MACON & JOAN BROCK
VIRGINIA HEALTH SCIENCES
AT OLD DOMINION UNIVERSITY

Pregnancy & Heart Disease

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Eastern Virginia Medical School
at Old Dominion University

Objectives

- Review of cardiovascular changes in pregnancy
- Normal and abnormal cardiopulmonary signs and symptoms
- Risk stratification and assessment tools for pregnancy and the postpartum period

Circulation

AHA SCIENTIFIC STATEMENT

Cardiovascular Considerations in Caring for Pregnant Patients

A Scientific Statement From the American Heart Association

Mehta et al, Circulation (2020).

ESC
European Society of Cardiology
European Heart Journal (2018) **39**, 3165–3241
doi:10.1093/eurheartj/ehy340

ESC GUIDELINES

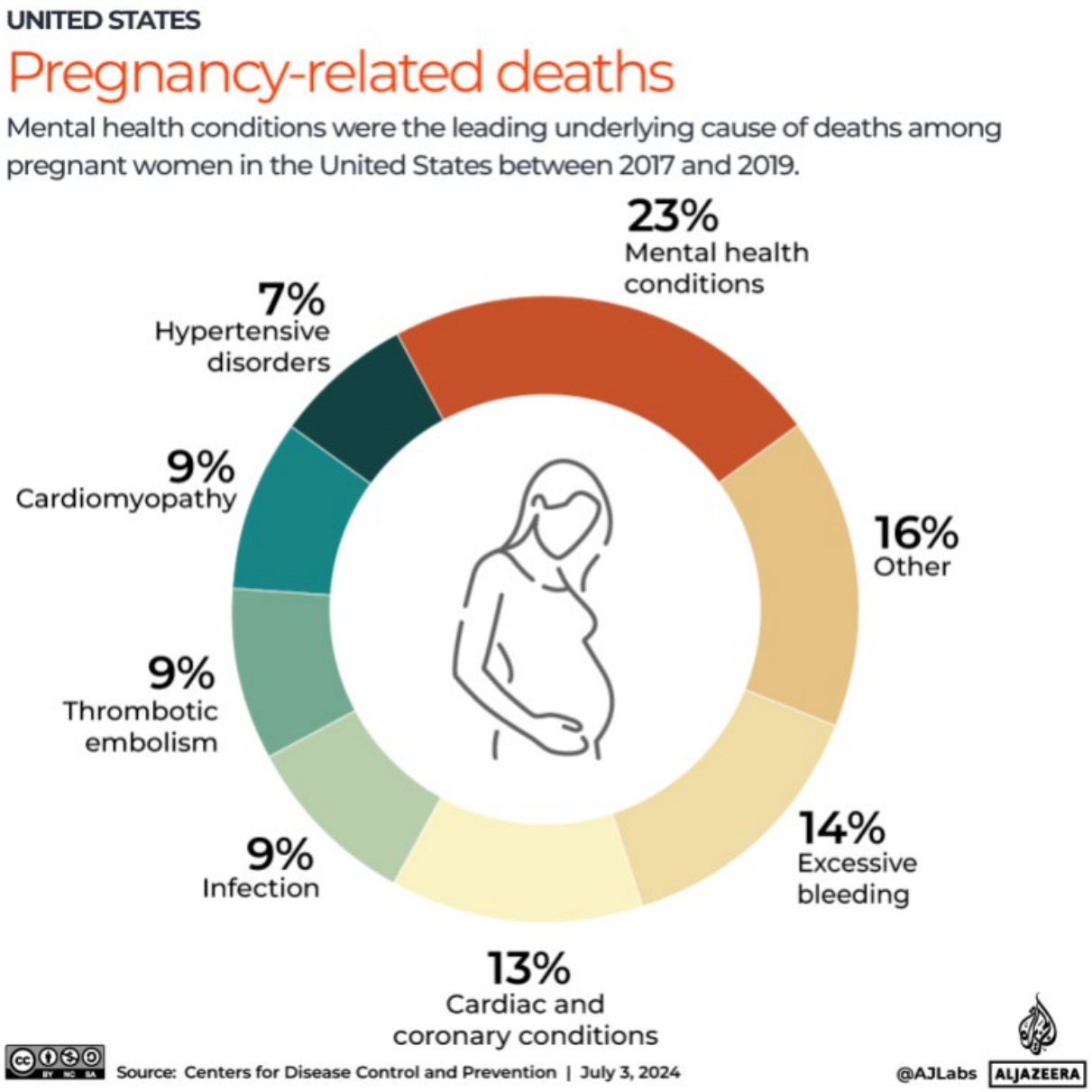
2018 ESC Guidelines for the management of cardiovascular diseases during pregnancy

The Task Force for the Management of Cardiovascular Diseases during Pregnancy of the European Society of Cardiology (ESC)

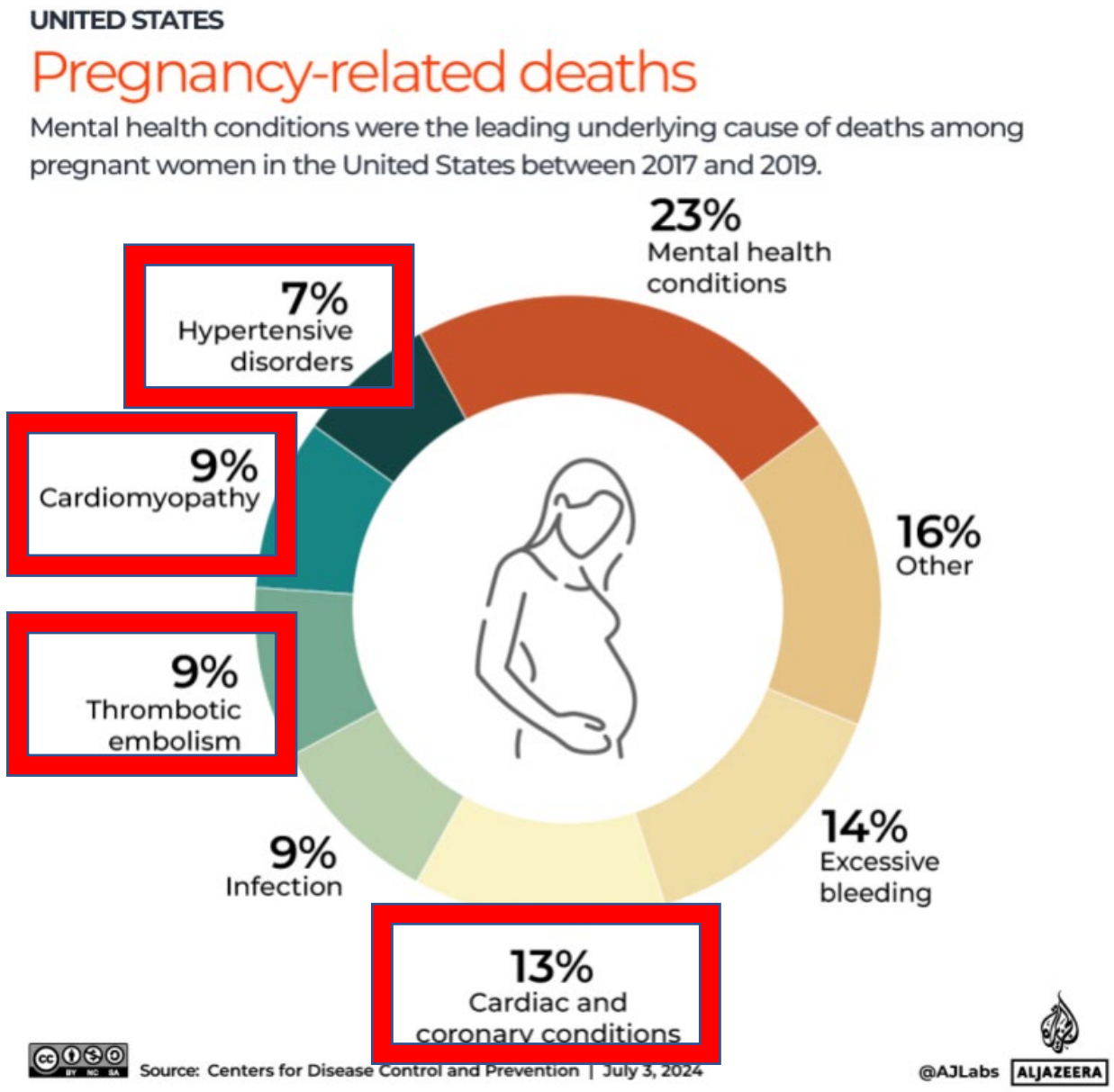
Introduction

- Cardiovascular disease complicates 0.2-4% of pregnancies
- May be difficult to differentiate from normal pregnancy symptoms

ESC Guidelines on Cardiovascular Disease in Pregnancy (2018).

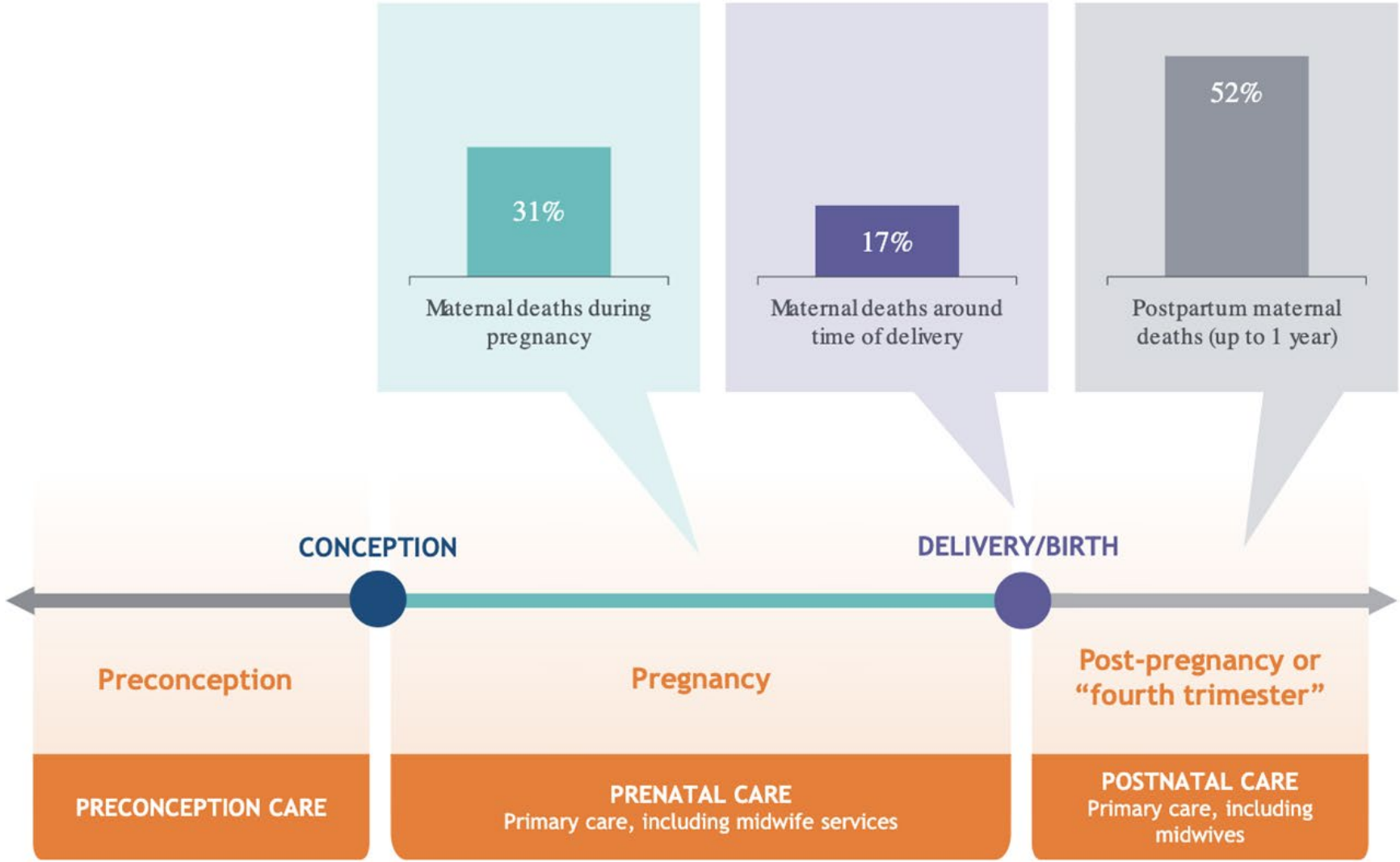


- Cardiovascular disease is a leading cause of pregnancy related mortality in the United States



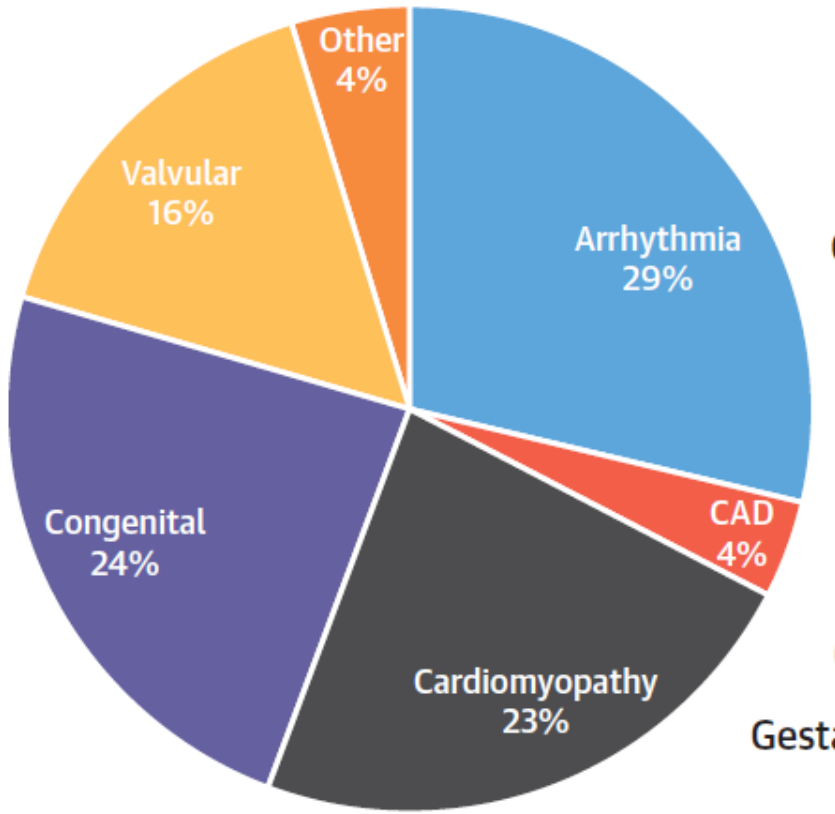
- Cardiovascular disease is a leading cause of pregnancy related mortality in the United States
- **“Four in 5 pregnancy related deaths in the U.S. are preventable”**

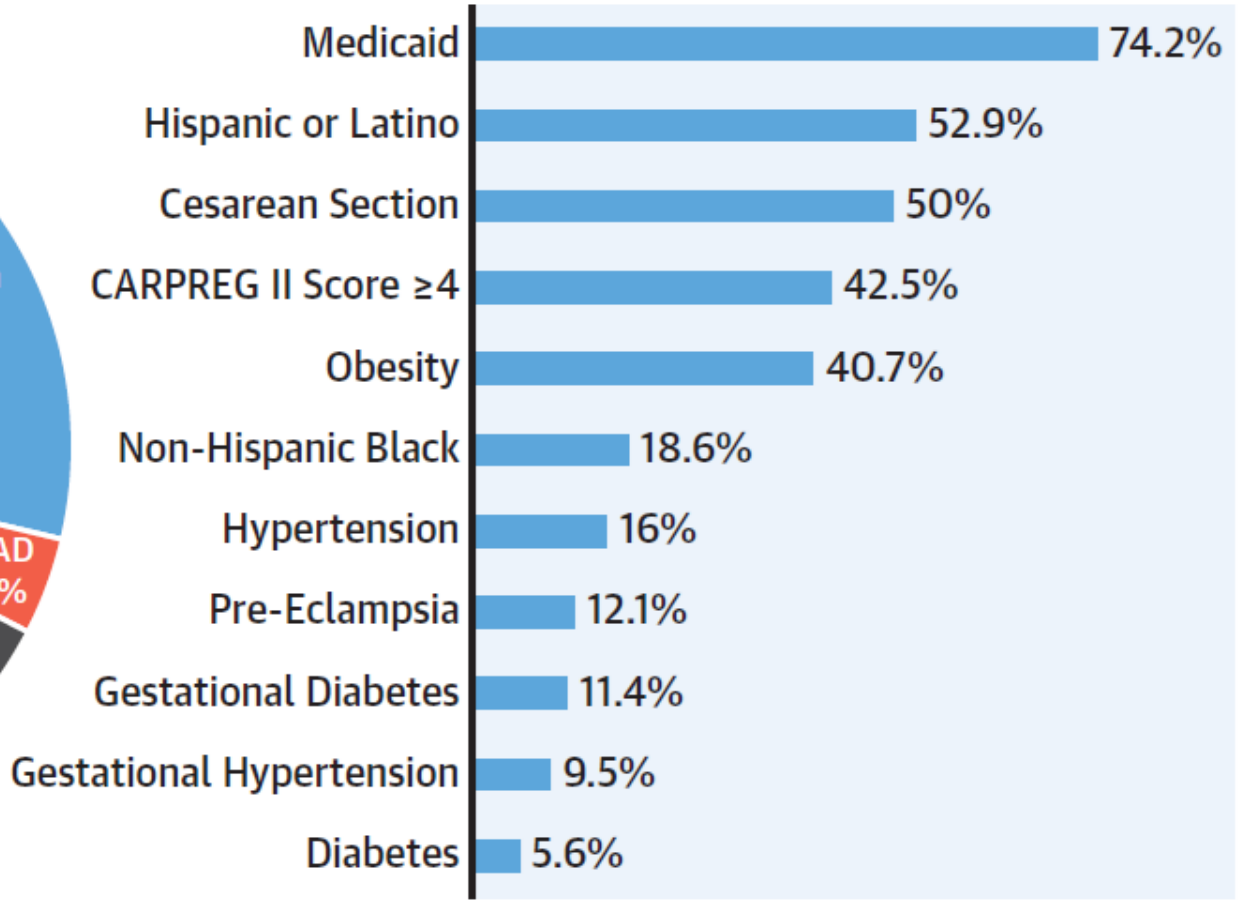
Half of pregnancy-related deaths occur after the day of birth.



Source: Eugene Declercqand Laurie Zephyrin, *Maternal Mortality in the United States: A Primer* (Commonwealth Fund, Dec. 2020). https://doi.org/10.26099/ta1q-mw24

CENTRAL ILLUSTRATION Characteristics of Patients Evaluated by Our Cardio-Obstetrics Team





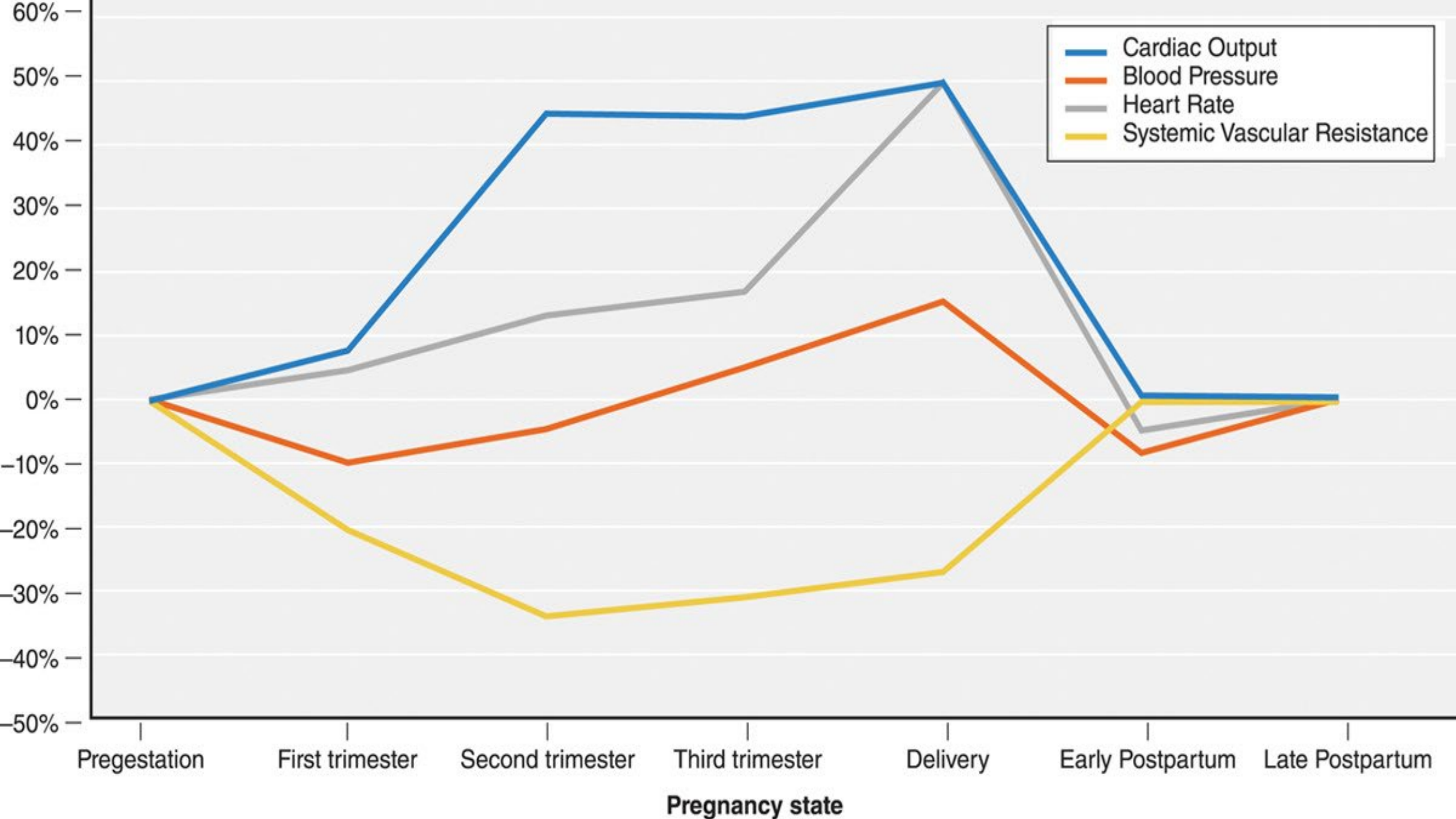
Magun, E. et al. J Am Coll Cardiol. 2020;76(18):2102-13.

The patient population seen by our cardio-obstetrics program has a variety of underlying cardiovascular disease as displayed in the pie chart. It is also notable that the majority of our patients are Hispanic or Latino women with Medicaid. CAD = coronary artery disease; CARPREG = Cardiac Disease in Pregnancy.

Why does this occur in pregnancy?

- Hemodynamic and physiologic adaptations of pregnancy
  - 50% increase in intravascular volume
  - Decreased systemic vascular resistance
  - Marked fluctuation of cardiac output
  - Hypercoagulability
- Increased cardiac demand in the peripartum period
- Limited safety data on medications

- Increased risk of cardiac complications in pregnancy


60%
50%
40%
30%
20%
10%
0%
−10%
−20%
−30%
−40%
−50%
Cardiac Output
Blood Pressure
Heart Rate
Systemic Vascular Resistance
Pregestation
First trimester
Second trimester
Third trimester
Delivery
Early Postpartum
Late Postpartum
Pregnancy state

Cardiovascular Symptoms in Pregnancy

- Normal Symptoms
  - Dyspnea
  - Orthopnea
  - Easy fatigability
  - Presyncope
  - Syncope

Foley, Obstetric Intensive Care Manual (2016)
Creasy and Resnik (2012)

Cardiovascular Symptoms in Pregnancy

- Normal Symptoms
  - Dyspnea
  - Orthopnea
  - Easy fatigability
  - Presyncope
  - Syncope
- Abnormal Symptoms
  - Severe dyspnea
  - Hemoptysis
  - Paroxysmal nocturnal dyspnea
  - Syncope with exertion
  - Chest pain with exertion

Foley, Obstetric Intensive Care Manual (2016)
Creasy and Resnik (2012)

Cardiovascular Signs in Pregnancy

- Normal Findings
  - Dependent edema
  - Rales in lower lung fields
  - Increased JVP
  - Cardiomegaly
  - Systolic murmur
  - S3 gallop

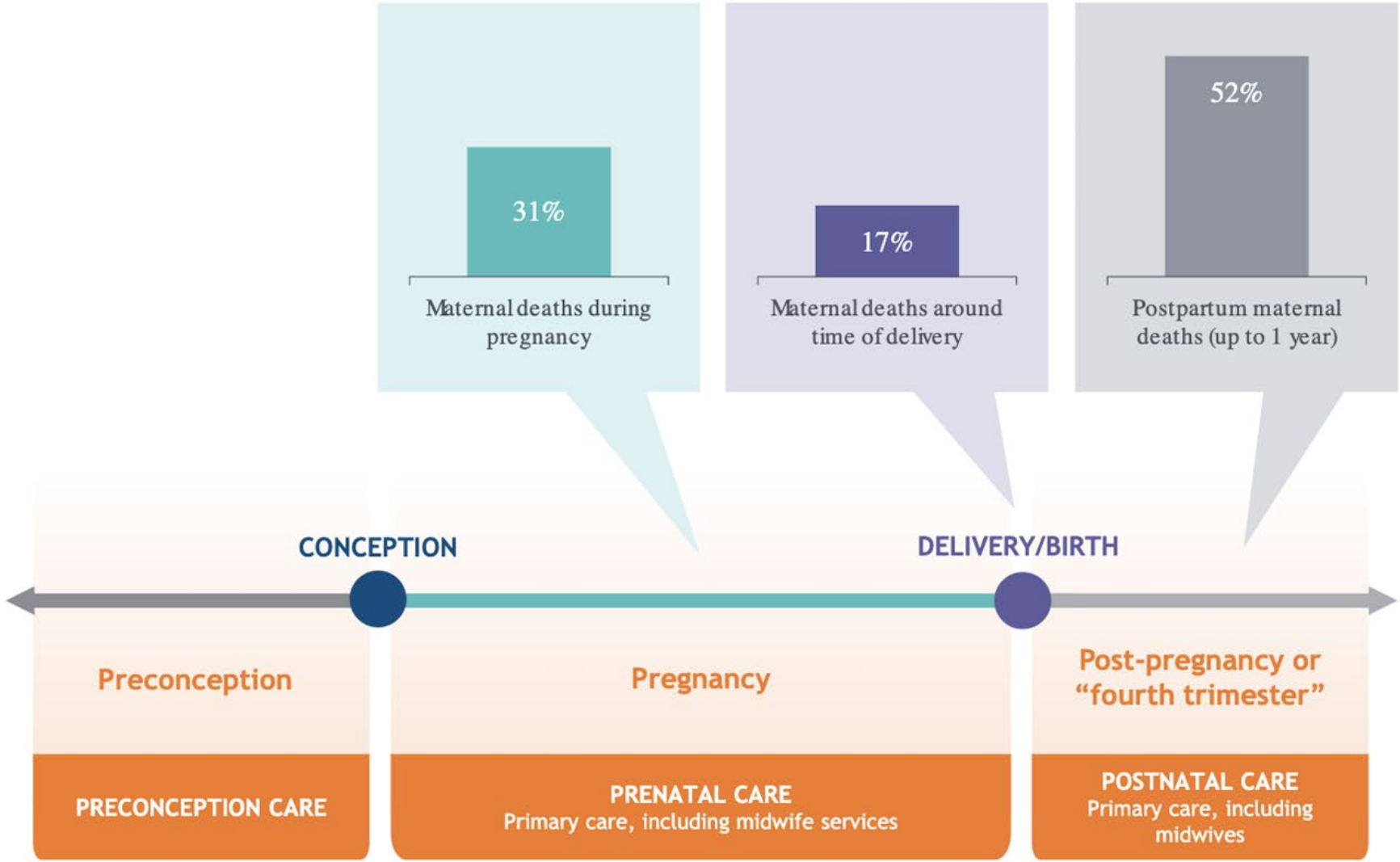
Foley, Obstetric intensive care manual (2016)

Cardiovascular Signs in Pregnancy

- Normal Findings
  - Dependent edema
  - Rales in lower lung fields
  - Increased JVP
  - Cardiomegaly
  - Systolic murmur
  - S3 gallop
- Abnormal Findings
  - Sustained arrhythmias
  - Cyanosis
  - Clubbing
  - Harsh systolic murmur
  - Diastolic murmur
  - S4 gallop

Foley, Obstetric intensive care manual (2016)

Half of pregnancy-related deaths occur after the day of birth.



Source: Eugene Declercqand Laurie Zephyrin, *Maternal Mortality in the United States: A Primer* (Commonwealth Fund, Dec. 2020). https://doi.org/10.26099/ta1q-mw24

Preconception

Time period
At least 3 months prior to conception

Recommendations

1. ***Identify and screen*** women for cardiovascular risk factors
2. ***Educate*** patients on their individual risk factors and the impact on cardiovascular health
3. ***Assess*** and assist with barriers to care and adverse SDOH
4. *Optimize* cardiometabolic health and modifiable ASCVD risk factors based on the AHA's ***"Life's Essential 8"***

Pregnancy

Time period
Fertilization and implantation until delivery of fetus, spanning three trimesters

Recommendations

1. ***Multidisciplinary monitoring*** during pregnancy for women with risk factors
2. ***Treat*** pregnancy associated conditions per current guidelines

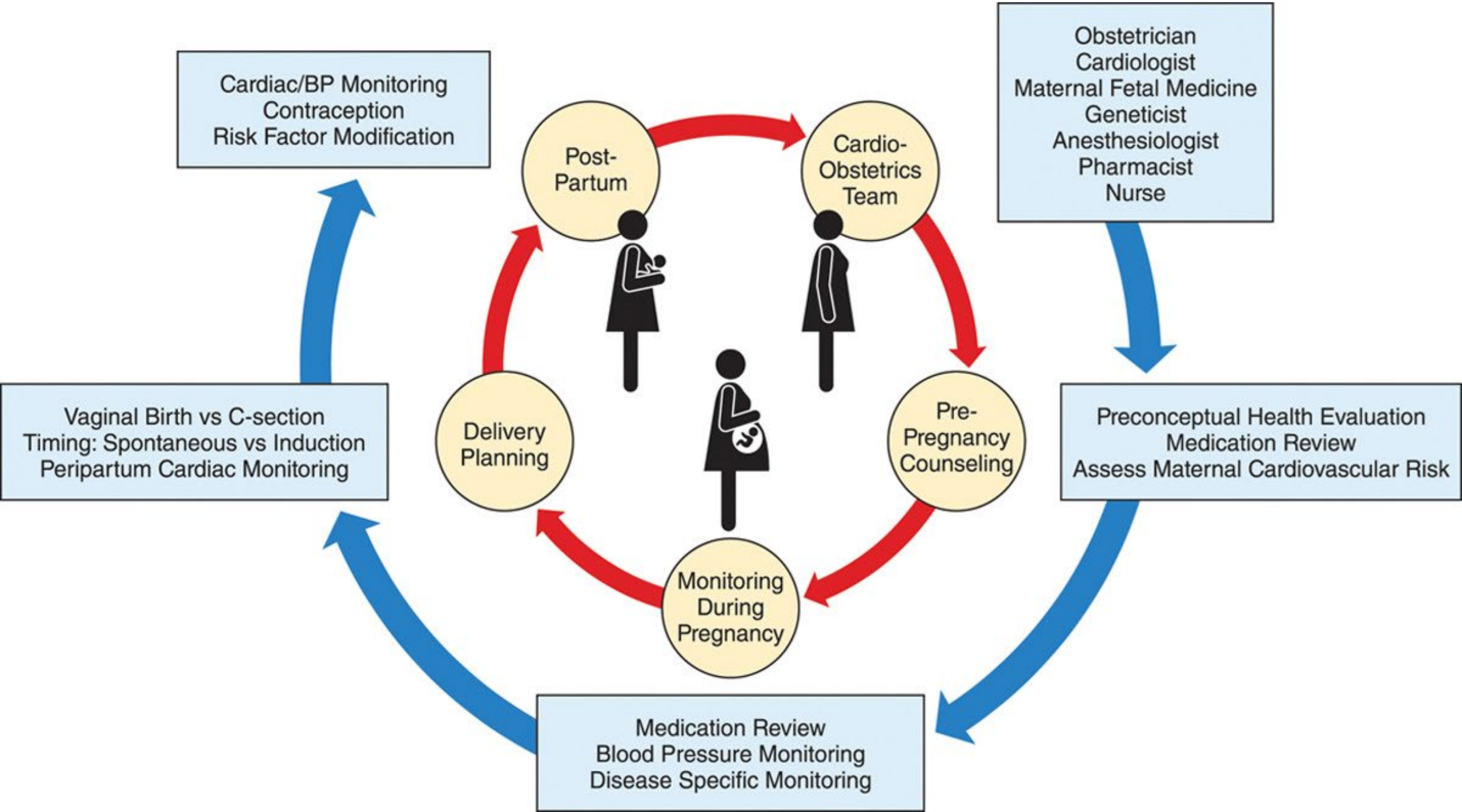
Postpartum, 4th Trimester

Time period
weeks to 3 months after delivery

Recommendations

1. ***Adjust*** post-partum visit frequency per guidelines and clinical need
2. ***Continue screening for and treating*** *chronic conditions associated with pregnancy related conditions*
3. ***Transition*** to primary and specialty care for risk factor management
4. ***Reinitiate*** pharmacologic therapy that was held during pregnancy and lactation or **start** appropriate therapy that was deferred

Reinforce AHA's *Life's Essential 8* throughout the pregnancy continuum


Obstetrician
Cardiologist
Maternal Fetal Medicine
Geneticist
Anesthesiologist
Pharmacist
Nurse
Cardiac/BP Monitoring
Contraception
Risk Factor Modification
Post-Partum
Cardio-Obstetrics Team
Pre-Pregnancy Counseling
Monitoring During Pregnancy
Delivery Planning
Preconceptual Health Evaluation
Medication Review
Assess Maternal Cardiovascular Risk
Vaginal Birth vs C-section
Timing: Spontaneous vs Induction
Peripartum Cardiac Monitoring
Medication Review
Blood Pressure Monitoring
Disease Specific Monitoring

Preconception Counseling

- Review of cardiac history
  - Previous cardiac disease/lesion, medications, surgeries
  - History of cardiac events
- Planning for pregnancy
  - Imaging and monitoring
  - Risk stratification and counseling
  - Genetic counseling
  - Recommendations for optimization prior to pregnancy

Risk Stratification

- Classification systems are used to estimate individual maternal cardiovascular risk in women with CVD

Modified WHO Classification

Class	Risk in pregnancy	Conditions
I	No increased risk of mortality No/Small increase in morbidity	Pulmonary stenosis (mild) Patent ductus arteriosus Mitral valve prolapse Successfully repaired simple shunts
II	Small increase risk of mortality Moderate increase in morbidity	Unrepaired septal defect Repaired TOF Turner syndrome without aortic dilation
II-III		Mild LVEF impairment Native tissue valve disease Marfan syndrome without aortic dilation Bicuspid aortic valve with aorta < 45mm AVSD

Modified WHO Classification

III	Significantly increased risk of mortality or severe morbidity	LVEF 30-45% Mechanical valve Systemic RV with good or mildly impaired function Fontan without complication Unrepaired cyanotic disease Moderate mitral stenosis Severe aortic stenosis Moderate aortic dilation
IV	Extremely high risk of severe morbidity or mortality (PREGNANCY CONTRAINDICATED)	Significant PAH LVEF < 30%, NYHA III to IV Moderate RV dysfunction Severe mitral stenosis Severe symptomatic aortic stenosis Bicuspid aortic valve with aorta > 50mm Vascular Ehlers-Danlos Severe coarctation Fontan with any complication

CARPREG II

- 1pt = 5% risk
- 2 pts = 10% risk
- 3 pts = 15% risk
- 4 pts = 22% risk
- >4pts = 41% risk

Table 1: CARPREG II Risk Predictors

Predictor	Points
Prior cardiac events or arrhythmias	3
Baseline NYHA 3–4 or cyanosis	3
Mechanical valve	3
Systemic ventricular dysfunction LVEF<55 %	2
High-risk valve disease or left ventricular outflow tract obstruction (aortic valve area <1.5 cm^2, subaortic gradient >30, or moderate to severe mitral regurgitation, mitral stenosis < 2.0 cm^2)	2
Pulmonary hypertension, RVSP >49 mmHg	2
High-risk aortopathy	2
Coronary artery disease	2
No prior cardiac intervention	1
Late pregnancy assessment	1

Primary cardiac event risk: score = 1, 5 % risk, score = 2, 10 % risk, score = 3, 15 % risk, score = 4, 22 % risk and 41 % risk if score greater than 4. NYHA = New York Heart Association Functional Classification; LVEF = left ventricular ejection fraction; RVSP = right ventricular systolic pressure. Source: Silversides et al., 2018, with permission from Elsevier.[14]

ZAHARA

- Retrospective study of 1300 pregnancies with CHD

Predictors	Points		Total Points	Risk
Prior arrhythmias	**1.5**		**0**	**2.9%**
NYHA class ≥II	**0.75**		**0.5-1.5**	**7.5%**
Left heart obstruction (PG >50 mmHg or AVA <1 cm^2)	**2.5**		**1.51-2.50**	**17.5%**
Cardiac medication before pregnancy	**1.5**		**2.51-3.50**	**43.1%**
Systemic AV valve regurgitation	**0.75**		**>3.51**	**70%**
Pulmonary AV valve regurgitation	**0.75**			

Antihypertensive Medication

Angiotensin Converting Enzyme-Inhibitors

Certain ACEIs may be safe during lactation (captopril, enalapril).

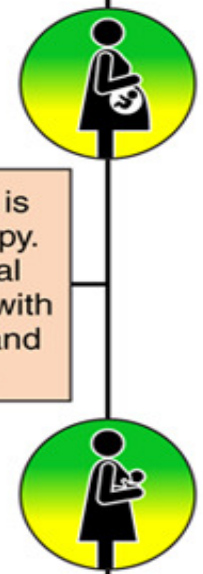
Angiotensin Receptor Blockers

Beta-Blockers and Combined Alpha/Beta Blockers

Labetalol is 1st line therapy. Possible increase risk of fetal growth restriction (propranolol, atenolol, metoprolol). Can result in neonatal bradycardia (nadolol, esmolol) and hypoglycemia.

May be safe during lactation except for atenolol. Carvedilol effects unknown.

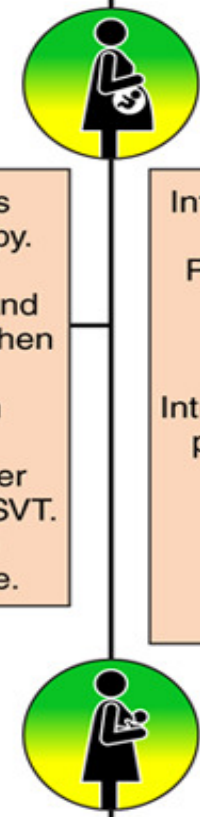
Alpha Adrenergic Agonists



Methyldopa is 1st line therapy. Mild neonatal hypertension with methyldopa and clonidine.

May use methyldopa and probably safe to use clonidine.

Calcium Channel Blockers



Nifedipine is 1st line therapy. Maternal hypotension and fetal hypoxia when used with magnesium sulphate. Verapamil over diltiazem for PSVT. Amlodipine probably safe.

Nifedipine is safe during lactation. Unclear about diltiazem and verapamil.

Vasodilators

Intravenous hydralazine is 1st line therapy. Possible risk of lupus like syndrome or reflex tachycardia with hydralazine. Intravenous nitroglycerin preferred drug when preeclampsia with pulmonary edema. Possible transient bradycardia with nitroprusside.

Hydralazine likely safe during lactation, nitroglycerin probably safe. Unknown effect with other agents.

Antithrombotic Agents

Antiplatelet Agents

Aspirin

Low dose aspirin is used in preeclampsia and no known deleterious effect during lactation. Avoid full dose given risk of premature closure of fetal ductal arteriosus.

$P2Y_{12}$ inhibitors

Use with caution. Clopidogrel is preferred agent but has limited data during pregnancy and lactation. Conflicting/unknown data for prasugrel and ticagrelor.

Anticoagulants

Vitamin K

Risk of coumadin embryopathy. Consider switching to heparin during 1st trimester. Switch to unfractionated heparin prior to planned vaginal delivery.

Unfractionated Heparin and Low Molecular Weight Heparin (enoxaparin)

Intravenous Direct Thrombin Inhibitors (bivalirudin, argatroban)

Use with caution during pregnancy and conflicting/unknown data for use during lactation.

Direct oral anticoagulants

Thrombolytics

Alteplase and streptokinase. Use with extreme caution due to increased risks of maternal hemorrhage. Limited data.

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Reinforce AHA's *Life's Essential 8* throughout the pregnancy continuum

Sentara

EVMS
Eastern Virginia Medical School

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Meet Our Team
Clinical Services and Treatments

Appointments or questions
757-446-7900

Sentara-EVMS Cardio-Obstetrics Center
825 Fairfax Avenue, Suite 310
Norfolk, VA 23507

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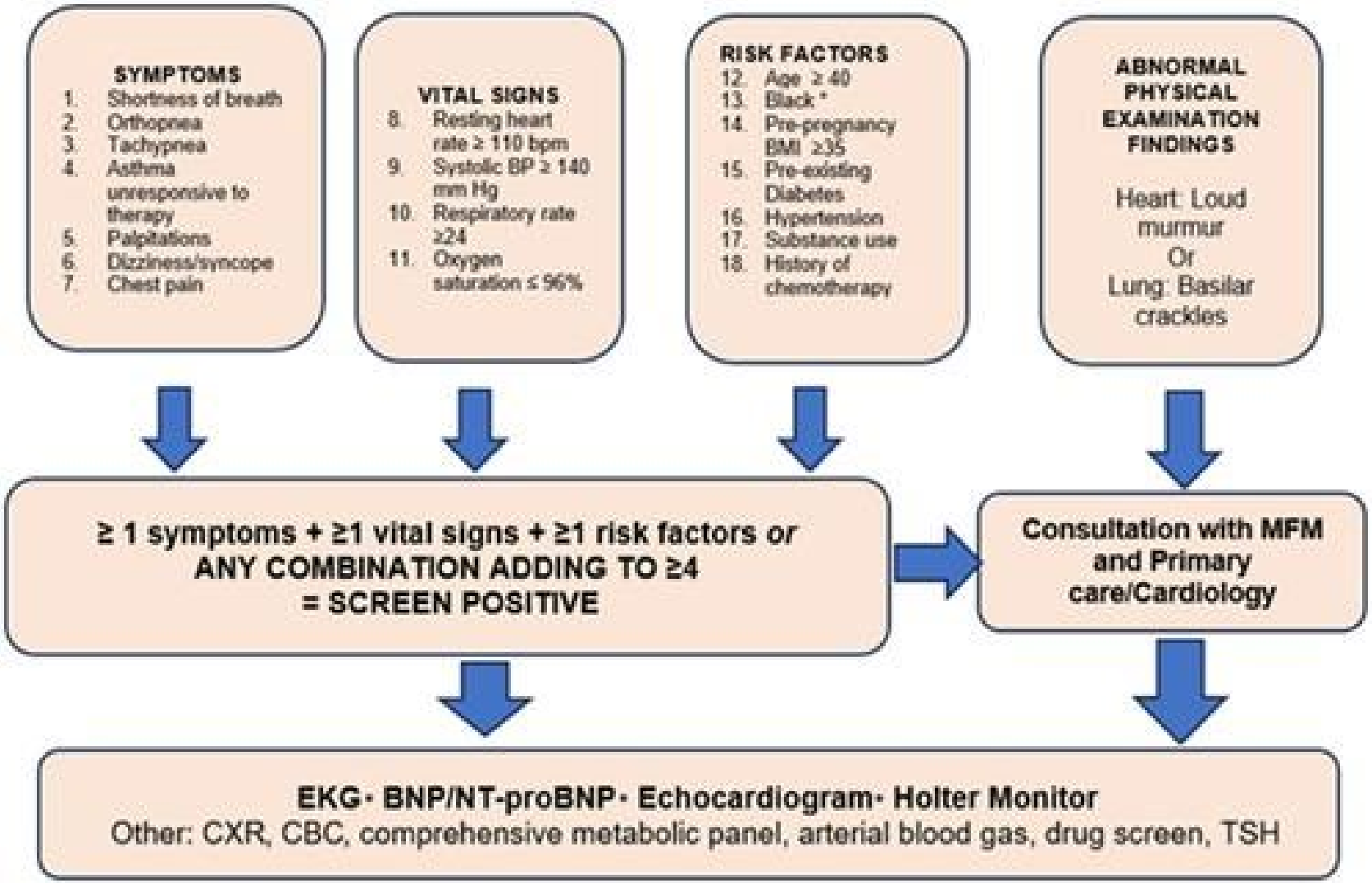
Pregnancy and Postpartum Assessment



Afshan B. Hameed et al. *JACC Adv* 2024; 3:

Key Points

- A patient's pregnancy risk can be assessed by looking at the type and severity of her cardiac disease
- The best time to assess risk and optimize a cardiac condition is prior to pregnancy
- Cardiac conditions benefit from a multidisciplinary approach
- Delivery doesn't cure all – continue to screen for cardiovascular disease postpartum

Questions?