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Beyond “Normal Pregnancy”: A Practical Cardiology Guide to Cardio-Obstetrics

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#CardioObstetrics

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Objectives

- Understand the epidemiology of pregnancy mortality in the US
- Review 2025 ESC CVOB risk stratification
- Identify who needs CVOB referral — and who does not
- Recognize high-risk pregnancy & postpartum CV scenarios
- Review the relationship between pregnancy, pregnancy adverse outcomes and cardiovascular health

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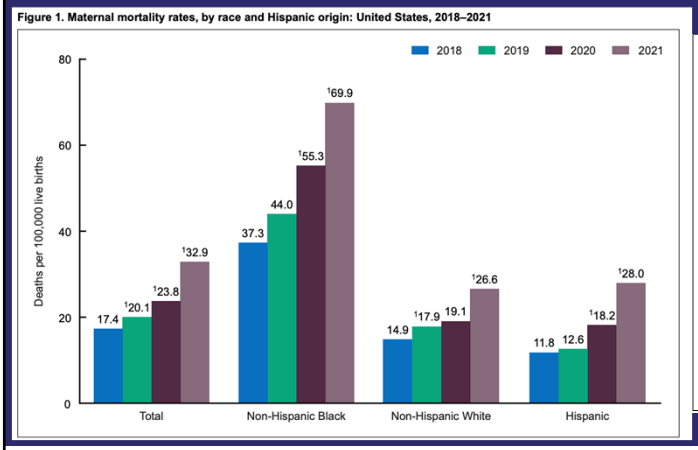
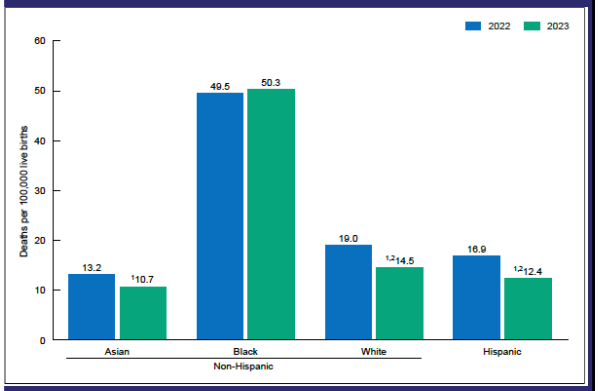
Why does CardioOB Matter? The Scope of the Problem

In 2018, preventing maternal deaths act passed





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[1]Statistically significant increase from previous year ($p < 0.05$).
NOTE: Race groups are single race.
SOURCE: National Center for Health Statistics, National Vital Statistics System, Mortality.

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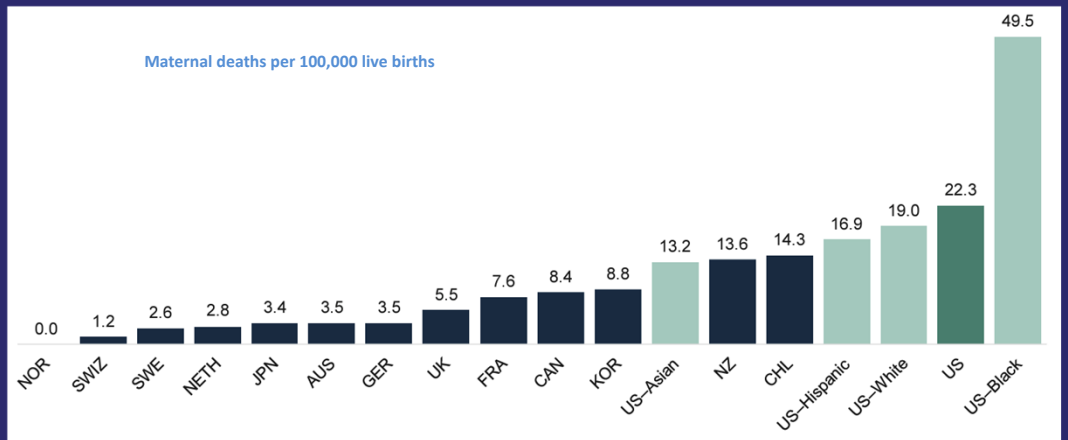
The United States continues to have the highest maternal death rate, with the rate for Black women by far the highest of any group.



Notes: The maternal mortality ratio is defined as the death of a woman while pregnant or within 42 days of termination of pregnancy, irrespective of the duration and site of the pregnancy, from any cause related to or aggravated by the pregnancy or its management but not from accidental or incidental causes. For more information on how maternal mortality is defined, see Organisation for Economic Co-operation and Development, "Maternal and Infant Mortality," in *Health at a Glance 2023: OECD Indicators* (OECD, 2023). 2015 data for FRA; 2017 data for UK; 2018 data for NZ; 2020 data for CAN and SWIZ; 2021 data for AUS, GER, JPN, KOR, NETH, and SWE; 2022 data for CHL (provisional) NOR, and US. Due to sample size limitations, data for US–AIAN cannot be displayed. AIAN = American Indian and Alaska Native. Asian Americans include a wide range of distinct communities. Such groupings are imperfect, as they mask significant difference in maternal mortality rates.

Data: All country data from OECD Health Statistics 2023 extracted on February 29, 2024, except data for US are 2022 data from the Centers for Disease Control and Prevention, National Center for Health Statistics, National Vital Statistics System, mortality and natality data files, "Maternal Mortality Rates in the United States, 2022."

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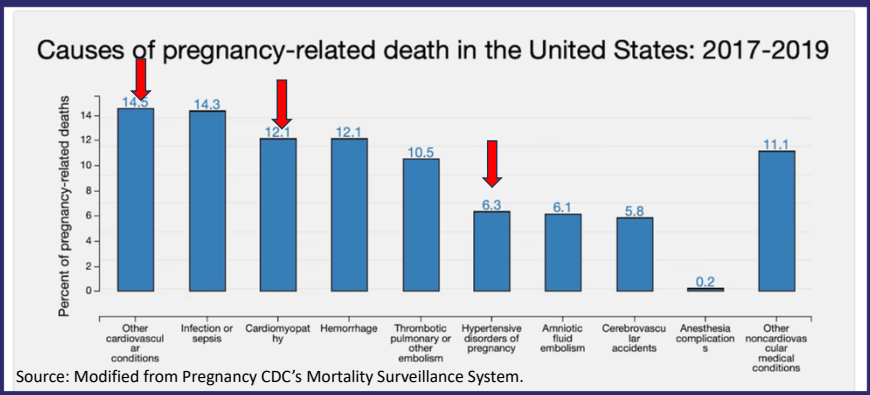
Maternal Mortality – Cardiovascular Deaths

Causes of Pregnancy-Related Deaths



Source: Modified from Pregnancy CDC's Mortality Surveillance System.

- The most common causes of pregnancy-related deaths were cardiovascular conditions:
  - Congenital heart disease
  - Ischemic heart disease
  - Valvular disease
  - Hypertensive heart disease
  - Congestive heart failure
- **92% of pregnancy-related cardiac deaths are preventable[1]**

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[1]Main et. Al Obstet Gynecol 2015;125:938–47)

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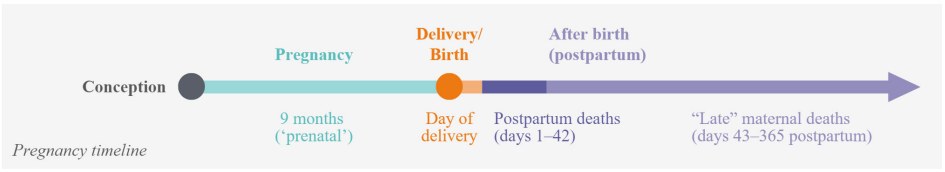
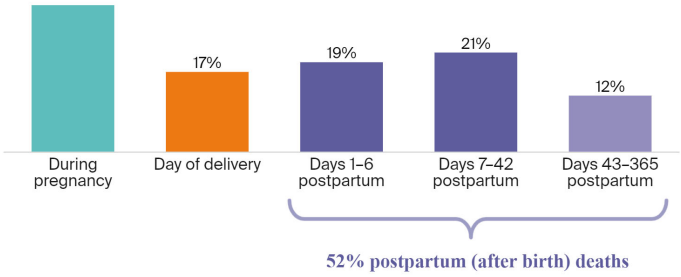
Exhibit 2

Timing of U.S. Maternal and Pregnancy-Related Deaths, 2011–2015





Data: Centers for Disease Control and Prevention Pregnancy-Related Mortality Surveillance data from: Emily E. Petersen et al., "Vital Signs: Pregnancy-Related Deaths, United States, 2011–2015, and Strategies for Prevention, 13 States, 2013–2017," *Morbidity and Mortality Weekly Report* 68, no. 18 (May 10, 2019): 423–29.

Source: Roosa Tikkanen et al., *Maternal Mortality and Maternity Care in the United States Compared to 10 Other Developed Countries* (Commonwealth Fund, Nov. 2020). https://doi.org/10.26099/411v-9255

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First pregnancies should be utilized as an early life stress test to identify women who may have CVD risk

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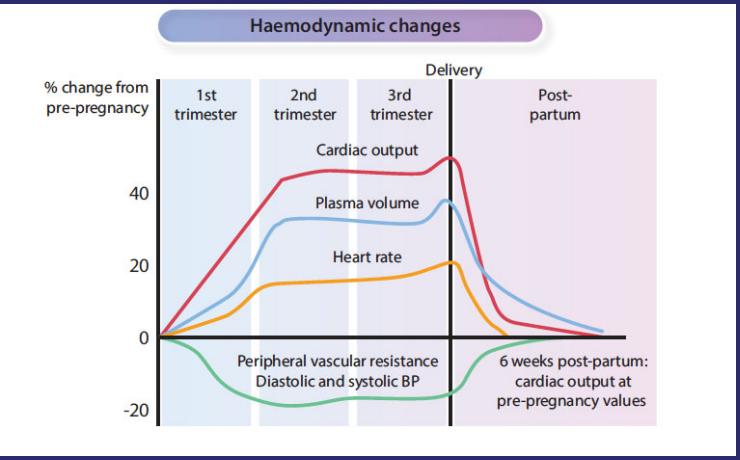
Pregnancy – A Stress Test



30-50% increase in volume & cardiac output in pregnancy

Precipitates decompensation, particularly 3rd trimester

Uterus receives 12% of cardiac output at term

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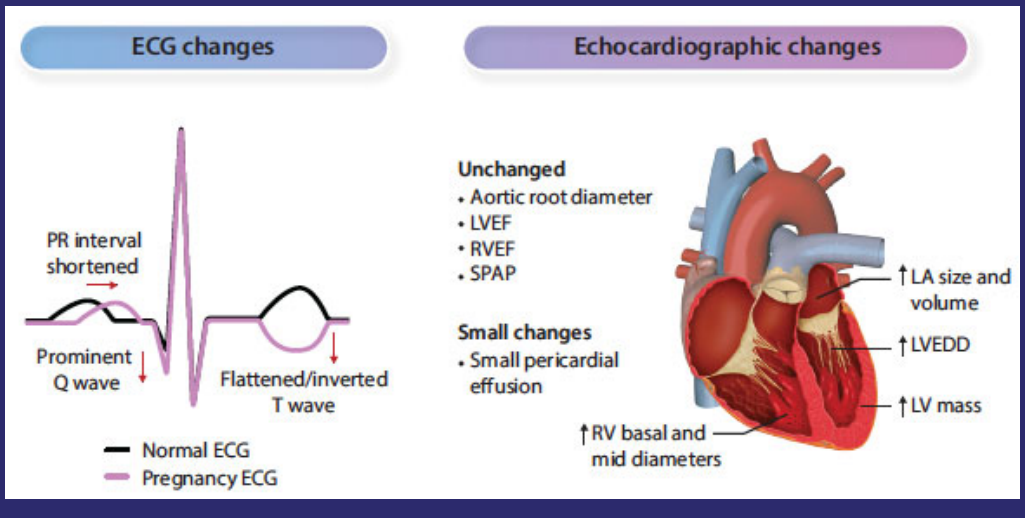
Cardiovascular Changes Through Pregnancy



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Multidisciplinary Approach to Peripartum Care

- Symptoms of pregnancy ≠ benign by default
  - Symptoms of pregnancy = cardiac symptoms
- PREGNANCY AS AN ETIOLOGY OF SYMPTOMS SHOULD BE A DIAGNOSIS OF EXCLUSION
- Underlying disease is often **unmasked**, not created
- Cardiology involvement often ends too early

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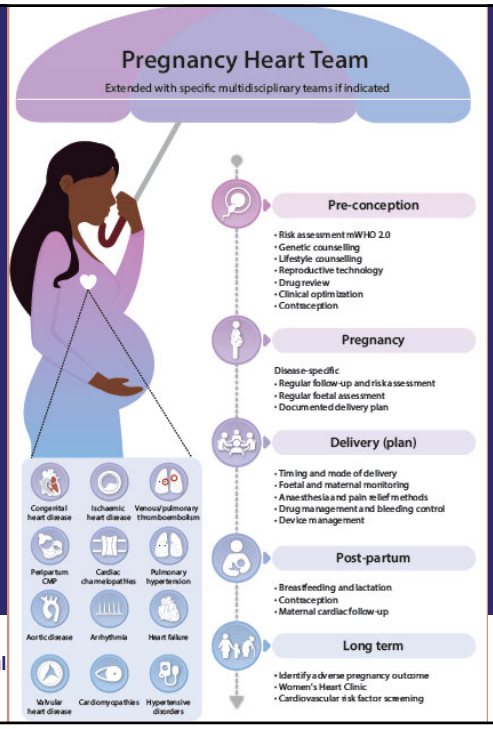
Cardio Obstetrics: A Village



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CVOB: who to refer? Preconception To Delivery

- **Symptoms**
- Dyspnea out of proportion to pregnancy
- Syncope or presyncope
- Chest pain
- New or sustained arrhythmia
- Pulmonary edema
- Severe hypertension

- **Findings**
- Abnormal ECG
- Elevated BNP / NT-proBNP
- LV dysfunction or significant structural disease

Refer to CVOB if ANY are present:

- Cardiomyopathy (EF <50% or prior PPCM)
- Moderate–severe valvular disease (especially stenotic)
- Aortopathy or known genetic aortic disease
- Pulmonary hypertension
- Clinically significant arrhythmias
- Severe hypertensive disorders of pregnancy
- Congenital Heart disease (excluding simple PFO, repaired ASD/VSD)
- **mWHO II–IV risk**

Low-Risk / Routine Cardiology Care

Usually managed in General Cardiology

- Isolated sinus tachycardia
- Benign ectopy with normal echo
- Mild, well-controlled hypertension
- Normal BNP and normal cardiac structure

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Cardio OB scoring- ESC/Carpreg II

TABLE 1 CARPREG II Risk Prediction Model

CARPREG II Predictors	Points
Prior cardiac event or arrhythmia	3
Baseline NYHA functional class III to IV or cyanosis	3
Mechanical valve	3
Ventricular dysfunction	2
High-risk left-sided valve disease/LVOT obstruction	2
Pulmonary hypertension	2
Coronary artery disease	2
High-risk aortopathy	2
No prior cardiac intervention	1
Late pregnancy assessment	1
CARPREG II Score	**Predicted Risk, %**
0 to 1	5
2	10
3	15
4	22
>4	41

CARPREG = Cardiac Disease in Pregnancy Study; LVOT = left ventricular outflow tract; NYHA = New York Heart Association.

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	mWHO 2.0 I	mWHO 2.0 II	mWHO 2.0 II–III	mWHO 2.0 III	mWHO 2.0 IV
Diagnosis	**Ventricular (dys)function + pulmonary hypertension**				
			Mild left ventricular impairment: EF >45%. Significantly impaired RV (subpulmonary) function.	Moderate left ventricular impairment: EF 30%–45%. Previous PPCM with not more than mild residual left ventricular impairment.	Severe left ventricular impairment: EF <30% or NYHA class IIIV. Previous PPCM with more than mild left ventricular impairment. PAH.
	Arrhythmias				
	Atrial or ventricular ectopic beats, isolated.	Most supraventricular arrhythmias. Bradycardia requiring pacemaker.	Low-risk LQTS: no previous events + on full dose beta-blocker therapy. Low-risk CPVT: well controlled by medical therapy. BrS with no previous events.	Sustained ventricular tachycardia from any aetiology. LQT2 (post-partum). Symptomatic CPVT and LQTS not adequately controlled by therapy. BrS with previous events.	
	Cardiomyopathy				
	HCM: genotype-positive + phenotype-negative.		Low-risk ARVC: genotype-positive + no or mild phenotype. HCM without complications. DCM/NDLVC with normal or mild left ventricular impairment: EF >45%.	ARVC with moderate/severe disease. HCM with arrhythmic and/or moderate haemodynamic complications. DCM/NDLVC with moderate left ventricular impairment: EF 30%–45%.	DCM/NDLVC with severe left ventricular impairment: EF <30% or NYHA class IIIV. HCM with symptomatic severe outflow tract obstruction: ≥50 mmHg. HCM with severely symptomatic LV dysfunction (EF <50%).
	Congenital heart disease				
	Successfully repaired simple lesions without significant residual (haemodynamic) complications (atrial or ventricular septal defect, patent ductus arteriosus, anomalous pulmonary venous drainage).	Unoperated uncomplicated atrial or ventricular septal defect. Repaired tetralogy of Fallot without significant residual haemodynamic/ arrhythmic lesions. Transposition of the great arteries with arterial switch without significant residual lesions.	Repaired atrioventricular septal defect without significant residual lesions. Uncomplicated Ebstein anomaly: mild to moderate TR, no tricuspid stenosis, no accessory pathway.	Unrepaired cyanotic heart disease (not Eisenmenger). Systemic RV with good or mildly decreased ventricular function. Uncomplicated Fontan circulation: good ventricular function, no significant valve disease or arrhythmias, good exercise tolerance, and normal arterial saturations. Ebstein anomaly with any complication.	Systemic RV with moderate or severely decreased ventricular function. Fontan with any complication. Eisenmenger syndrome.

		mWHO 2.0 I	mWHO 2.0 II	mWHO 2.0 II–III	mWHO 2.0 III	mWHO 2.0 IV
		Valvular heart disease				
		Small or mild • pulmonary stenosis • mitral valve prolapse without significant regurgitation.		Native, homograft or tissue valve disease not considered mWHO 2.0 I or IV: mild mitral stenosis, moderate aortic stenosis. Moderate valvular regurgitation.	Uncomplicated mechanical valve with stable well controlled INRs. Moderate mitral stenosis. Severe asymptomatic aortic stenosis. Severe left-sided valvular regurgitation.	Severe mitral stenosis. Severe symptomatic aortic stenosis.
		Aortopathy				
		Non-HTAD mild aortic dilatation (<40 mm).	Turner syndrome without cardiovascular features (BAV, coarctation, AHT, aortic dilatation).	Marfan or other HTAD syndrome without aortic dilatation. Aorta <45 mm in BAV pathology. Repaired coarctation.	Moderate aortic dilatation: 40–45 mm in Marfan syndrome or other HTAD; 45–50 mm in BAV, Turner syndrome ASI 20–25 mm/m^2, other aortic dilatation <50 mm. Marfan with previous aortic root replacement. Previous aortic dissection with stable diameter.	Severe aortic dilatation: >45 mm in Marfan syndrome or other HTAD, >50 mm in BAV, ASI >25 mm/m^2 in Turner syndrome, other aortic dilatation >50 mm. Vascular Ehlers–Danlos syndrome. Severe (re)coarctation. Previous aortic dissection with increasing diameter.
		Acquired + coronary heart disease + other				
					Prior SCAD. Prior ischaemic cardiac event (STEMI/NSTE ACS). Prior adverse pregnancy outcome requiring hospitalization. Prior adverse cardiovascular effects of cancer treatment.	
Risk		No detectable increased risk of maternal mortality and no/mild increased risk in morbidity.	Small increased risk of maternal mortality or moderate increase in morbidity.	Intermediate increased risk of maternal mortality or moderate to severe increase in morbidity.	Significantly increased risk of maternal mortality or severe morbidity.	Extremely high risk of maternal mortality or severe morbidity.
Average maternal cardiac event rates*	Van Hagen et al. (2016)[51]	9.9%	7.7%	17.7%	28.9%	50.3%
	Silversides et al. (2018)[52]	3.1%	21.7%	12.8%	21.1%	35.6%

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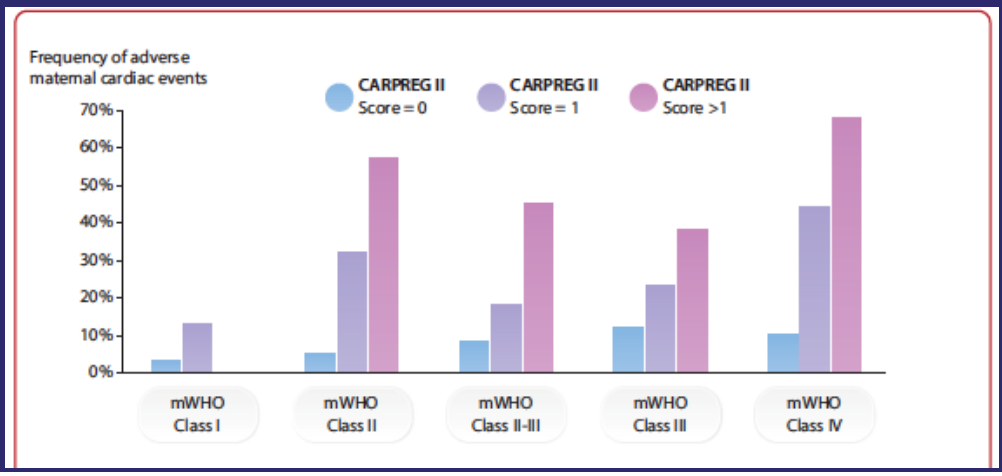
Risk Scoring and Outcome



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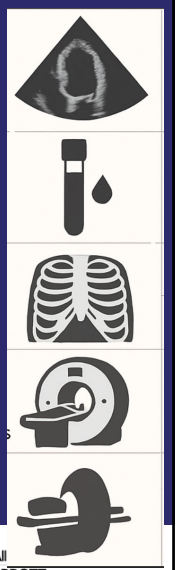
Testing/Management

- Echocardiography: first line imaging tool in pregnancy
- Biomarkers: Valid in pregnancy and can be followed longitudinally
- Ionizing radiation:
  - CXR is safe, first line for radiographic imaging for dyspnea
  - Chest CT and coronary angiography are safe if benefit > risk (abdominal shielding based on gestational age)
- Magnetic resonance imaging:
  - Gadolinium typically avoided in pregnancy unless it will change diagnosis or management of the mother
  - Breastfeeding does NOT need to be interrupted after gadolinium



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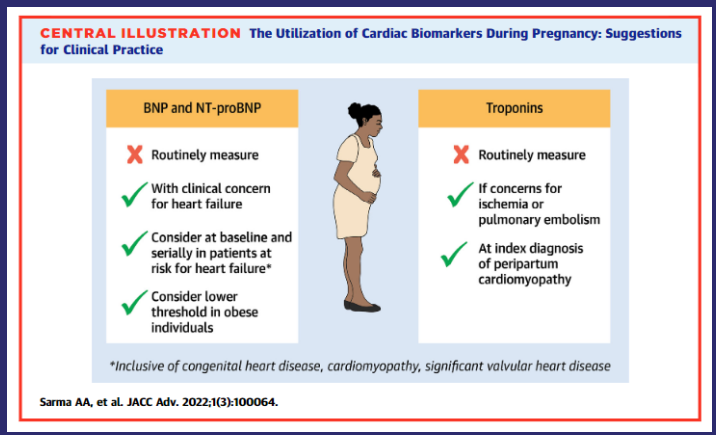
Biomarkers

- ProBNP <128 is normal
- ProBNP >200 is seen in Preeclampsia
- ProBNP >300 is associated with PPCM
- Higher levels of ProBNP are associated with worse outcomes in PPCM
- Should not be used as a sole marker of pathology
- Troponins (rise and fall) should be evaluated for ischemia



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Hypertension and Pregnancy
Heart Failure in Pregnancy

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Pregnancy and Hypertension

Hypertension
BP ≥140 and/or 90 mm Hg on at least 2 occasions

Severe Range Hypertension
BP ≥160 and/or 110 mm Hg confirmed as persistent with a 2nd reading in 15 min

- Before 20 weeks gestation OR Persistent >3 months postpartum
  - Chronic Hypertension
  - Chronic Hypertension with Superimposed Pre-Eclampsia
- After 20 weeks gestation
  - Gestational Hypertension
  - Pre-Eclampsia/Eclampsia

Diagnostic Criteria for Pre-Eclampsia

Blood pressure
- SBP ≥140 mm Hg and/or DBP ≥90 mm Hg on two occasions at least 4 h apart after 20 weeks of gestation in a woman with a previously normal blood pressure
- SBP ≥160 mm Hg and/or DBP ≥100 (confirmed over 15 min)

AND

Proteinuria
- ≥300 mg per 24 h urine collection
- Protein/creatinine ratio ≥0.3 mg/dl
- Dipstick reading of 2+ (if quantitative methods are not available)

Severe Features

Or
- Thrombocytopenia (<100k)
- Renal insufficiency (Cr >1.1 mg/dl or 2x Cr in the absence of other renal disease)
- Impaired liver function (transaminases >2x ULN)
- Pulmonary edema
- New-onset headache or visual symptoms

ACOG Practice Bulletin No. 202. Jan 2019

Pregnant and BP >160/110 mmHg

YES

Severe Hypertension
- Admit patient to hospital for maternal and fetal monitoring
- Start first line therapy (IV labetalol, IV hydralazine and if no IV access oral short acting nifedipine) immediately
- Intravenous magnesium sulphate to prevent seizures in preeclampsia with severe features.
- Intraenous nitroglycerin when pulmonary edema in setting of preeclampsia

NO

Non-Severe Hypertension
- Start single therapy with first line agent (labetalol, nifedipine, methyldopa) to achieve BP in the range of 140-150/190-100 mmHg.
- If BP not controlled with one or more of the above, then consider second line agent (hydrochloro-thiazide) and combination therapy
- Maternal and fetal assessments and regular BP checks.

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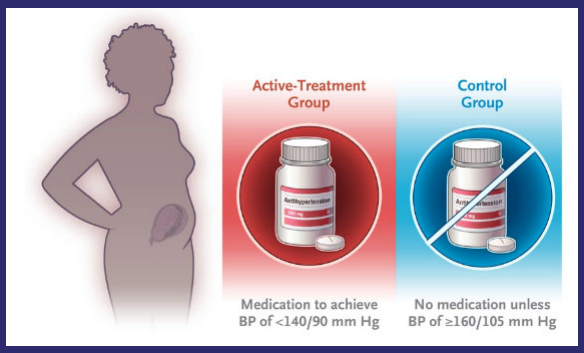
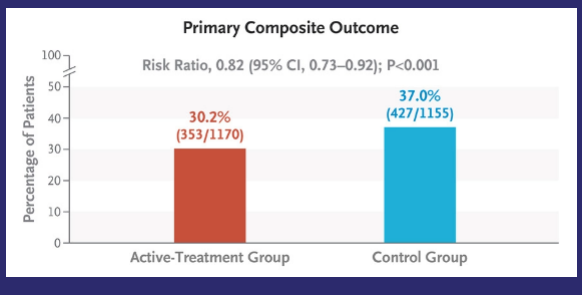
CHAP Trial (Treatment for Mild Chronic Hypertension during Pregnancy)



2408 women with mild chronic hypertension were randomized

Treating 20 pregnant patients to a BP goal of < 140/90, rather than < 160/100 prevented 1 major adverse event (preeclampsia with severe features, medically indicated preterm birth, placental abruption, or fetal or neonatal death).



Tita et al. NEJM. 2022;386:1781-1792.

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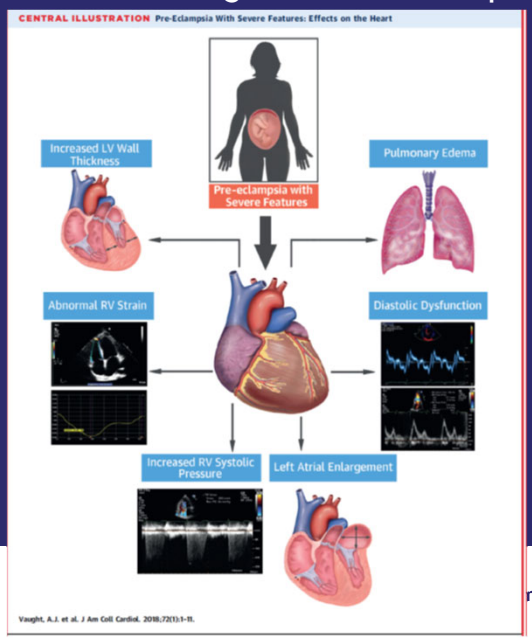
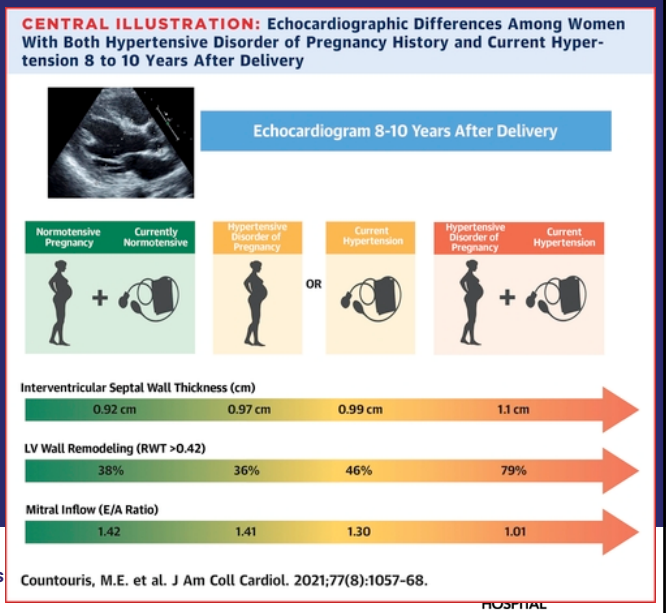
Acute CV Changes in Preeclampsia



Chronic CV changes with HDP



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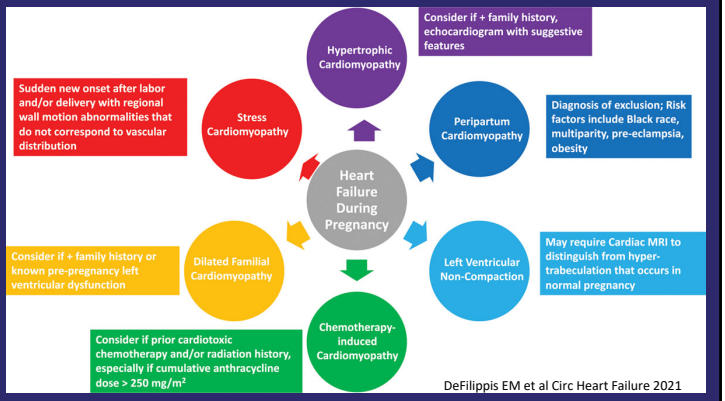
Heart Failure in Pregnancy

- Obstetric etiologies
  - Preeclampsia/hypertensive disorders of pregnancy
  - Sepsis
  - Amniotic fluid embolism
  - Peripartum cardiomyopathy
- Intrinsic cardiac etiologies
  - Cardiomyopathies
  - Valvular disease
  - Congenital heart disease
  - Myocarditis
- Other etiologies
  - Pulmonary hypertension
  - Pulmonary embolism
  - Systemic disorders (amyloidosis)
  - Drug use
  - Viral infection, including HIV



DeFilippis EM et al Circ Heart Failure 2021

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The Continuum of Heart Failure in Pregnancy

HF – Preserved EF
LVEF > 50%

HF – Mid range EF
LVEF 40-50%
Overlap with PPCM defined as EF < 45%

HF – Reduced EF
LVEF < 40%

- Pre-eclampsia is highly prevalent in all three groups: HFpEF 81%, HFmrEF 44%, and HFrEF 45%.
- BNP levels were similar between HFpEF and HFmrEF, but much higher in HFrEF ($p < 0.001$).
- One-year mortality for HFrEF 16% and 0% for both HFpEF and HFmrEF.

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PPCM vs Preeclampsia

Peripartum Cardiomyopathy

- Non-ischemic cardiomyopathy
- LVEF <45%
- Presents 3rd trimester-6 months PP
- No other identifiable etiology

- 1:1000 live births
- Recurrence risk: 20%
- Outcomes stratified by severity of LV dysfunction
- Risk of death/transplant in 1 year: 5-10%

Preeclampsia

- Systemic disorder characterized by endothelial dysfunction, hypertension, proteinuria, end organ damage
- Diastolic dysfunction & LV remodeling
- Typically leads to HFpEF

- 2-8% of pregnancies worldwide
- Recurrence risk: 20-50%
- 16% of maternal deaths are from hypertensive disorders of pregnancy
- More likely to recover EF

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Management of HF During Pregnancy

- Acute: Loop diuretic, hydralazine, isosorbide dinitrate are standard
  - Beta blockade – typically metoprolol succinate or carvedilol
  - Digoxin can be added
  - ***Avoid:*** spironolactone, ACEi/ARB/ARNI, SGLT2 inhibitors
  - IV inotropes – dobutamine safe
  - Nitroglycerin or nitroprusside – monitor FHR due to risk of rapid BP drop
    - Risk of fetal cyanide toxicity with nitroprusside
  - Anticoagulation – depends on etiology of HF
- Delivery: SVD + epidural, strict I/O
  - Decrease cardiac work
  - Minimize fluid overload

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Management of HF in Pregnancy

- Postpartum: Optimization
  - Adjust GDMT--> switch to ACEi = SAFE in lactation
  - MRA = spironolactone is SAFE in lactation
    - ARB & ARNI (Entresto) - no data in lactation, avoid if breastfeeding
  - Continue beta-blockers = SAFE in lactation (prefer carvedilol, metoprolol succinate)
  - Continue diuretics, digoxin = SAFE in lactation
  - SGLT2 inhibitors – no data in lactation, typically avoided
  - Minimize risk of VTE if LV thrombus or other risk factors for VTE
  - Contraception!

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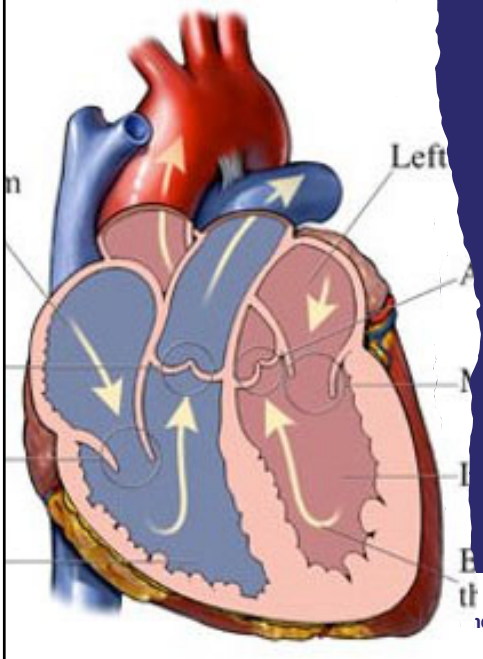

Valvular Disease

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Valvular Disease in Pregnancy

- 1-2% of women of reproductive age have valvular disease
- 1/3 of heart disease in pregnant people is valve disease
- Most common etiology in the USA = congenital
  - Acquired rheumatic heart disease is most common etiology worldwide
- Generally regurgitant lesions better tolerated than stenotic
  - Increased volume and HR, lower SVR decrease regurgitation

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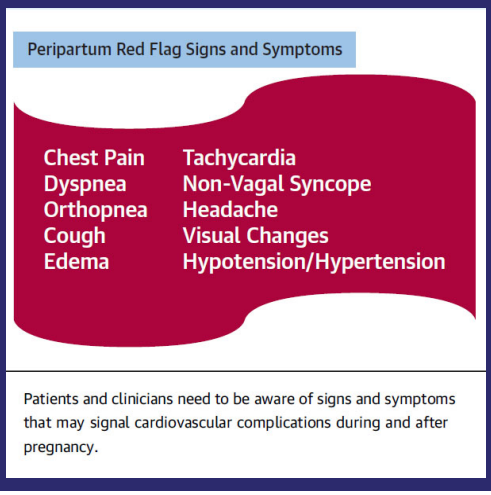
Screening for Valvular Disease

- Red flag symptoms
- Exam findings
  - Loud systolic murmur, any diastolic murmur, wheezing/crackles, significant edema
- Known repaired congenital heart disease
- Certain familial conditions (ex: bicuspid aortic valve)
- Preconception should have transthoracic echocardiogram, stress test, or both
  - Invasive hemodynamics can guide intervention
- Pregnancy = diagnosis of exclusion



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Right-sided Lesions

- Tricuspid & Pulmonic Lesions
  - Often congenital – requires fetal echocardiogram
- Rare need for intervention in pregnancy
  - Pulmonic lesions with concomitant RV dysfunction – risk of RH failure
- Echocardiogram in 3rd trimester at peak plasma volume
  - Rhythm monitor if symptoms of arrhythmia
- Vaginal delivery preferred

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Left-sided Lesions

- Regurgitant lesions tend to be well-tolerated, even if severe
  - EXCEPTION: concurrent LV failure
  - Severe symptomatic MR/AR or LV dysfunction = 20-25% risk of HF in pregnancy
  - Fetal risk is low
- Stenotic lesions obstruct the LVOT -> fixed cardiac output frequently not well-tolerated with hemodynamic changes of pregnancy
  - High risks of arrhythmia, hypoxia, pulmonary edema
  - Critical to control heart rate and volume -> beta blockers, diuretics
  - Balloon valvuloplasty in pregnancy for severe symptomatic stenosis

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Labor & Delivery Considerations

- Vaginal delivery is preferred
  - Regional anesthesia – improves hemodynamics & oxygen consumption in labor
  - Consideration of assisted second stage
- Why?
  - C-section has higher risks of hemorrhage, hemodynamic fluctuations, myocardial oxygen consumption
  - Study of planned delivery for CVOB patients – 276 patients, 76% with planned VD[1]
    - 76.7% SVD, 9.5% operative VD (2.3% cardiac indication), 13.8% C-section
    - Similar rate of primary cardiac outcome in VD vs. C-section groups (4.3% vs 3.0%, p=1.0)
    - No differences in composite maternal outcome
    - SVD group had lower PPH, lower blood transfusion
    - No neonatal complications
- Fluid considerations: Delivery leads to rapid fluid shift
  - Mitral stenosis: better dry, risk of flash pulmonary edema, IV furosemide with delivery
  - Aortic stenosis: better wetter, pulmonary edema better than coronary hypoperfusion

[1]Easter SR et al, AJOG 2020

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When to Intervene?

- Pre-pregnancy valve intervention
  - Symptomatic severe AS or asymptomatic severe AS with LV dysfunction
  - Symptomatic severe MS or asymptomatic severe MS with high embolic risk, pAFib
  - Severe PS
  - Severe AR or MR with LV dysfunction
  - Severe symptomatic PR with RV failure
- Exercise testing & invasive hemodynamics to guide valve intervention
- Valve choice
  - Mechanical valve – lifelong anticoagulation (warfarin), higher thrombosis risk, higher durability
  - Bioprosthetic valve – early deterioration requiring re-do valve replacement, aspirin only
  - Contraception discussion is CRITICAL

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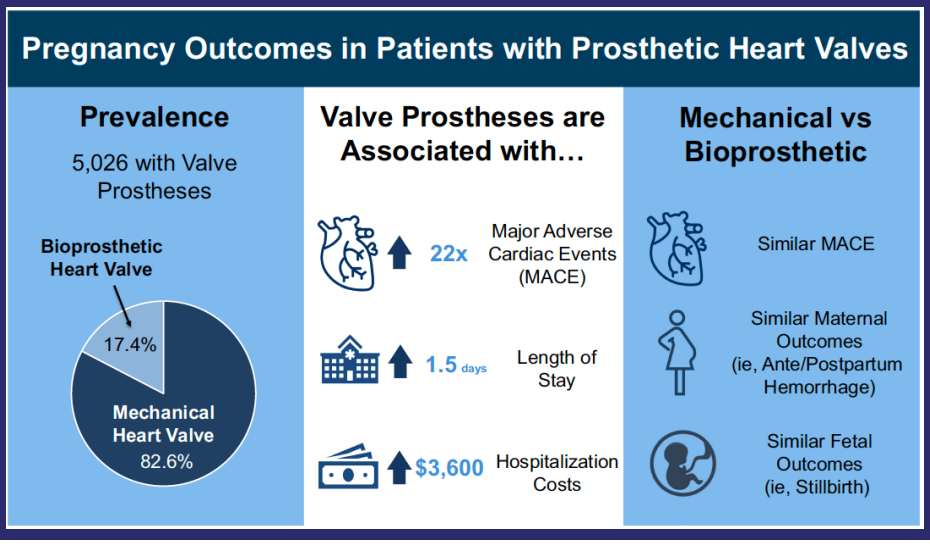
Prosthetic valves



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Intervention during Pregnancy

- Severely symptomatic patients with failed medical therapy
- Cardiopulmonary bypass in pregnancy carries high morbidity & mortality[1]
  - Maternal mortality 11.2/100 pregnancies
  - Maternal morbidity 8.8/100 pregnancies (CHF, arrhythmia, bleeding)
  - Fetal loss 33.1/100 pregnancies
  - Neonatal complications 10.8/100 pregnancies (malformation, IUGR, respiratory distress)
- Catheter based interventions = safer profile in pregnancy[2]
  - Percutaneous balloon valvuloplasty (mitral, aortic, pulmonic) have all been reported
    - Requires anesthesia, TEE, fluoroscopy
  - Transcatheter valve replacement --> case reports in pregnancy but appears feasible/safe

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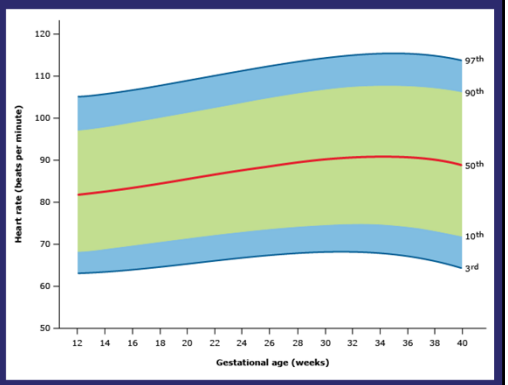
Arrhythmia in Pregnancy

- Most common cardiac complication during pregnancy
  - Both with and without structural heart disease
  - Sustained tachycardia 2-3/1000 pregnancies[1]
- Resting heart rate increases longitudinally – 25% increase
  - Upper limit typically no greater than 115 bpm
- Patients with known arrhythmia benefit from electrophysiologic testing prior to pregnancy
  - Treat definitively pre-pregnancy if needed
  - Adjust medications



[1]Adamson DL & Nelson-Piercy C. Heart 2007.

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Common Arrhythmias

- Sinus tachycardia, particularly 3rd trimester
- Isolated supraventricular & ventricular extrasystoles = common
  - 50% of investigations for "palpitations" in pregnancy
  - No treatment necessary
- Most common sustained arrhythmia = SVT
  - Vagal maneuvers first line
  - Adenosine – first line medication, no dose adjustment
  - Hemodynamically unstable – direct-current cardioversion is safe

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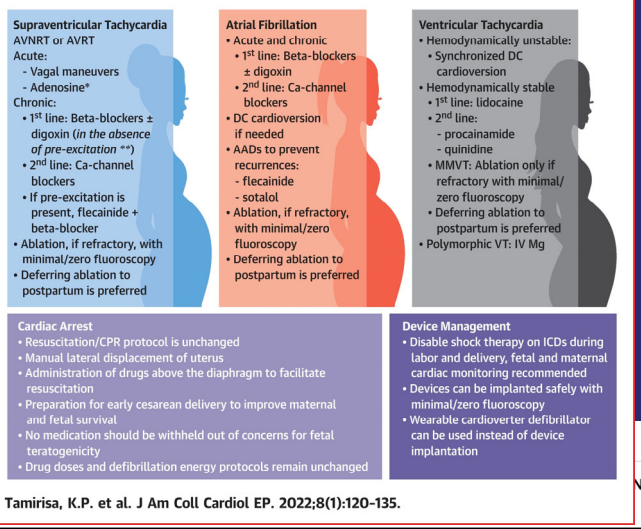
Medical Management of Arrhythmia

- 12-lead ECG
- Echocardiogram
- Prolonged rhythm monitor
- Labs

CENTRAL ILLUSTRATION: Arrhythmia Management During Pregnancy for Supraventricular Tachycardia, Atrial Fibrillation, Ventricular Tachycardia, and Cardiac Arrest



Tamirisa, K.P. et al. J Am Coll Cardiol EP. 2022;8(1):120-135.

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[1]Adamson DL & Nelson-Piercy C. Heart 2007.
[2]Tamirisa KP et all JACC 2022

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Definitive Treatment of Sustained Arrhythmia

- Ablation – typically recommended prior to pregnancy
  - Fluoroscopy concern
  - More challenging technically in the pregnant patient
- ICD – pregnant women with indication for ICD should have one placed
  - Minimize radiation exposure – ex: echocardiographic guidance
  - Pregnancy not associated with increased ICD complications or increase in number of shocks

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Future Cardiovascular Health

Adverse Perinatal Outcomes Modify Risk

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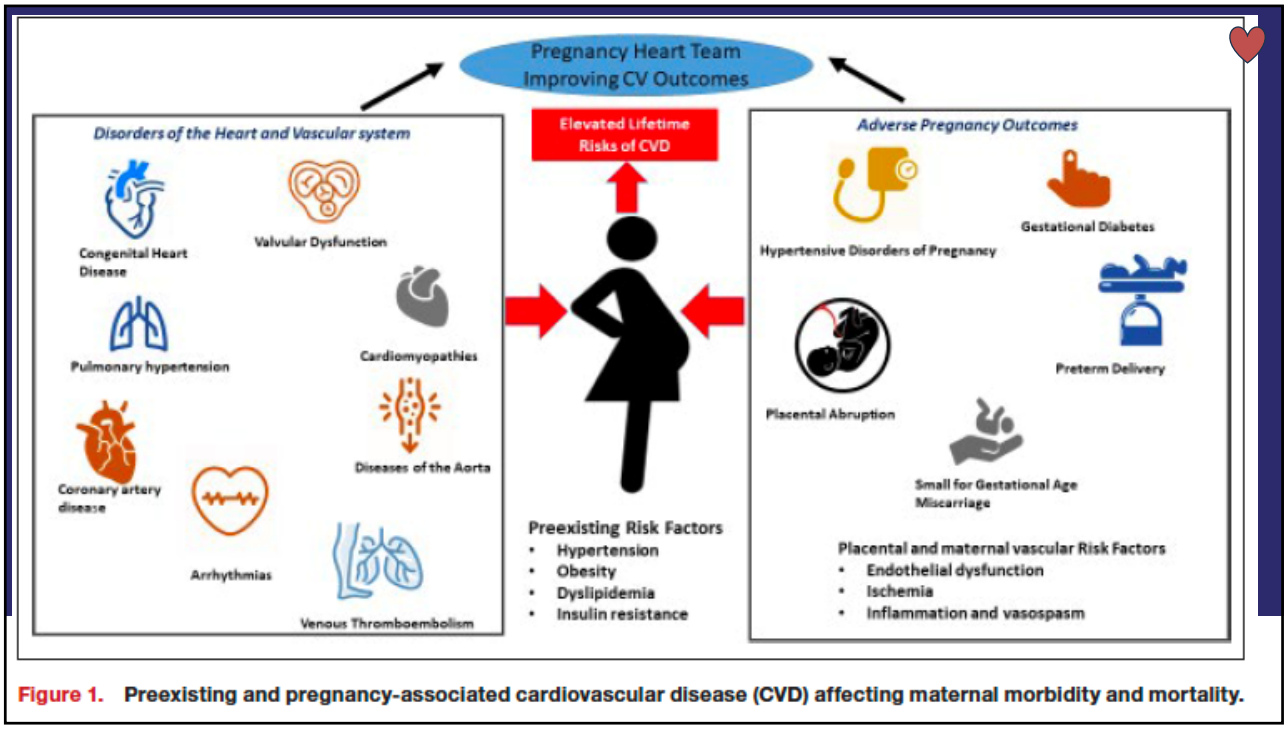

Figure 1. **Preexisting and pregnancy-associated cardiovascular disease (CVD) affecting maternal morbidity and mortality.**

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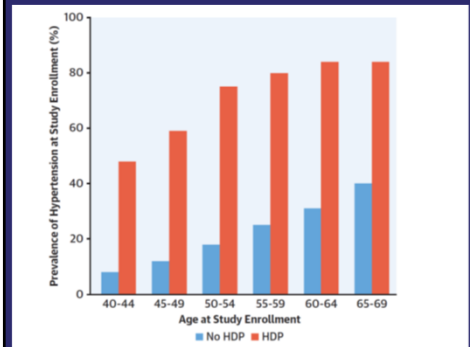
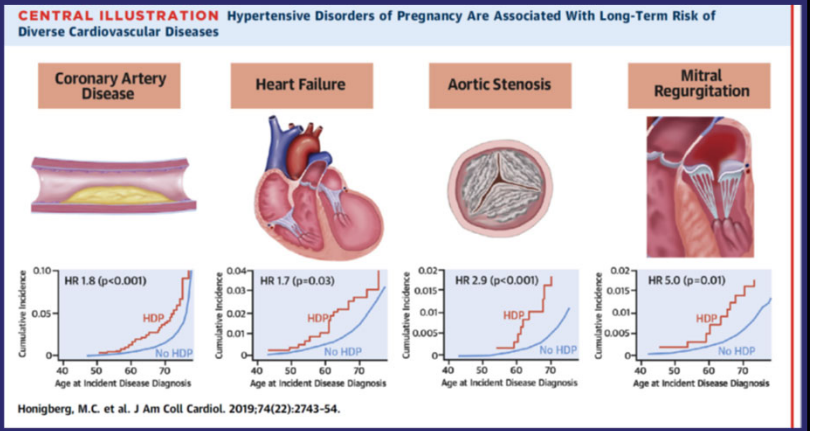
Hypertensive disorders of pregnancy and longterm CV risk





CHTN accounts for one-half to two-thirds of the excess cardiovascular disease risk in women with prior HDP

Only about 33% of women with prior HDP are on antihypertensives

UK BioBank Data

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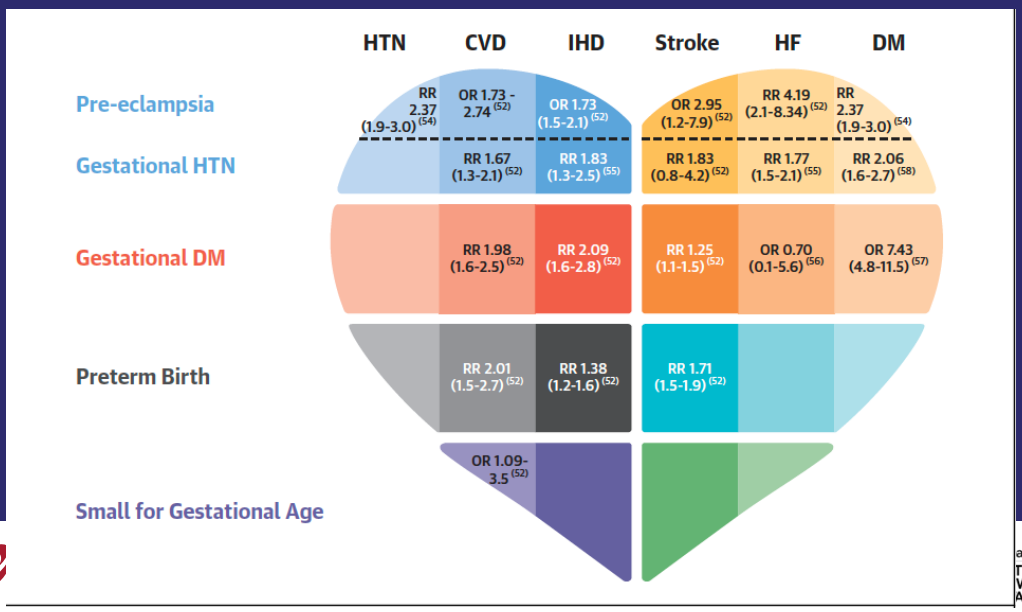
The Fourth Trimester



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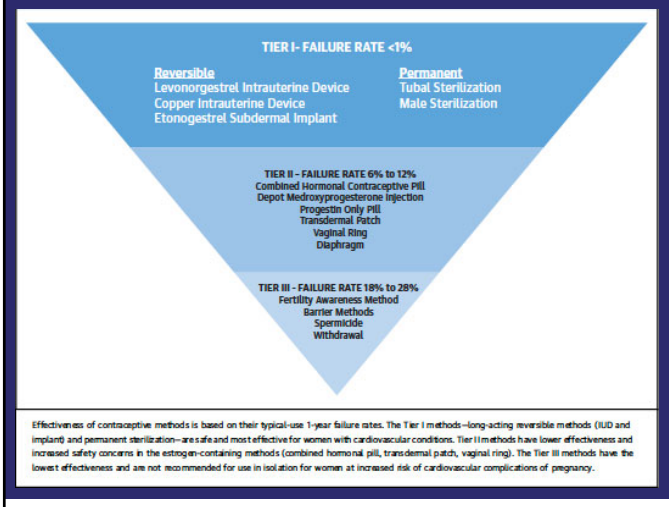
Contraception in Cardiac Patients



Mode of contraception	Safety
Combined oral contraceptives	Considered safe in as follows:
	patients with recovered cardiomyopathy
	HCM without atrial arrhythmias
	Avoid in as follows:
	patients with EF <30%
	mechanical mitral valves
Progestin-only formulations	Appropriate for patients with reduced LVEF (IUD preferred; see below)
Intrauterine devices	Recommended as the first-line longer-term reversible option in as follows:
	patients with EF <30%
	postheart transplantation (as there is a low risk of pelvic infection)
Barrier methods	Not recommended; unreliable and insufficient as sole method of contraception

EF indicates ejection fraction; HCM, hypertrophic cardiomyopathy; IUD, intrauterine device; and LVEF, left ventricular ejection fraction.

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Educational Materials

Pregnancy-induced Cardiovascular Risk

A Provider Resource

https://mplsheart.org/womens-heart-health/broach

Pregnancy and Heart Health

What to know to live healthfully beyond your pregnancy

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Pregnancy is an exciting time in a woman's life filled with anticipation of what's to come. Many people believe that conditions that occur during pregnancy resolve themselves when the baby is born, but often, that's not the case.

The reality: Many pregnancy-induced conditions increase a woman's health risks immediately following delivery and for many years to come. In fact, pregnancy is often thought of as a woman's first "stress test" that can unmask underlying heart and vascular problems and future risk.

For women who are pregnant, it's important to understand the long-term heart and vascular impacts that can result from pregnancy-induced conditions.

Unique heart disease risk factors in pregnancy

High blood pressure during pregnancy

How common is it?

- Pregnancy-induced hypertension (or high blood pressure) affects about 10-15 percent of pregnancies.

What are the health concerns it causes?

Gestational diabetes

What is it?

- Gestational diabetes is diabetes that develops during pregnancy and usually resolves after delivery.

What are the health concerns it causes?

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CVD risk factor screening in women with pregnancy-induced complications

	Time for initial screening	Time for follow-up screening
Hypertension	Within 6 to 12 months post-partum	Preferably check blood pressure at each visit or minimally as follows: • If hypertension during pregnancy, screen annually • If BP >120-139/80-90, screen annually • If BP<120/80, screen every 2 years
Hyperlipidemia	Within 12 weeks post-partum and post-lactation	If hypertension during pregnancy or elevated CVD risk, check lipids and screen annually
Diabetes	If GDM, check glucose and screen 4 to 12 weeks post-partum	Check glucose and screen annually if impaired fasting glucose at 6 weeks or hypertension during pregnancy; otherwise screen every 3 years
Obesity/BMI	Screen annually	Screen annually
Tobacco use	Screen at first post-partum visit	Screen at each visit
Nutrition and physical activity	Assess at first post-partum visit	Assess at each visit depending on risks

Adapted from Mehta, P. K., Minissian, M., & Merz, C. N. B. (2015, June). Adverse pregnancy outcomes and cardiovascular risk factor management. In Seminars in perinatology (Vol. 39, No. 4, pp. 268-275). WB Saunders.

If no pregnancy related risk:
Check BP annually over age 40, every 2 years under 40

Check cholesterol in patients > 20 years of age if no risk factors about ever 4-6 years, more frequently with risk factors

Screen patients > 40 for DM, if family history, CVD screen more frequently

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Conclusions

- Maternal Mortality in the US remains highest in the developed world
- CVD is now the number one cause of maternal M and M
- Pregnancy and post partum symptoms = CV symptoms and should be assessed
- Most maternal CV complications are identifiable early
- CVOB teams improve outcomes — when used appropriately
- Cardiology involvement **should not end at delivery**

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Thank you!

Questions?

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