Pregnancy and Heart Disease

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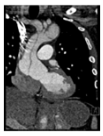
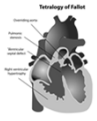
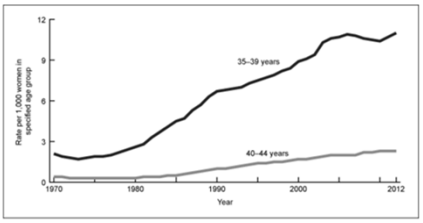




1st Birth Rates By Selected Age of Mother



SOURCE: CDC/NCHS, National Vital Statistics System.

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Objectives:

1. Define trends in maternal mortality in the US
2. Review the spectrum of heart disease in and related to pregnancy
3. Discuss the cardiovascular care of women in pregnancy
4. Introduce the Fourth Trimester and propose strategies for primary care providers to impact maternal mortality

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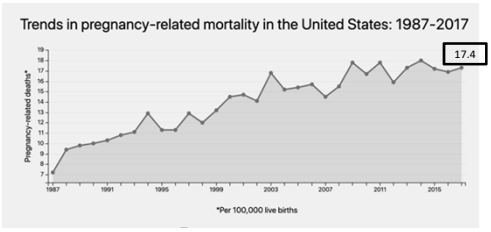
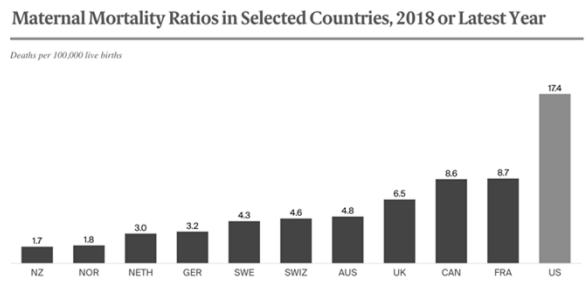
Maternal Mortality trends: USA

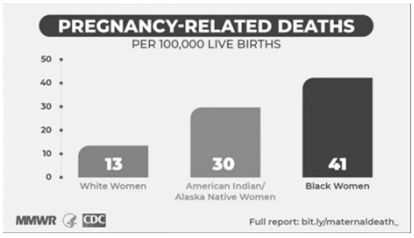


https://www.cdc.gov/reproductivehealth/maternal-mortality/pregnancy-mortality-surveillance-system.htm



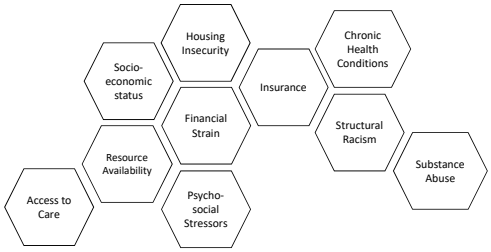
Source: Roosa Tikkanen et al., Maternal Mortality and Maternity Care in the United States Compared to 10 Other Developed Countries (Commonwealth Fund, Nov. 2020). https://doi.org/10.26099/411v-9255

Maternal Mortality: Racial/Ethnic Disparities



https://www.cdc.gov/mmwr/volumes/68/wr/mm6835a3.htm

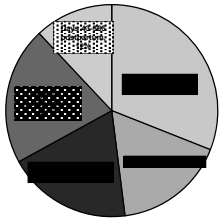
Rising Maternal Mortality in the USA: Why?



Definitions

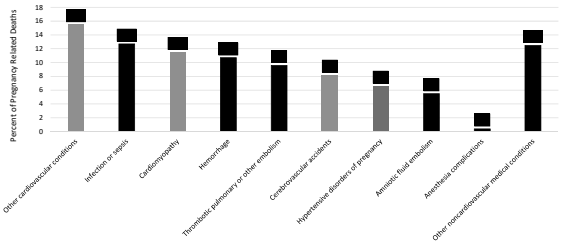
- **Pregnancy-Related Death:** death of a woman while pregnant or within 1 year of the end of pregnancy from any cause *related to or aggravated by the pregnancy.*
- **Pregnancy-Associated Death:** death of a woman during or within 1 year of pregnancy, regardless of the cause

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



Roosa Tikkanen et al., *Maternal Mortality and Maternity Care in the United States Compared to 10 Other Developed Countries* (Commonwealth Fund, Nov. 2020)

Causes of pregnancy-related death in the United States: 2014-2017



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Spectrum of Heart Disease in Pregnancy

Acquired

- Coronary artery disease
- Heart failure/cardiomyopathy
- Arrhythmia
- Valve disease
- Hypertensive disorders of pregnancy *(PreE, G-HTN, etc)*
- Pulmonary Hypertension

Inherited/Congenital

- Congenital heart disease
- Some cardiomyopathies
  - *Hypertrophic, familial*
- Aortopathy

Spectrum of Heart disease in Pregnancy

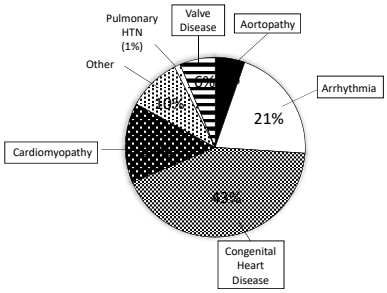
Peripartum cardiomyopathy

- Heart failure developing in the last month of pregnancy or 5 months postpartum
- LVEF < 45%
- High mortality rate
- High risk for subsequent pregnancies if no recovery of LV function

Spontaneous Coronary Artery Dissection (SCAD)

- Separation of the layers of the arterial wall
- Rare cause of acute coronary syndrome
- More common in women
- 30% occur in peripartum period

OSU Pregnant Cardiac Patients - 2017



Heart disease related to pregnancy

- Adverse pregnancy outcomes associated with ASCVD risk
  - Pre-eclampsia
  - Gestational diabetes
  - Gestational hypertension
  - Preterm delivery
  - Low birth weight

Risk Factor	HTN	CVD	IDH	Stroke	HF	DM
Pre-eclampsia	RR 2.4	OR 1.7	OR 1.3	OR 3.0	RR 4.2	RR 2.4
Gestational HTN		RR 1.7	RR 1.8	RR 1.8	RR 1.8	RR 2.1
Gestational DM		RR 2.0	RR 2.1	RR 1.3	RR 0.7	OR 7.4
Preterm Birth		RR 2.0	RR 1.4	RR 1.7		
Small for gestational age		OR 1.1-3.5				

Davis et al. J Am Coll Cardiol. 2021 Apr 13;77(14):1763-1777.

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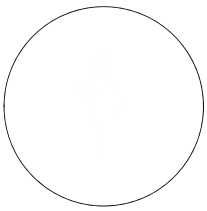
Cardiovascular Care of Pregnant Women

1. Pre-conception counseling
2. Risk assessment
3. Delivery planning
4. Monitoring during pregnancy
5. Delivery
6. Postpartum monitoring
7. The Fourth Trimester



Case - JS:

Ms. JS is a 30 y/o female with history of Ewing osteosarcoma as a teenager for which she received treatment with anthracycline chemotherapy and radiation. She is now in remission but developed chemotherapy-induced cardiomyopathy several years ago. She follows closely with cardiology and has been stable for many years.

Case- JS, cont.

She does yoga 5 days a week and is on her feet all day in her job as a hair stylist. She is NYHA functional class 1.

She comes into clinic for her yearly wellness visit and tells you she is recently married and is trying to get pregnant.

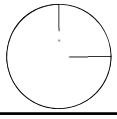
Current Meds: lisinopril 10mg daily, metoprolol XL 50mg daily, multivitamin

Case- JS, cont.

- Her most recent echocardiogram showed:
  - Dilated LV; LVEF 35%
  - Normal RV size and systolic function
  - Mild mitral regurgitation
- On exam, she is euvolemic with normal vitals and SpO2

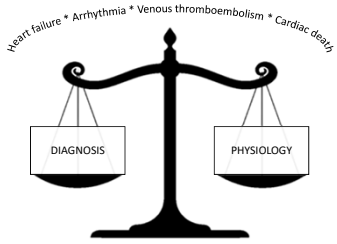
Preconception Counseling

1. Identify presence and severity of underlying cardiovascular disease
2. Assess degree of physical compensation
3. Assess maternal cardiovascular risk
4. Create plan for optimization
5. Review medications: stop medications that are not safe in pregnancy
6. Discuss tentative plans for pregnancy and delivery

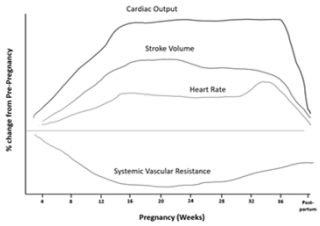


Assessing maternal cardiovascular risk

How do we think about this?



Hemodynamic Changes in Pregnancy



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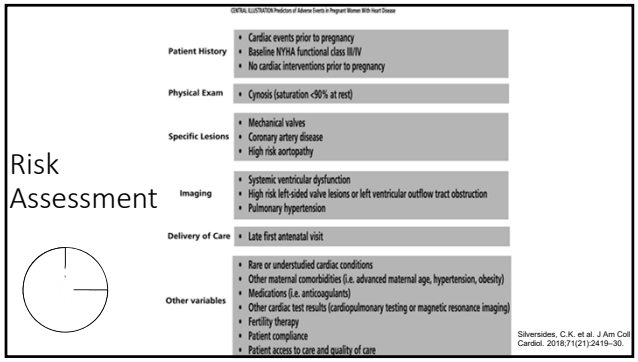
Risk Assessment

mWHO I	mWHO II	mWHO II-III	mWHO III	mWHO IV
Small or mild - Pulmonary stenosis - PDA - MV repair Repaired simple lesions (ASD, VSD, PDA, anomalous pulmonary venous drainage) PACs/PVCs	Unrepaired ASD or VSD Repaired ToF Most SVTs Turner syndrome with normal aorta	Mild LV impairment (EF > 45%) Hypertrophic cardiomyopathy Native or tissue valve disease not considered WHO I or IV (mild MS, moderate AS) Marfan or other HTAD without aortic dilatation Repaired CoA	Moderate ventricular dysfunction (EF 30-45%) Previous PPCM with now normal EF Mechanical valve Fontan, no complications Moderate MS Severe asymptomatic AS Ventricular tachycardia Moderate aortic dilation	Pulmonary arterial HTN Severe ventricular dysfunction (EF < 30%) Previous PPCM w/residual LV dysfunction Severe MS or AS w/sx Severe aortic dilation Vascular EDS Severe (re)coarctation Fontan w/complication
Risk 2.5-5%	5.7-10.5%	10-19%	19-27%	40-100%

Eur Heart J. 2018 Sep 7;39(34).

Risk Assessment



Silversides, C.K. et al. J Am Coll Cardiol. 2018;71(21):2419–30.

Case JS – Risk assessment

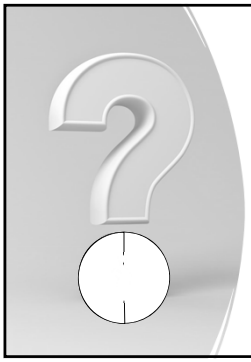
- Moderate LV systolic dysfunction – EF 35%

- NYHA functional class 1
- No prior heart failure hospitalizations
- Euvolemic

mWHO Group III (LVEF 30-45%) → 19-27% maternal cardiac risk
Carpreg 2 score = 2 (LV dysfunction) → 10% risk of maternal cardiac event

Case JS – Preconception Counseling

- Discussed increased risk for maternal cardiac event during pregnancy
  - *Heart failure/volume overload, arrhythmia. Less likely death*
- Stop lisinopril
- Start hydralazine/nitrate combination
- Continue Toprol XL



Pregnancy Monitoring/Delivery Planning

- Where should she be followed in pregnancy?
- How often?
- What testing needs to be done?
- Who should be involved?
- What monitoring devices are needed in the peripartum period?
- Where will she deliver? Recover?

OSU Delivery Plan

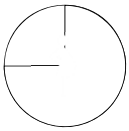
Cardio-Obstetrics DELIVERY PLAN for ***
CARPREG II score:{NUMBERS: 0-15:110028::"0"}
mWHO class:{mwho:37390::"TBD"}
Risk of adverse CV event in pregnancy:{mgrisklevel:37392}

MRN | DOB | Age | GP | Estimated Date of Delivery:
Patient of: Lastinger/MFM Co-manage

Advance Anesthesia Consult (Call 3-7301):	TBD
Consult ACHD on admission:	TBD
Cardiac Diagnosis:	***
Location of delivery:	TBD
Recommend assisted 2nd stage (from cardiac perspective):	TBD
Anesthesia and/or monitoring recs:	None
Telemetry recommendations:	TBD
Echo 48 hours post-partum:	TBD
Cardiac Meds:	
Next cardiology appointment:	
Additional Recs:	Acceptable risk for either vaginal or cesarean delivery
Induction or surgery date (if scheduled):	

Echo	
Cardiac MRI or CT	
Holter	
Other	

Delivery Myths vs Reality



MYTHS

- Women with heart disease:
  - Should not get pregnant
  - Will have to deliver early
  - Will have to have a c-section

REALITY

- Majority of women with heart disease can achieve a safe and healthy pregnancy/delivery
- Almost never a cardiac indication for induction before 39 weeks
- Most women will be able to deliver spontaneously
- C-section generally for OB reasons with *rare* indication for cardiovascular reasons

Case JS – Delivery Planning

Cardio-Obstetrics DELIVERY PLAN for JS

CARPREG II score:2
mWHO class:III

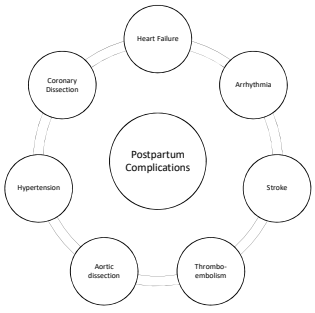
Risk of adverse CV event in pregnancy:Intermediate-High

99999999 | 1/1/1986 | 35 y/o | G1P0000 | Estimated Date of Delivery: 1/1/2022
Patient of Lastinger/Dr Ob MFM

Advance Anesthesia Consult (Call 3-7301)	No
Consult Cardio-obstetrics on admission	Yes
Cardiac Diagnosis	Chemo-induced cardiomyopathy (LVEF 35%)
Location of delivery	OSU L&D
Recommend assisted 2nd stage (from cardiac perspective)	As needed for OB reasons
Anesthesia and/or monitoring recs	None
Telemetry recommendations	None
Echo 48 hours post-partum	No
Cardiac Meds	Toprol XL 50mg daily, hydralazine 10mg TID, isosorbide mononitrate 30mg daily
Next cardiology appointment	11/30/2021
Additional Recs	Acceptable risk for either vaginal or cesarean delivery
Induction or surgery date (if scheduled)	TBD

Echo	Mildly dilated LV with moderate systolic dysfunction, EF 35% Normal RV size and systolic function. Mild mitral regurgitation.
Cardiac MRI or CT	
Holter	
Other	

Postpartum Cardiovascular Complications



Case JS – Postpartum monitoring

- Developed hypotension with epidural placement so received 4L IV fluids during labor
- Uncomplicated vaginal delivery
- Mild ankle/pedal edema postpartum→IV Lasix 20mg x 1 with good response

- Follow-up 2 weeks postpartum (telemedicine) – doing well, some fatigue but no shortness of breath, orthopnea, palpitations or LE edema
- Follow-up 6 months postpartum – LVEF 35% on repeat echo

I'm an Expert in Neither Cardiology nor Obstetrics—what can I do?

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AHA POLICY STATEMENT

Call to Action: Maternal Health and Saving Mothers

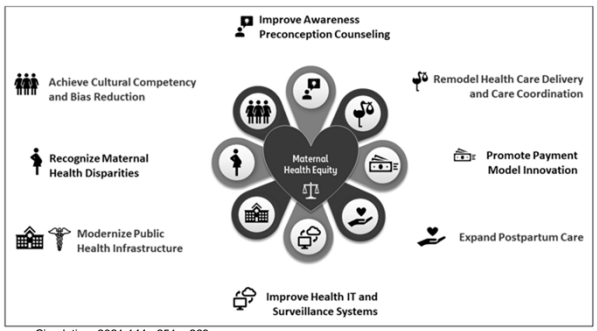
A Policy Statement From the American Heart Association

The American College of Obstetricians and Gynecologists supports the value of this clinical document as an educational tool, September 2021.

Society for Maternal-Fetal Medicine supports this document.

Laxmi S. Mehta, MD, FAHA, Chair; Garima Sharma, MD, Vice Chair; Andreea A. Creanga, MD, PhD; Afshan B. Hameed, MD; Lisa M. Hollier, MD; Janay C. Johnson, MPH, Lisa Leffert, MD; Louise D. McCullough, MD; Mahasin S. Mujahid, PhD, MS, FAHA; Karol Watson, MD, FAHA; Courtney J. White, Esq; on behalf of the American Heart Association Advocacy Coordinating Committee

Circulation. 2021;144:e251–e269.

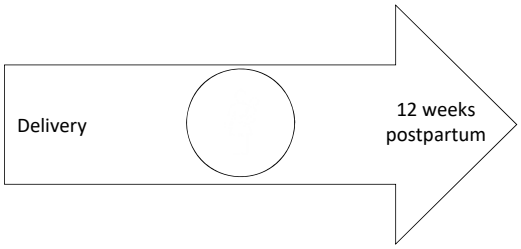


Circulation. 2021;144:e251–e269.

What Can I Do?

- Improve awareness
- Preconception counseling
- Recognize and address maternal health disparities
- Recognize and actively address implicit bias
- Expand postpartum care

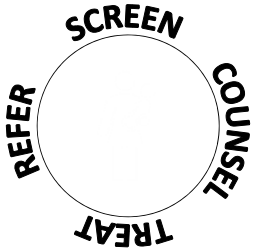
Postpartum monitoring



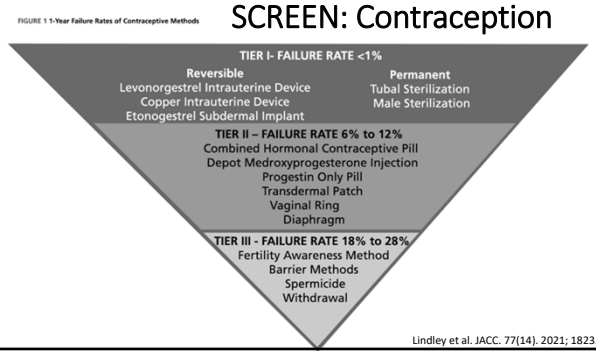
The Fourth Trimester

Delivery to 12 weeks postpartum

- Opportunity to screen for and address:
  - Contraception
  - Cardiovascular risk factors
  - Postpartum complications
  - Mental Health



SCREEN: Contraception



Lindley et al. JACC. 77(14). 2021; 1823.

SCREEN: Cardiovascular Risk Factors

- Diabetes
- Hypertension
- Tobacco use
- Obesity
- Hyperlipidemia *(*no earlier than 8-12 weeks postpartum)*

Recommendation:
CV risk factor assessment 3 months postpartum,
then again 6-12 months later
after implementation of lifestyle changes

SCREEN: Postpartum complications

Be alert to signs/symptoms

- **Heart failure**: shortness of breath, cough, lower extremity swelling, orthopnea
- **Pre-eclampsia**: headache, vision changes, elevated BP, shortness of breath
- **Pulmonary embolism**: chest pain, shortness of breath, tachycardia, hypoxia
- **Arrhythmia**: palpitations, irregular heart rate

- **LOW THRESHOLD FOR TESTING or REFERRAL**
- **Take advantage of e-consults**

BNP
SpO2
ECG
Echo

COUNSEL & TREAT

- Hypertension
- Diabetes
- Hyperlipidemia
- Mental Health Disorders
- Tobacco cessation medications/counseling
- Obesity

TREAT: Hypertension

- Pre-eclampsia may develop postpartum (~5% of cases)
- Severe HTN (BP > 160mmHg systolic and/or > 110mmHg diastolic) in a pregnant or recently postpartum patient is considered a medical emergency
  - Prompt treatment/referral vital to reduce risk of stroke and other complications

Antihypertensives in Pregnancy

TABLE 4 - Preferred Agents for Antihypertensive Treatment in Pregnancy

	Starting Dose	Titration	Maximum Dosage
First line			
Labetalol	100-200 mg by mouth twice daily	Every 2-3 days	2,400 mg/24 h
Nifedipine ER	30-60 mg by mouth every day	Every 7-14 days	120 mg/24 h
Alpha-methyldopa	250 mg by mouth 2 to 3 times daily	Every 2 days	3,000 mg/24 h
Second/third line			
Hydralazine*	10 mg by mouth 4 times daily	Every 2-5 days	300 mg/24 h
Thiazide diuretics	12.5 mg by mouth once a day	Every 7-14 days	50 mg/ 24 h
Clonidine	0.1-0.3 mg by mouth twice a day	Every 7 days	0.6 mg/24 h
	0.1 mg transdermal every day	Every 7-14 days	0.3 mg/24 h

Park et al. JACC. 2021, 77(14) 1799.

Antihypertensives: Breast Feeding

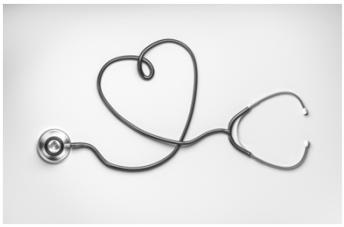
TABLE 5 - Antihypertensives and Breast Feeding

Medication Class	Preferred Agents
Calcium-channel blockers	Nifedipine, verapamil, diltiazem
Beta-blockers	Labetalol, metoprolol, and propranolol are preferred
ACE inhibitor	Captopril, enalapril, benazepril, quinapril
Diuretics	Hydrochlorothiazide, spironolactone
	Safe, can decrease milk production
	Exception: chlorthalidone due to risk of fetal jaundice, thrombocytopenia, hypoglycemia, and electrolyte abnormalities
Methyldopa	Caution! May exacerbate postpartum depression
ARBs	Insufficient data to recommend their use during breast feeding
Clonidine transdermal patch	Caution! Possible infant/lactation effects

Park et al. JACC. 2021, 77(14) 1799.

REFER

- Subspecialists
- Primary care
- Social services
- Mental health services
- Nutritionist



Davis et al. J Am Coll Cardiol. 2021 Apr 13;77(14):1763-1777.

Take Home Points:

1. Maternal mortality in the United States is on the rise. We must engage the entire healthcare community to work to improve outcomes for pregnant and postpartum women.
2. The spectrum of heart disease in pregnancy is wide, but most women with heart disease can safely undergo pregnancy and delivery
3. Adverse pregnancy outcomes (preE, gestational HTN and DM, etc) are associated with increased risk of ASCVD.

Take Home Points:

4. Comprehensive care of pregnant women with heart disease involves pre-conception counseling, risk assessment and careful planning. Involvement of a multidisciplinary cardio-obstetrics team throughout pregnancy and the postpartum period is crucial to optimizing outcomes.
5. The Fourth Trimester is an opportunity for primary care providers to impact maternal mortality by screening for a treating for cardiovascular risk factors.

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