe left ventricular dysfunction (LVEF <30% or NYHA functional class III to IV) Previous peripartum cardiomyopathy with any residual impairment of LV function Severe left heart obstruction (AVA <1 cm <sup>2</sup> or peak gradient >50 mm Hg; MVA <1.5 cm <sup>2</sup> ) Marfan syndrome with aortic dilation >45 mm Bicuspid aortic valve with aortic dilation >50 mm	40–100

# High Risk Pregnancy Conditions



# What IS a CONTRAINDICATION to pregnancy?

IV—Pregnancy  
contraindicated



Pulmonary arterial hypertension of any cause

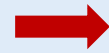
40-100



Severe left ventricular dysfunction (LVEF  
<30% or NYHA functional class III to IV)



Previous peripartum cardiomyopathy with  
any residual impairment of LV function



Severe left heart obstruction (AVA <1 cm<sup>2</sup> or  
peak gradient >50 mm Hg; MVA <1.5 cm<sup>2</sup>)



Marfan syndrome with aortic dilation  
>45 mm

Bicuspid aortic valve with aortic  
dilation >50 mm

# Pregnancy Itself = Risk Factor

- Pro-thrombotic state
- Increased levels estrogen/progesterone/relaxin
- Increased incidence of
  - Aortic and coronary dissection
  - Plaque Rupture
  - Stroke
  - Embolic Phenomena
- Do not return to baseline until ~12 weeks post-partum



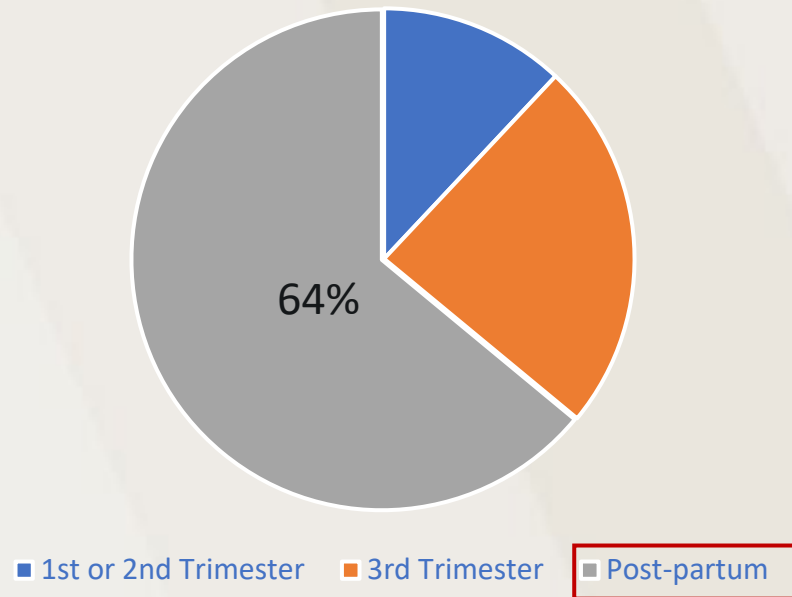
# Post-Partum = THE WEEDS!



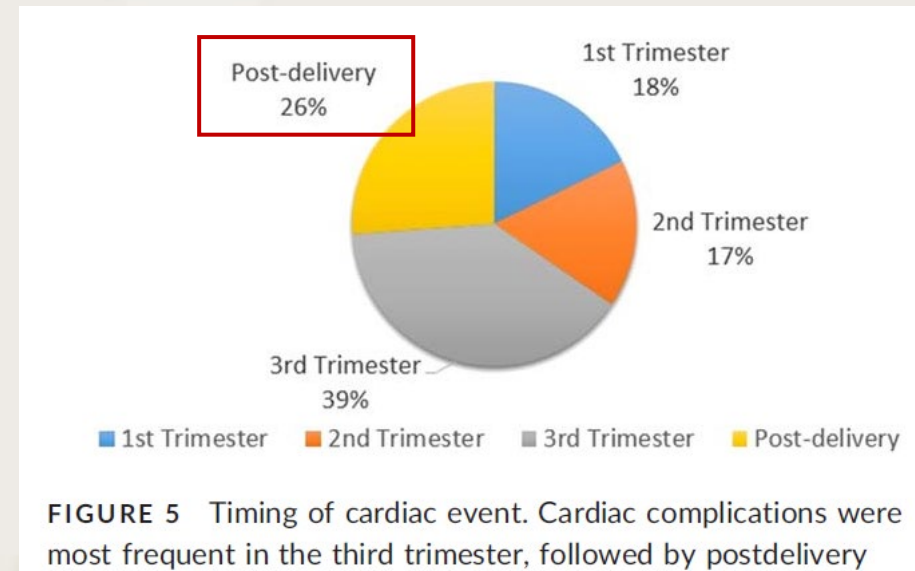


# Post-partum Acquired Cardiac Events

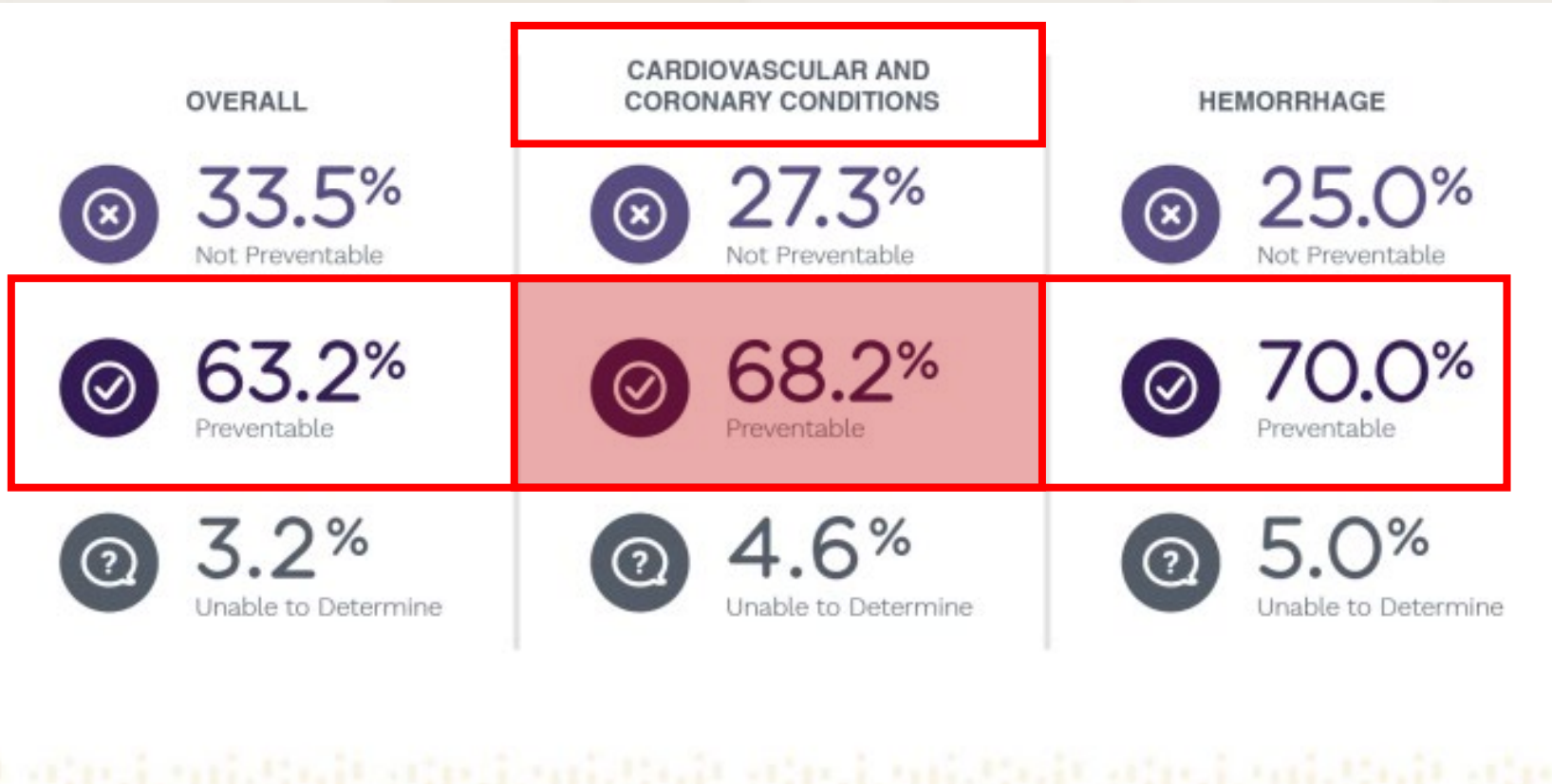
## Coronary Artery Dissection



## Cardiac Events in Marfan Syndrome



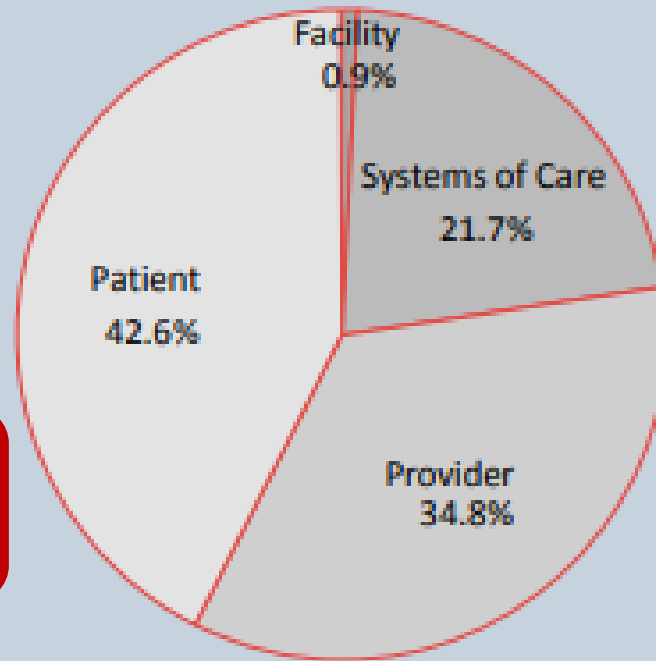
# Maternal Mortality is Preventable



- **85%** of deaths of GA were deemed preventable

# Addressing Critical Factors in Maternal Deaths

**Figure 9.** Distribution of Critical Factors among Pregnancy-Related Deaths



- Failure to Recognize Symptoms
- Chronic Conditions (esp obesity)

# Health Policy and Health Outcomes

## Georgia performed worst on:

- ▼ Women ages 18–44 who went without care because of cost (48 of 51)
- ▼ Self-pay in-hospital births (49 of 51)
- ▼ Uninsured women, ages 19–64 (50 of 51)

# 4 Key Factors Related to Maternal Cardiovascular Mortality

- Race/Ethnicity
  - Black women have 3.4 times risk of dying than whites
- Age
  - Age >40 increases risk to 30 TIMES the risk of women <20 years old
- Hypertension – chronic or hypertensive disorder of pregnancy
  - Risk of MI is 13 fold
  - Risk of heart failure is 8 fold
- Obesity
  - 60% of maternal deaths occur in overweight or obese women



# Hypertension: A Major Cause of CV Morbidity and Mortality

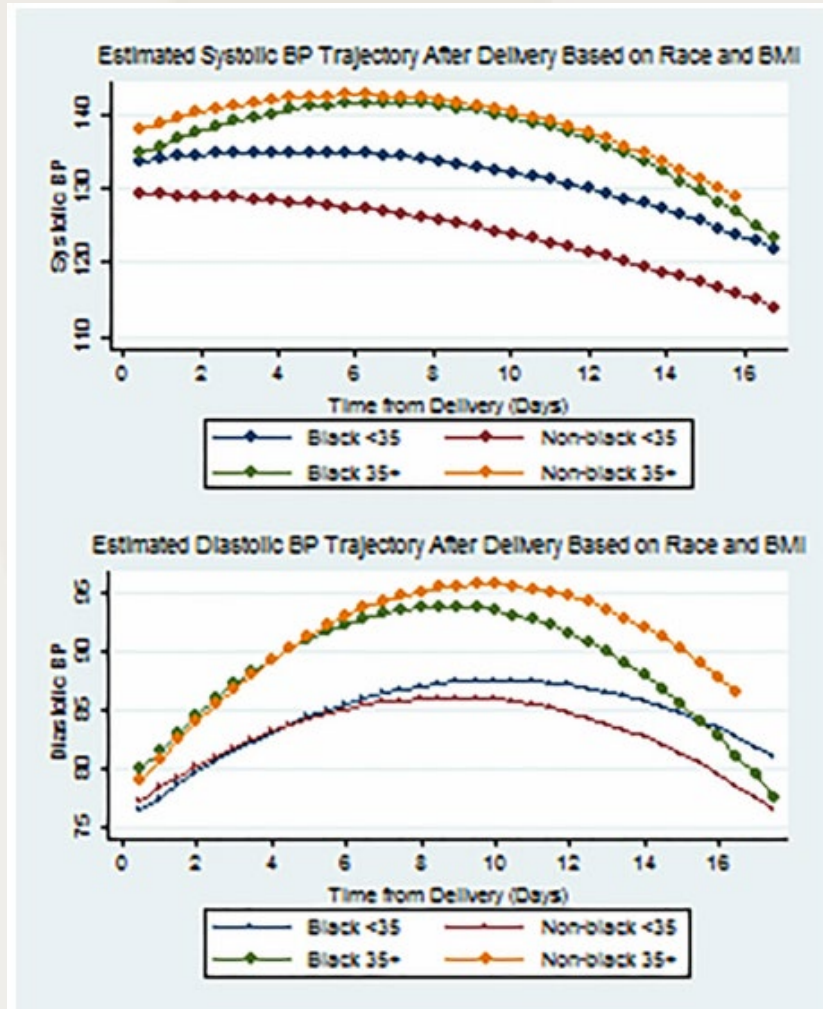
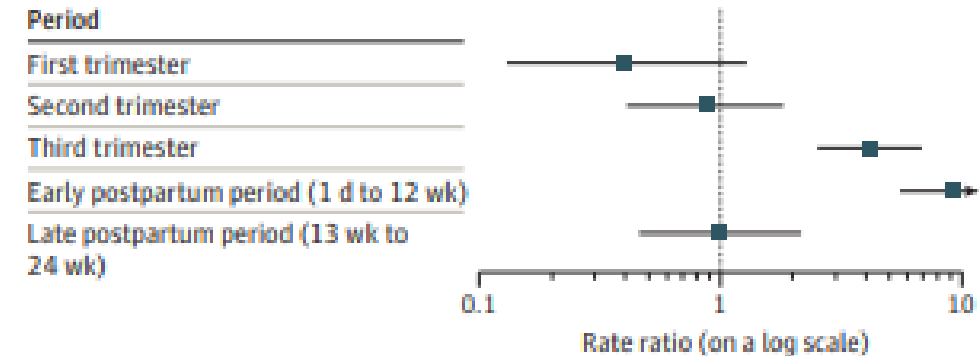


Figure 3. Rate Ratios for Intracerebral Hemorrhage During Pregnancy and Post Partum as Determined by Conditional Poisson Regression in a Matched Patient Population

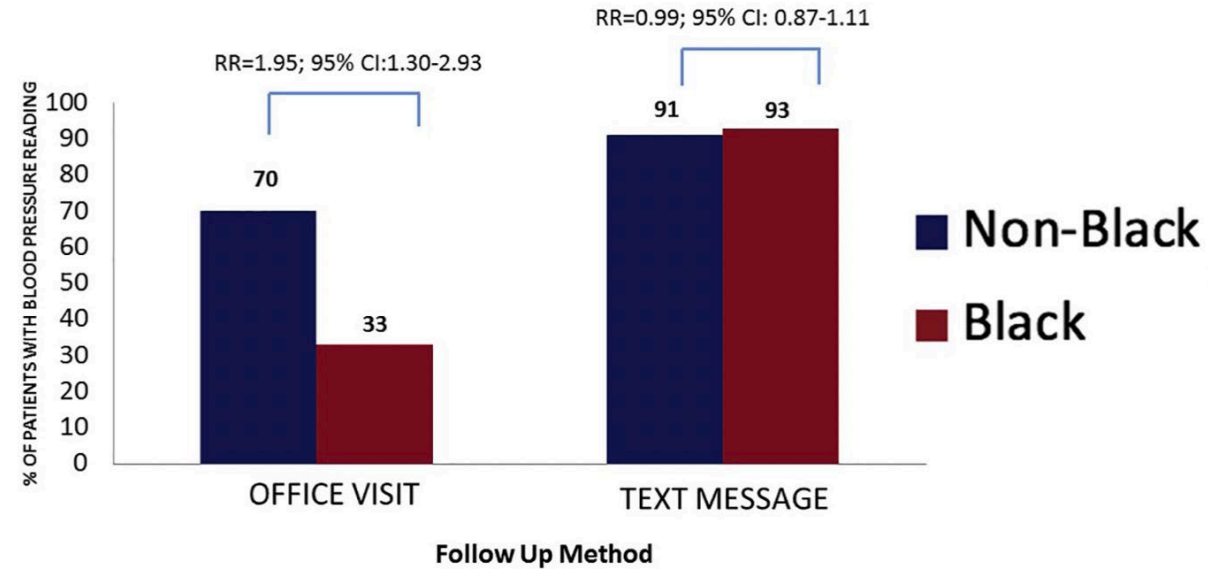


The 64-week matched observation period of 2 719 443 patients is stratified into the 3 trimesters of pregnancy and 2 12-week postpartum periods. Rate ratios are indicated by squares and associated 95% confidence intervals are indicated by horizontal error bars. A dashed vertical line is present at 1 as a reference line for statistical significance.

# Identify Novel Ways To Reach High Risk Patients

**FIGURE**

**Postpartum blood pressure ascertainment by race and follow-up method**

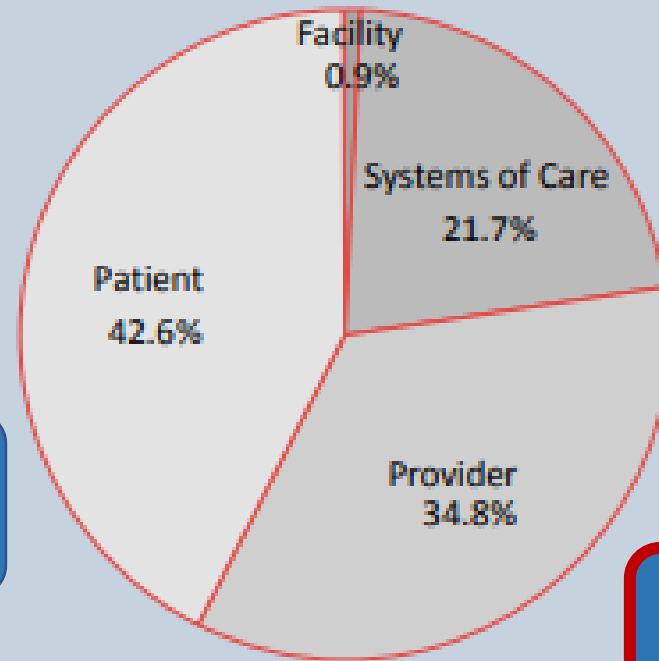


CI, confidence interval; RR, relative risk.

Hirshberg. Text messaging remote blood pressure monitoring. *Am J Obstet Gynecol* 2019.

# Improving Recognition of Disease

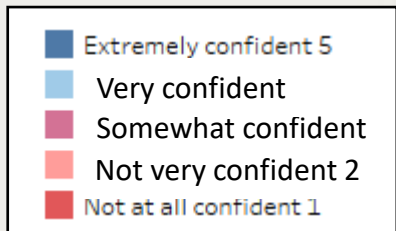
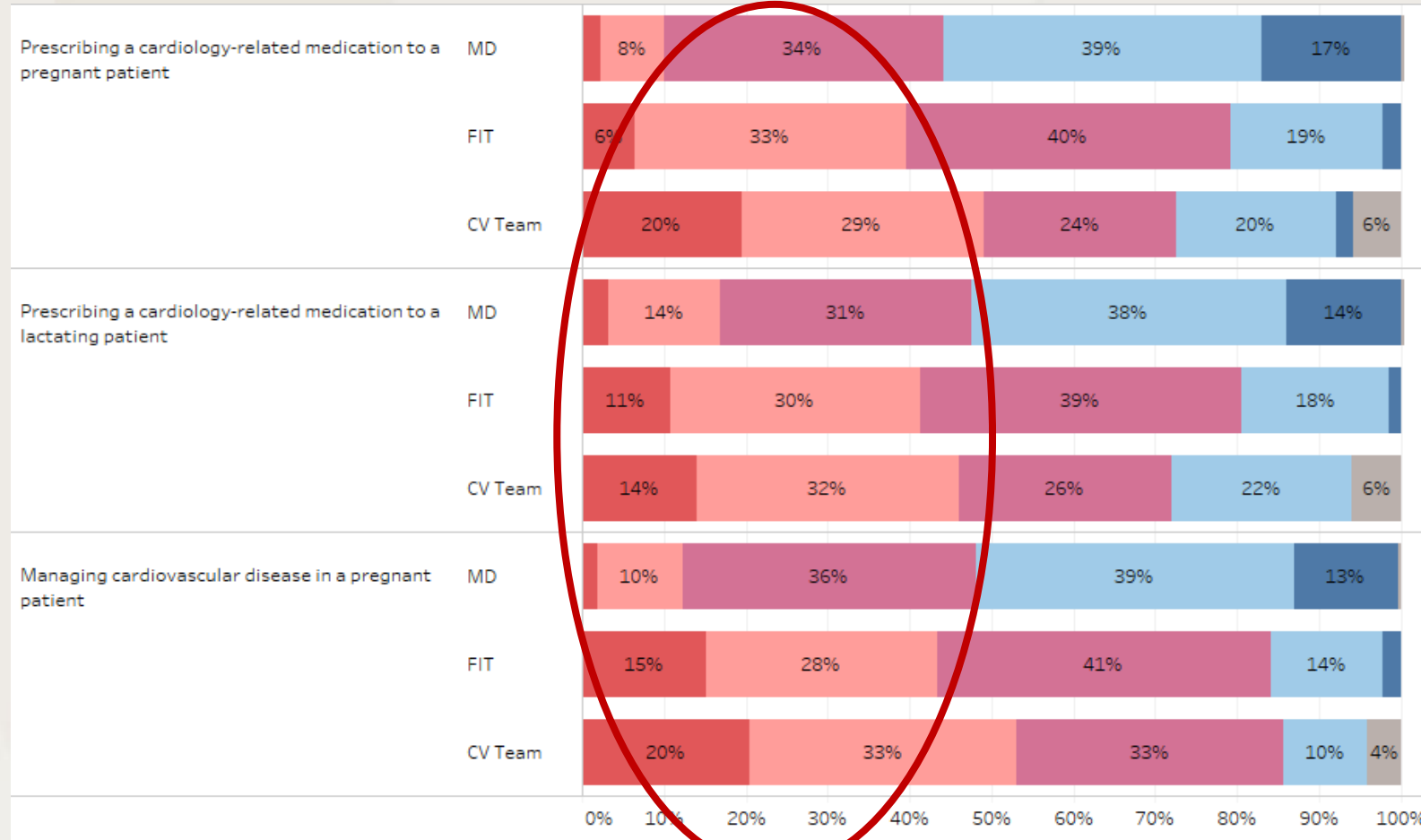
**Figure 9.** Distribution of Critical Factors among Pregnancy-Related Deaths



- Failure to Recognize Symptoms
- Chronic Conditions (esp obesity)

- Failure to Recognize Disease
- Ineffective Treatment
- Failure to Refer

# Cardiologist comfort with obstetric care



**Figure 4.** Gaps in Comfort Level for the treatment of CVD by topic for pregnant vs non-pregnant adults.

	MD	FIT	CV Team
Acute coronary syndromes during pregnancy	39%	67%	71%
Peripartum cardiomyopathy	18%	44%	57%
Chronic coronary artery disease during pregnancy	30%	51%	66%
Complex congenital heart disease	15%	11%	8%
Hypertension management during pregnancy	21%	38%	58%
Management of aortopathies during pregnancy and delivery	40%	55%	43%
Management of arrhythmias during pregnancy	33%	49%	58%
Management of prosthetic valves and anticoagulation in pregnancy	38%	46%	65%
Medication safety in lactation and pregnancy	42%	52%	68%
Multimodality imaging in pregnancy	30%	51%	39%
Performing a physical exam and interpreting cardiovascular physiology during pregnancy	24%	66%	53%
Recommending contraception to women with CVD	5%	21%	12%
Simple congenital heart disease	24%	31%	16%
Valvular disease in pregnancy	30%	69%	49%

Larger gap (%) indicates higher level of discomfort when treating pregnant patients. Note: just because the gap is small it doesn't imply comfort level is high, could be low for both pregnant and non-pregnant adults (component scores for pregnant and non-pregnant comfort level for the supplement)



**Figure 4.** Gaps in Comfort Level for the treatment of CVD by topic for pregnant vs non-pregnant adults.

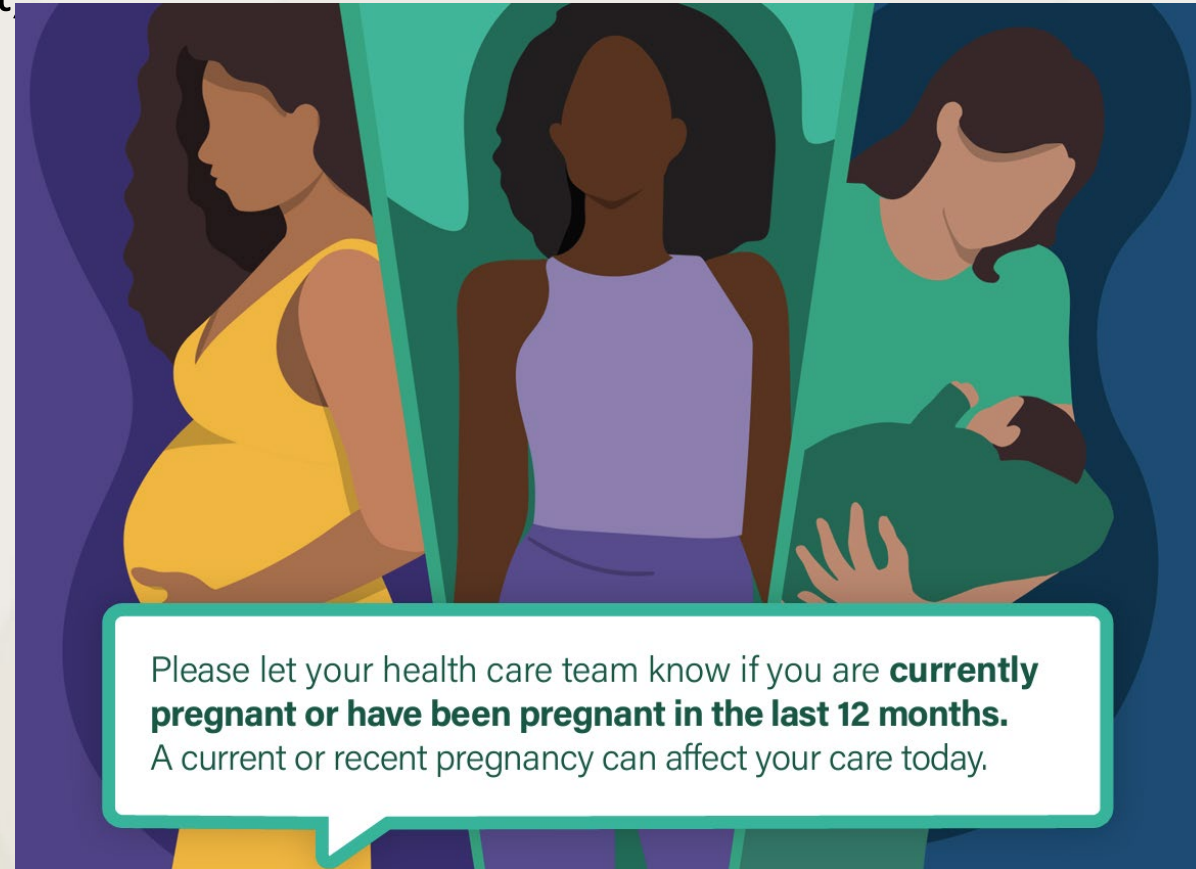
	MD	FIT	CV Team
Acute coronary syndromes during pregnancy	39%	67%	71%
Peripartum cardiomyopathy	18%	44%	57%
Chronic coronary artery disease during pregnancy	30%	51%	66%
Complex congenital heart disease	15%	11%	8%
Hypertension management during pregnancy	21%	38%	58%
Management of aortopathies during pregnancy and delivery	40%	55%	43%
Management of arrhythmias during pregnancy	33%	49%	58%
Management of prosthetic valves and anticoagulation in pregnancy	38%	46%	65%
Medication safety in lactation and pregnancy	42%	52%	68%
Multimodality imaging in pregnancy	30%	51%	39%
Performing a physical exam and interpreting cardiovascular physiology during pregnancy	24%	66%	53%
Recommending contraception to women with CVD	5%	21%	12%
Simple congenital heart disease	24%	31%	16%
Valvular disease in pregnancy	30%	69%	49%

Larger gap (%) indicates higher level of discomfort when treating pregnant patients. Note: just because the gap is small it doesn't imply comfort level is high, could be low for both pregnant and non-pregnant adults (component scores for pregnant and non-pregnant comfort level for the supplement)

# New Emergency Tools and Resources

- Download these free resources to your phone or tablet, print for your department, or incorporate into your electronic health record:
  - Acute Hypertension in Pregnancy and Postpartum clinical algorithm
  - Eclampsia clinical algorithm
  - Cardiovascular Disease (CVD) in Pregnancy and Postpartum clinical algorithm
  - Patient-facing sign requesting that patients disclose pregnancy status (English and Spanish)

**Download these resources today:**  
**[www.acog.org/obemergencies](http://www.acog.org/obemergencies)**



**Ask your patient,  
“Are you pregnant or have you been pregnant in the last 12 months?”**



**Consider the leading causes of pregnancy-related deaths in your differential diagnosis**

**Hemorrhage**

**Cardiac and coronary  
conditions**

**Infection**

**Thrombotic embolism**

**Cardiomyopathy**

**Hypertensive disorders  
of pregnancy**



**Refer to clinical algorithms and protocols to help you identify and treat a patient with an  
obstetric emergency**

## Cardiovascular Disease (CVD) in Pregnancy & Postpartum Algorithm

Ask your patient:

**"Are you pregnant or have you been pregnant in the last 12 months?"**

If yes, symptoms may be related to pregnancy and can occur up to 12 months postpartum.

**CVD can happen in this patient group regardless of age. Don't ignore red flags!**

### Red Flags for Cardiovascular Disease

- Shortness of breath at rest
- Chest pain at rest, with minimal exertion or ripping/tearing in quality
- Palpitations associated with near syncope
- Severe orthopnea
- Resting HR  $\geq 120$  bpm
- Resting systolic BP  $\geq 160$  or  $< 90$
- Resting RR  $\geq 25$
- Oxygen saturation  $\leq 94\%$ , with or without personal history of CVD
- Loud systolic murmur, diastolic murmur, S3, or S4
- Wheezing, crackles on lung exam
- Distended neck veins

### Consider in your differential diagnosis:

Myocardial infarction (including spontaneous coronary artery dissection), peripartum cardiomyopathy, congestive heart failure, arrhythmia, aortic dissection

### Key Work-up

EKG, BNP, chest X-ray, and troponin

### If testing is abnormal, CVD is a possible diagnosis:

- Obtain echocardiogram, consider transferring patient to obtain if not available at your facility
- Consult with cardiology and obstetrics or maternal-fetal medicine, if available
- Consider treatment and admission or transfer as clinically indicated

### Treatment

Most medications for the treatment of cardiovascular emergencies do not have robust data surrounding their use in pregnancy and breastfeeding. These medications should **not** be withheld from a pregnant or breastfeeding patient in a life-threatening emergency if they are otherwise indicated. However, long-term use of certain medications should be avoided or may be contraindicated in pregnant or lactating patients; consult a pharmaceutical reference, obstetrics, or cardiology for further considerations.

### Other Signs and Symptoms

may be vague but can include:

#### Chief Complaints

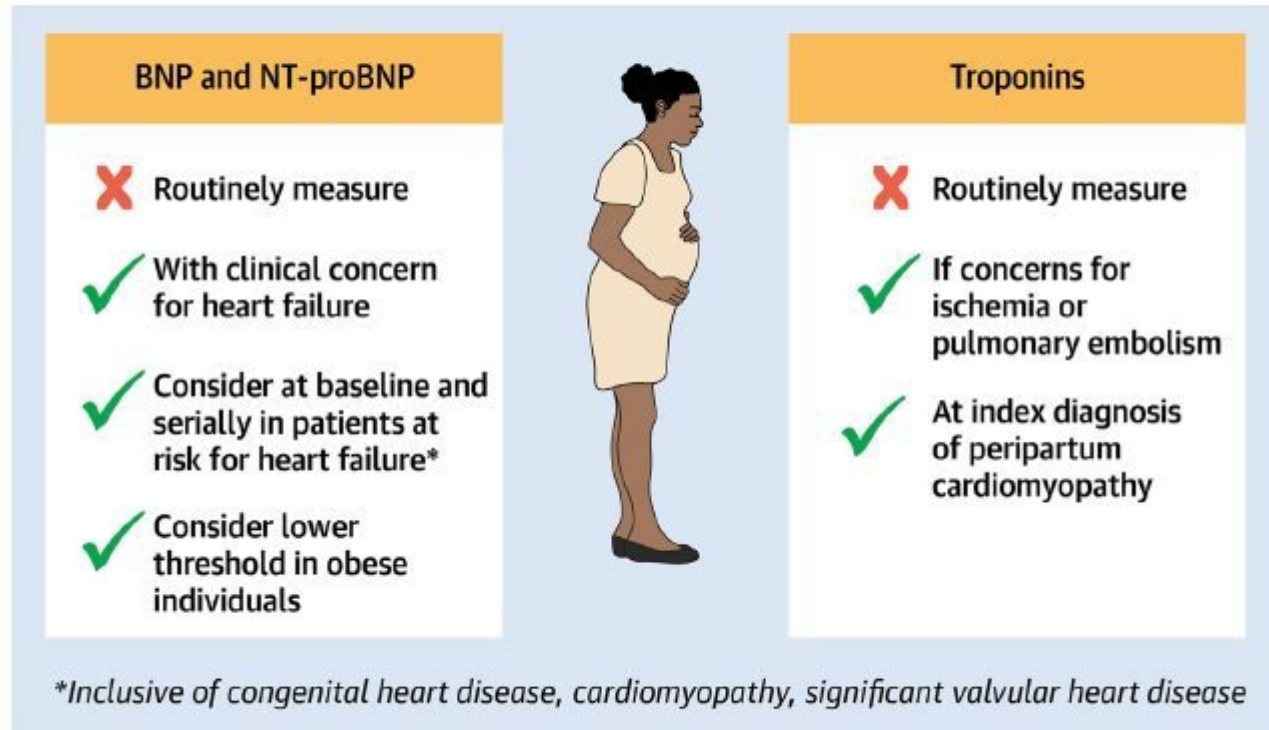
- Dyspnea
- Edema
- Cough
- Change in exercise tolerance
- Paroxysmal nocturnal dyspnea (PND)

#### Physical exam findings

- Desaturation with ambulation
- Murmur
- Peripheral edema

# Cardiac Biomarker Use During Pregnancy

## CENTRAL ILLUSTRATION The Utilization of Cardiac Biomarkers During Pregnancy: Suggestions for Clinical Practice



Sarma AA, et al. JACC Adv. 2022;1(3):100064.



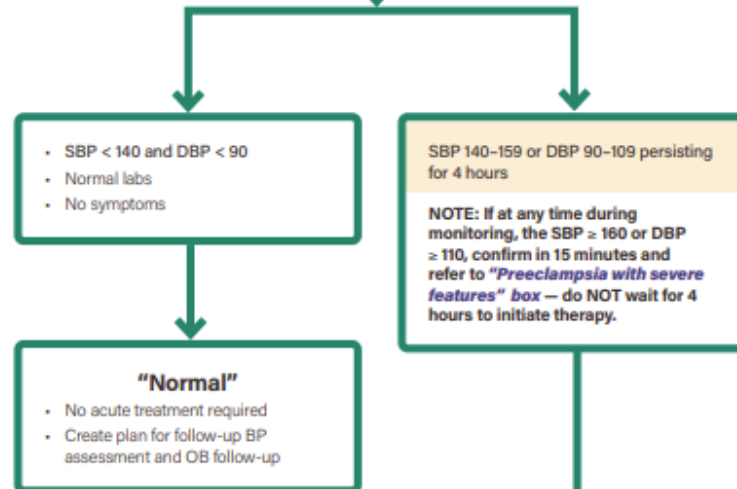
# Acute Hypertension in Pregnancy & Postpartum Algorithm

Ask the patient:  
**"Are you pregnant or have you been pregnant in the last 6 weeks?"**  
 If yes, these symptoms may be related to pregnancy and can occur up to 6 weeks postpartum.

≥20 weeks pregnant **OR** ≤6 weeks postpartum  
**AND**  
 SBP ≥ 140 or DBP ≥ 90 (with normal BP previously):

- Monitor BP every 15 minutes for up to 4 hours
- Assess for signs/symptoms (**see Box 1**)
- Consider obtaining labs (**see Box 2**)

**NOTE: If at any time the SBP ≥ 160 or DBP ≥ 110, confirm in 15 minutes and then proceed directly to "Preeclampsia with severe features" box — do NOT wait to initiate therapy.**



## Box 1

### Potential Signs/Symptoms

- New-onset headache
- Visual disturbances
- RUQ or epigastric pain
- Shortness of breath; pulmonary edema
- Oliguria
- If your pregnant or postpartum patient has hypertension and severe headache, consider **STROKE**.

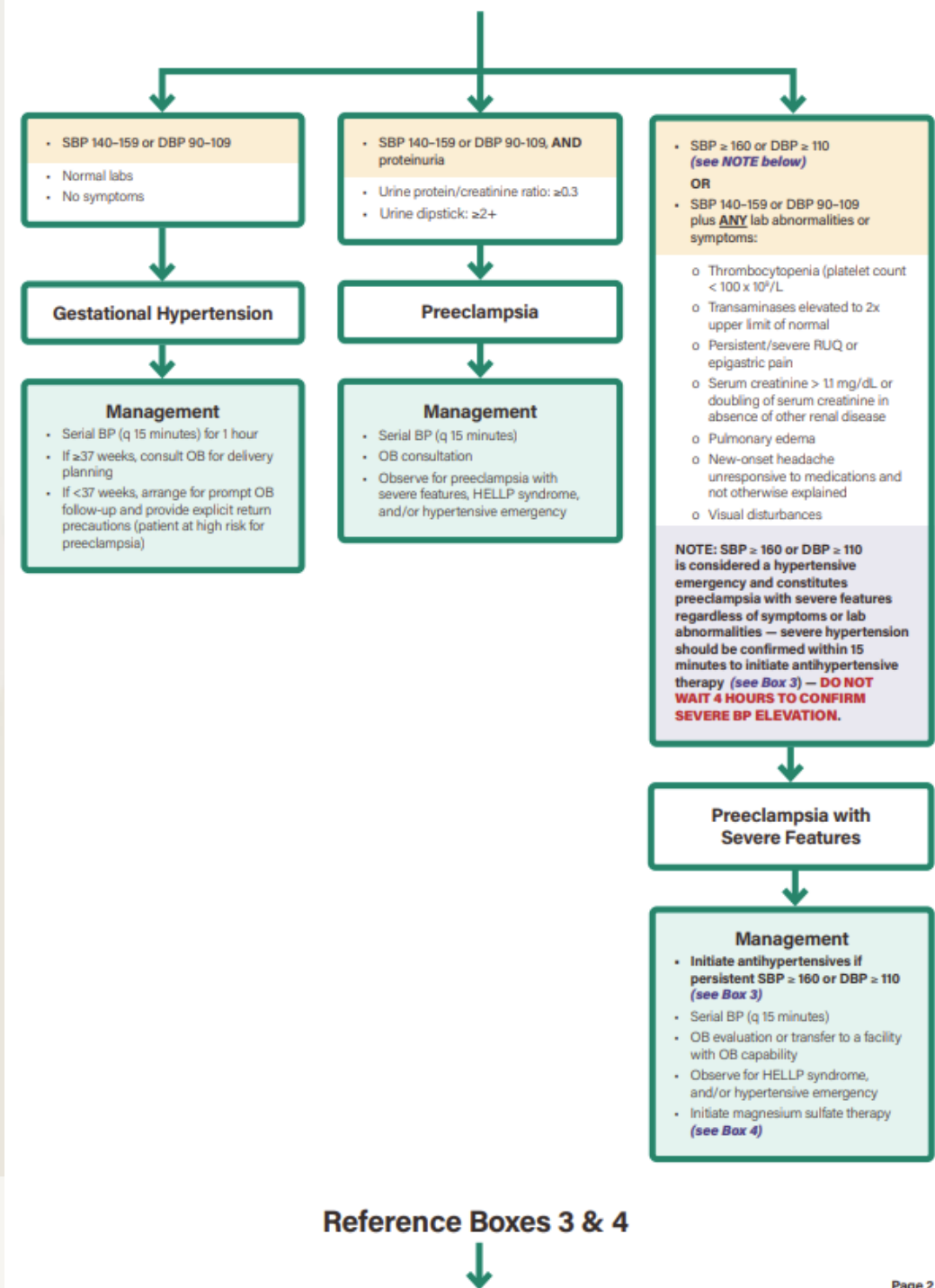
## Box 2

### Labs to Consider

- CBC
- AST, ALT
- Serum creatinine
- Urine protein:
  - Urine protein/creatinine ratio
  - Urine dipstick if 24-hour urine protein or protein/creatinine ratio is not available

### Imaging to Consider

- Head CT if severe headache or any neurological symptoms

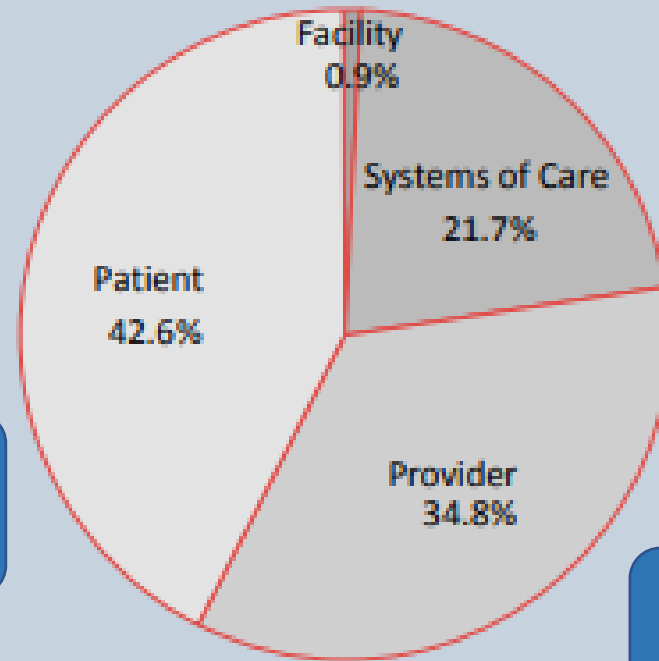


Reference Boxes 3 & 4



# Improve Delivery of Care

**Figure 9.** Distribution of Critical Factors among Pregnancy-Related Deaths



- Failure to Recognize Symptoms
- Chronic Conditions (esp obesity)

- Lack of Communication
- Barriers to Coordination of Care

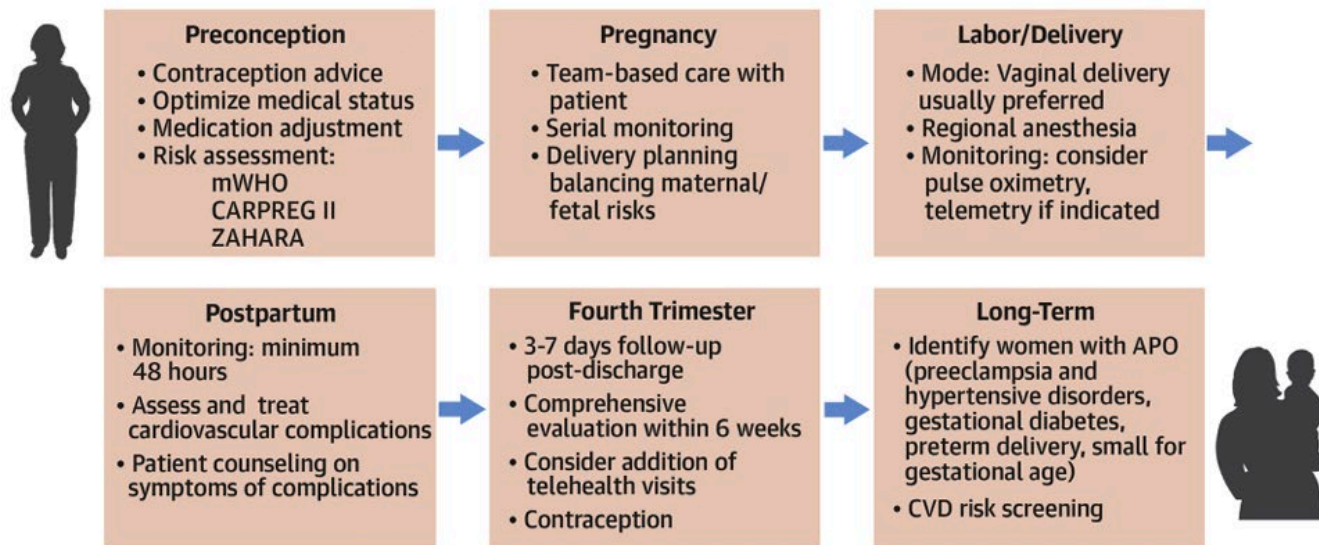
- Failure to Recognize Disease
- Ineffective Treatment
- Failure to Refer

# EXPERT, COORDINATED care is a KEY SOLUTION to reducing maternal mortality

- Multidisciplinary Approach
- Pre-conception Counseling
- Delivery Planning
- Managing Cardiac Complications
- Contraception Counseling



# Medicine is a Team Sport



Davis, M.B. et al. J Am Coll Cardiol. 2021;77(14):1763-77.



# Transition to ACHD Care

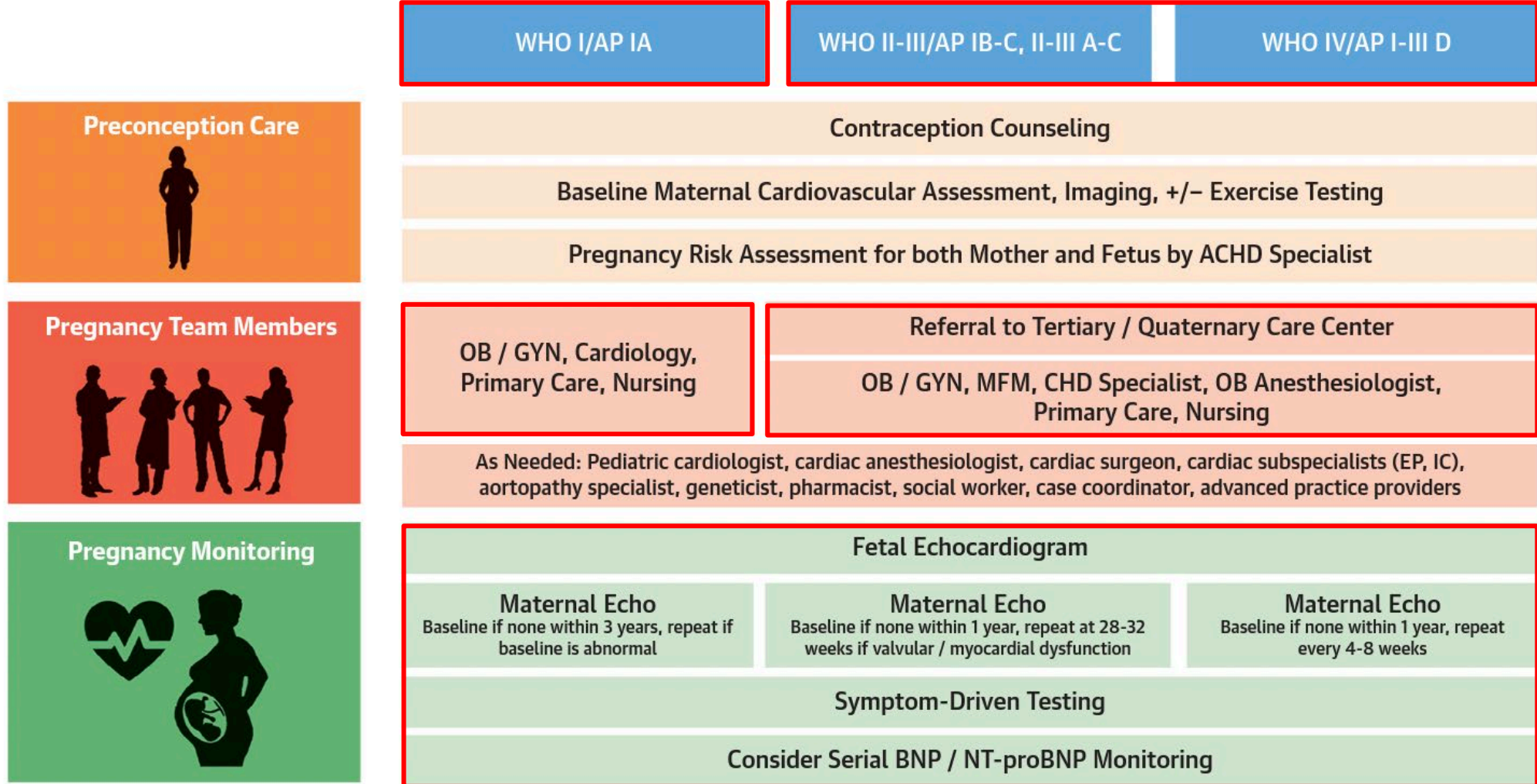
Up to 63% have significant lapse in care



Pregnancy is reason for return to care in 12% of patients.



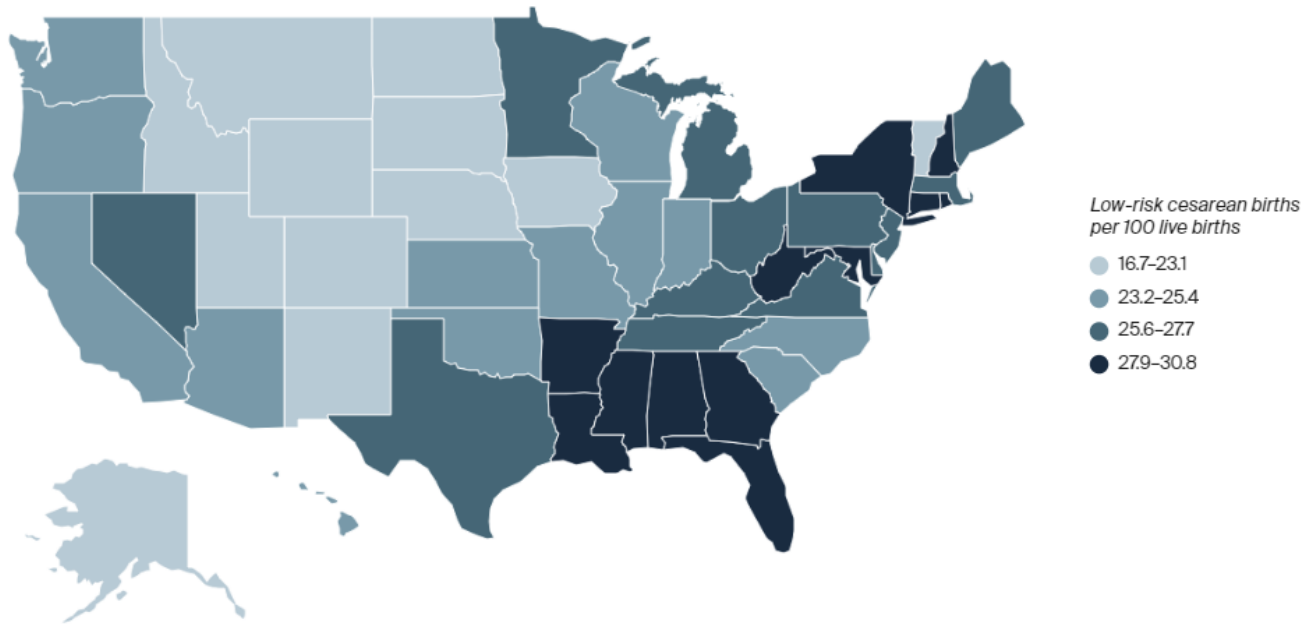
## CENTRAL ILLUSTRATION Multidisciplinary Cardio-Obstetrics Team Management for Women with Congenital Heart Disease



Lindley, K.J. et al. J Am Coll Cardiol. 2021;77(14):1778-98.

# Let them push!

Low-risk cesarean births — a key indicator of lower quality maternal health care — is more common on the East Coast and in the southern U.S.



JACC: HEART FAILURE  
© 2023 BY THE AMERICAN COLLEGE OF CARDIOLOGY FOUNDATION  
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## EDITORIAL COMMENT

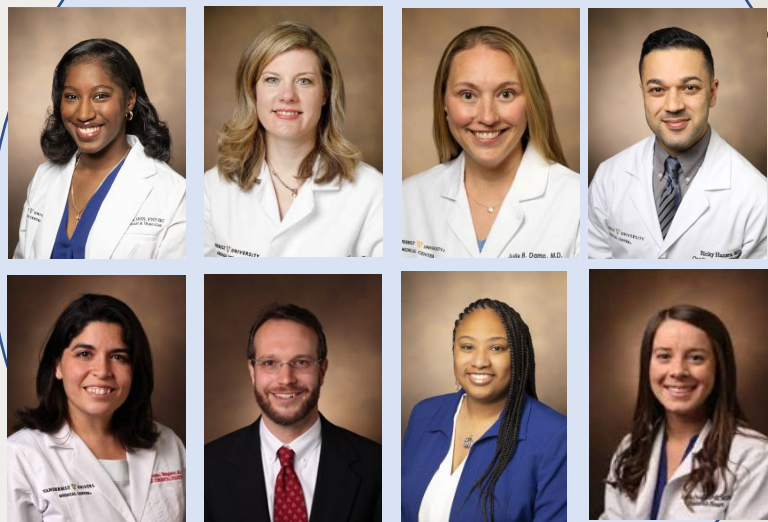
### Vaginal Delivery Remains the Preferred Mode of Delivery for Almost All Women With Cardiovascular Disease\*



Kathryn J. Lindley, MD,<sup>a,b</sup> Mary Norine Walsh, MD<sup>c,d</sup>



## Cardiology



## OB/GYN



## Support Services



## Anesthesia



## Neurology



# The VUMC Cardio-OB Team!

## Pediatrics



# An ounce of prevention...

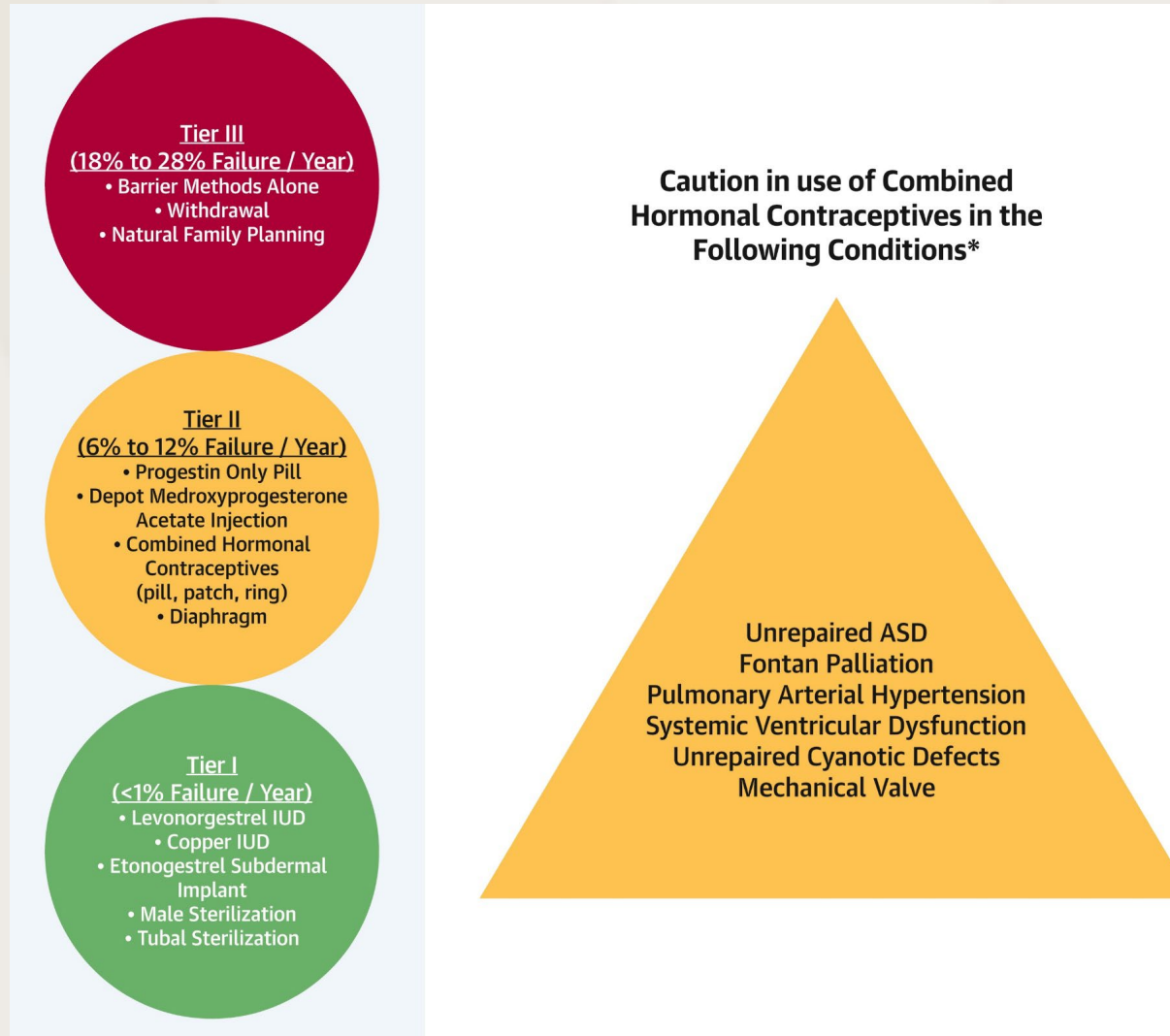
Women with heart disease should receive counseling on contraception

- PLANNING pregnancy for lower-risk patients
- PREVENTING pregnancy for highest-risk patients

Two important questions

- Is it safe?
- Does it work?

# Contraception Traffic Lights



# Conclusions

- Maternal morbidity and mortality is preventable!
  - Increase access to care
  - Increase provider education
  - Increase collaborative care

# Thank You!

Kathryn.Lindley@vumc.org

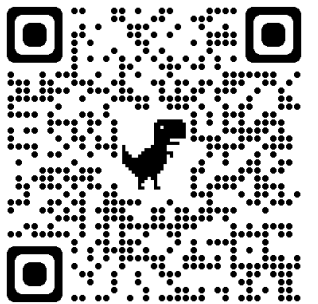
 @DrKLindley

#cardioobstetrics

VANDERBILT  HEALTH

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Women's Heart Center





# Suggested Reading

- Davis MB, Arendt K, Bello NA, Brown H, Briller J, Epps K, Hollier L, Langen E, Park K, Walsh MN, Williams D, Wood M, Silversides CK, Lindley KJ; American College of Cardiology Cardiovascular Disease in Women Committee and the Cardio-Obstetrics Work Group. Team-Based Care of Women With Cardiovascular Disease From Pre-Conception Through Pregnancy and Postpartum: JACC Focus Seminar 1/5. JACC 2021. 77(14):1763-1777.
- Lindley KJ, Bairey Merz CN, Asgar AW, Bello NA, Chandra S, Davis MB, Gomberg-Maitland M, Gulati M, Hollier LM, Krieger EV, Park K, Silversides C, Wolfe NK, Pepine CJ; American College of Cardiology Cardiovascular Disease in Women Committee and the Cardio-Obstetrics Work Group. Management of Women With Congenital or Inherited Cardiovascular Disease From Pre-Conception Through Pregnancy and Postpartum: JACC Focus Seminar 2/5. JACC 2021. 77(14):1778-17798.
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- Bello N A, Bairey Merz CN, Brown H, Davis MB, Dickert NW, El Hajj SC, Giullian C, Quesada O, Park K, Sanghanii RM, Shaw L, Volgman AS, Wenger NK, Williams D, Pepine CJ, Lindley KJ; American College of Cardiology Cardiovascular Disease in Women Committee and the Cardio-Obstetrics Work Group. Diagnostic Cardiovascular Imaging and Therapeutic Strategies in Pregnancy: JACC Focus Seminar 4/5. JACC 2021. 77(14):1813-1822.
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- Lindley KJ, Teal SB. Contraception in Women with Cardiovascular Disease. JAMA 2022. Aug 9;328(6):577-578.
- Lindley KJ, Walsh MN. Vaginal Delivery Remains the Preferred Mode of Delivery for Almost All Women with Cardiovascular Disease. JACC: Heart Failure 2023. 11(12):1690-1691.





**Questions?**

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