CardioPregnancy

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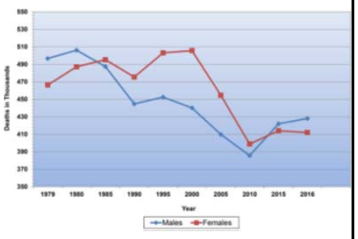
Objectives

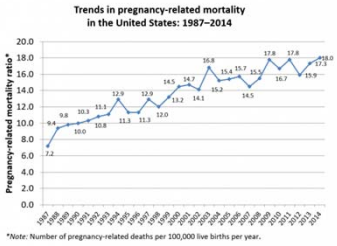
- Why
  - Think heart disease before pregnancy, during pregnancy and post partum
- Why now?
  - Numbers
  - Guidelines
- CardioPregnancy
- Fourth Trimester
- Follow up recommendations

Heart Disease in Women

- Women > 20 yo: 35.9% have some form of CVD. 35.1% white women, 47.7% black women, 33.3% Hispanics women.
- In 2016, CVD was the cause of death in 412,244 females (all ages). Represents 49% of deaths from CVD.
- CVD causes about 1 death every 1 minute 16 seconds among females.
- 2016, CVD was the first listed diagnosis of about 2.2 million females discharged from short-stay hospitals.
- 2014, 25.3% of bypass and 32.3% of percutaneous coronary intervention patients were female (~50% of patients are women)



Pregnancy and Mortality



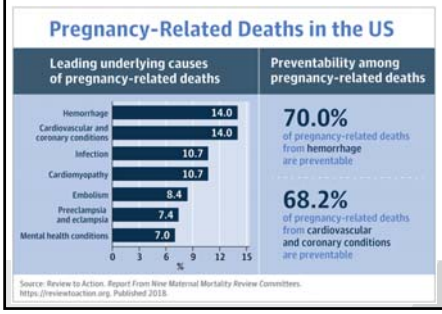
Maternal mortality rate was 26.4 per 100 000 live births in 2015.

All developed countries did better:
4.4/100000 Sweden,
9.2 in the United Kingdom
7.3 in Canada.

According to international groups, mortality rates dropped by an estimated 44% worldwide from 1990 to 2015—a decline of 48% for industrialized countries.

Based on US statistics, pregnancy-related deaths rose there by about 27% from 2000 to 2014.

Maternal Mortality

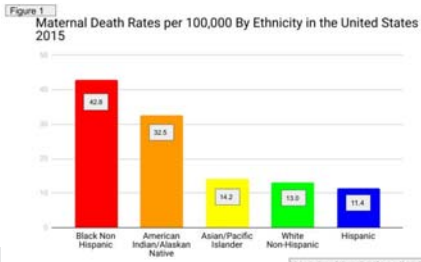


Causes of death vary by race:

- Preeclampsia and eclampsia, and embolism were the leading causes of death for black women,
- Mental health problems led to more deaths in non-Hispanic white women.

Deaths were most common within the 42 days postpartum (45%).

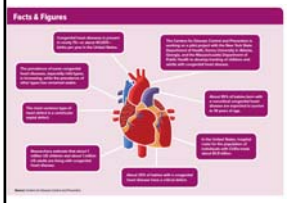
Maternal Mortality



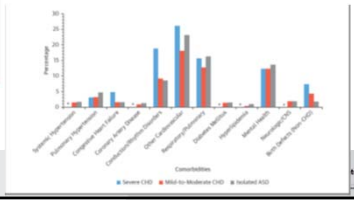
PrePregnancy

- Women with known heart disease should see a cardiologist prior to pregnancy and receive pre-pregnancy counseling.
- Pre pregnancy risk factors
  - Chronic hypertension
  - Dyslipidemia
  - BMI > 30 (even > 25)
- PrePregnancy BMI, SBP, DBP, HDL (low), Triglycerides (HIGH) account for 40% of the difference in rates of postpartum CV risk factors women who developed a hypertensive disorder of pregnancy
- Patients who have moderate and high-risk CVD should be managed during pregnancy, delivery, and postpartum via a multidisciplinary Pregnancy Heart Team

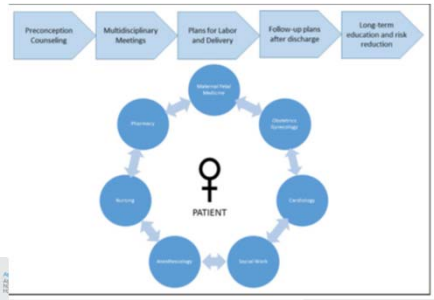
Congenital Heart Disease



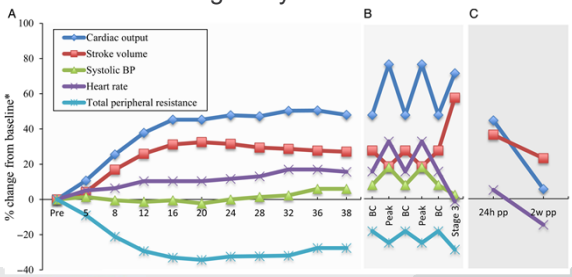
- Significant Increase Risk In Pregnancy
- Most women Can Be Managed with multidisciplinary care
- < 1% of women get recommended PRECONCEPTION care
- 23% of women get no pregnancy care at all



CardioPregnancy Team



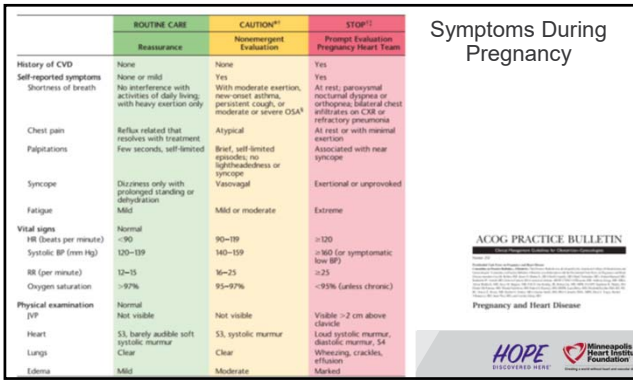
Pregnancy – A Stress Test

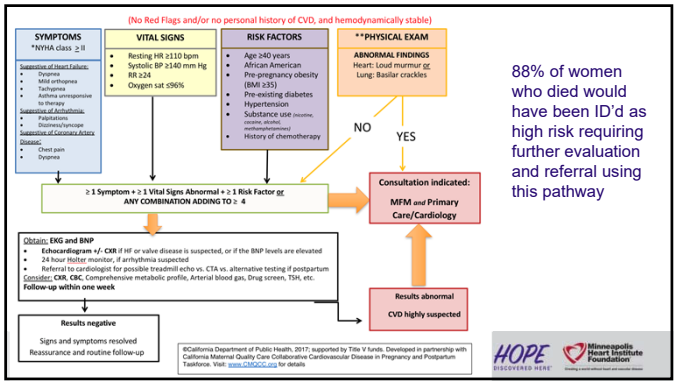


Normal Hemodynamic Changes During **Pregnancy**

Hemodynamic Parameter	Change During Normal Pregnancy	Change during labor and delivery	Change during postpartum
Blood volume	↑ 40-50%	↑	↓ (autodiuresis)
Heart rate	↑ 10-15 beats/min	↑	↓
Cardiac output	↑ 30-50 %	↑ additional 50%	↓
Blood pressure	↓ 10 mm Hg	↑	↓
Stroke volume	↑ 1st and 2nd trimester; ↓ 3rd trimester	↑ (300-500 mL per contraction)	↓
Systemic vascular resistance	↓	↑	↓

Symptoms During Pregnancy

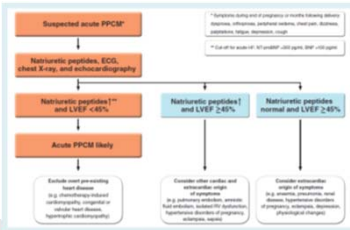




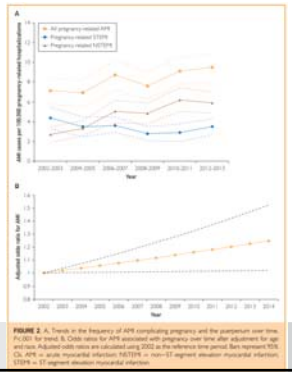
88% of women who died would have been ID'd as high risk requiring further evaluation and referral using this pathway

PeriPartum CM

Definition of peripartum cardiomyopathy
1. Heart failure secondary to left ventricular systolic dysfunction with a LVEF < 45%
2. Occurrence towards the end of pregnancy or in the months following delivery (mostly in the month following delivery)
3. No other identifiable cause of heart failure



PAMI

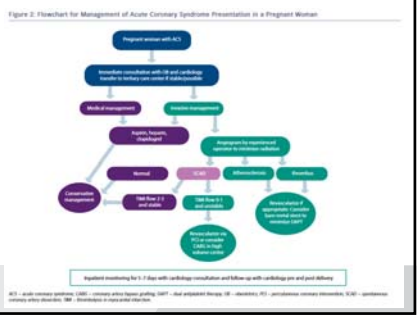


Pami

Table 1. Potential mechanisms of pregnancy-associated myocardial infarction

Etiology	Potential contributing factors
Coronary artery dissection	• Pregnancy-associated vascular remodeling • Vessel wall shear stress from increased plasma volume and cardiac output during pregnancy • Underlying genetic or acquired vasculopathy • Iatrogenic (e.g., catheter trauma during angiography)
Atherosclerosis	• Rising prevalence of cardiovascular risk factors (e.g., hypertension, hyperlipidemia, diabetes, and obesity) among reproductive-aged women
Coronary thrombosis	• Hypercoagulable state of pregnancy • Inherited thrombophilia • Right-to-left shunt with paradoxical embolism • May–Thurner anatomy
Vasospasm	• Enhanced vasoreactivity to angiotensin II • Endothelial dysfunction • Exposure to ergot alkaloids (for prevention of postpartum hemorrhage)
Takotsubo cardiomyopathy	• Pain, Anxiety, Tocolytic Agents

PAMI



Pregnancy and CAD outcomes

- Recent small trial of PAMI (79 women) – UK study
- 36% increased bmi > 30, 24.3% were current smokers., 22.8% had prior diabetes, 34.2% had dyslipidemia and 26.2% had hypertension.
- Etiology
  - was due to atherosclerosis in 65.8%
  - spontaneous coronary artery dissection (SCAD) in 13.9%
  - coronary artery spasm in 8.9%
  - thrombus in 11.4%.
- Only six adverse cardiac events (6.6% event rate)
  - one non-ST elevation myocardial infarction at 23 weeks' gestation, two SCAD recurrences, one worsening of left ventricular function and two women with worsening angina.
- 14% of women developed pre-eclampsia, 25% delivered preterm and 25% of infants were born small for gestational age

Maternal Pregnancy Risk Classification Systems

- ♥Modified WHO classification: CHD and maternal risk
- ♥Carpreg : cardiac disease in pregnancy – all cardiac disease
- ♥Zahara : CHD specific, also includes fetal outcomes
- ♥ROPAC: Registry of pregnancy and cardiac disease

mWHO Pregnancy Classification

- WHO I: no increase in mortality, no/small increase in morbidity
- WHO II: small increased risk of mortality, moderate morbidity
- WHO II- III: moderate risk of mortality and morbidity
- WHO III: Significantly increased maternal mortality or severe morbidity
  - Expert counseling required.
  - intensive specialist cardiac and obstetric monitoring needed throughout pregnancy, childbirth, and the puerperium
- WHO IV: Pregnancy Contraindicated. Extremely high risk of mortality/severe morbidity
  - Expert counseling required
  - termination maybe considered. If pregnancy continues, care should follow class III recommendations.

WHO Pregnancy Classification

mWHO I	mWHO II	mWHO II- III	mWHO III	mWHO IV
Small or mild – pulmonary stenosis – patent ductus arteriosus – mitral valve prolapse Successfully repaired simple lesions (atrial or ventricular septal defect, patent ductus arteriosus, anomalous pulmonary venous drainage) Atrial or ventricular ectopic beats, isolated	Unoperated atrial or ventricular septal defect Repaired tetralogy of Fallot Most arrhythmias (supraventricular arrhythmias) Turner syndrome without aortic dilatation	Mild left ventricular impairment (EF >45%) Hypertrophic cardiomyopathy Native or tissue valve disease not considered WHO I or IV (mild mitral stenosis, moderate aortic stenosis) Marfan or other HTAD syndrome without aortic dilatation Aorta <45 mm in bicuspid aortic valve pathology Repaired coarctation Atrioventricular septal defect	Moderate left ventricular impairment (EF 30–45%) Previous peripartum cardiomyopathy without any residual left ventricular impairment Mechanical valve Systemic right ventricle with good or mildly decreased ventricular function Fontan circulation. If otherwise the patient is well and the cardiac condition uncomplicated Unrepaired cyanotic heart disease Other complex heart disease Moderate mitral stenosis Severe asymptomatic aortic stenosis Moderate aortic dilatation (40–45 mm in Marfan syndrome or other HTAD; 45–50 mm in bicuspid aortic valve, Turner syndrome ASI 20–25 mm/m², tetralogy of Fallot <50 mm) Ventricular tachycardia	Pulmonary arterial hypertension Severe systemic ventricular dysfunction (EF < 30% or NYHA class III–IV) Previous peripartum cardiomyopathy with any residual left ventricular impairment Severe mitral stenosis Severe symptomatic aortic stenosis Systemic right ventricle with moderate or severely decreased ventricular function Severe aortic dilatation (>45 mm in Marfan syndrome or other HTAD; >50 mm in bicuspid aortic valve, Turner syndrome ASI >25 mm/m², tetralogy of Fallot >50 mm) Vascular Ehlers–Danlos Severe (re)coarctation Fontan with any complication

Zahara Risk Score

CARPREG Score

Prior cardiac event (heart failure, transient ischaemic attack, stroke before pregnancy or arrhythmia).
Baseline NYHA functional class >II or cyanosis.
Left heart obstruction (mitral valve area <2 cm², aortic valve area <1.5 cm², peak LV outflow tract gradient >30 mmHg by echocardiography).
Reduced systemic ventricular systolic function (ejection fraction <40%).

Risk of Adverse Event

- 0= 5%
- 1= 27%
- > 1= 75%

ZAHARA predictors[19]
History of arrhythmia event.
Baseline NYHA functional class >II.
Left heart obstruction (aortic valve peak gradient >50 mm Hg).
Mechanical valve prosthesis.
Moderate/severe systemic atrioventricular valve regurgitation (possibly related to ventricular dysfunction).
Moderate/severe sub-pulmonary atrioventricular valve regurgitation (possibly related to ventricular dysfunction).
Use of cardiac medication pre-pregnancy.
Repaired or unrepaired cyanotic heart disease.
Predictors from Khairy[20]
Smoking history.
Reduced subpulmonary ventricular function and/or severe pulmonary regurgitation.

NYHA = New York Heart Association.

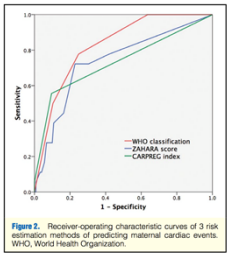
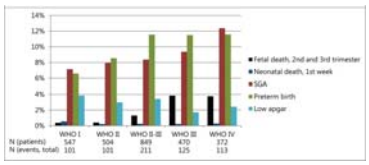


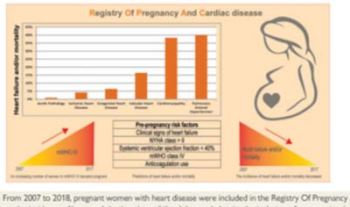
Figure 2. Receiver-operating characteristic curves of 3 risk estimation methods of predicting maternal cardiac events. WHO, World Health Organization.

Comparison of 3 Risk Estimation methods for predicting cardiac outcomes in pregnant women with CHD Circ J. 2015 Jun 25;79(7):1609-17. Lu et all

WHO Category and Fetal Outcome



Ropac Registry



Take home figure From 2007 to 2018, pregnant women with heart disease were included in the Registry Of Pregnancy And Cardiac disease (ROPAC). During that time, the incidence of 'maternal death or heart failure' dropped, despite the inclusion of more seriously ill women (mWHO IV). Especially women with cardiomyopathies or pulmonary arterial hypertension were at risk of 'maternal death or heart failure'. Pre-pregnancy risk factors were signs of heart failure prior to pregnancy, NYHA class > II, systemic ventricular ejection fraction of below 40%, mWHO class IV conditions and anticoagulation use.

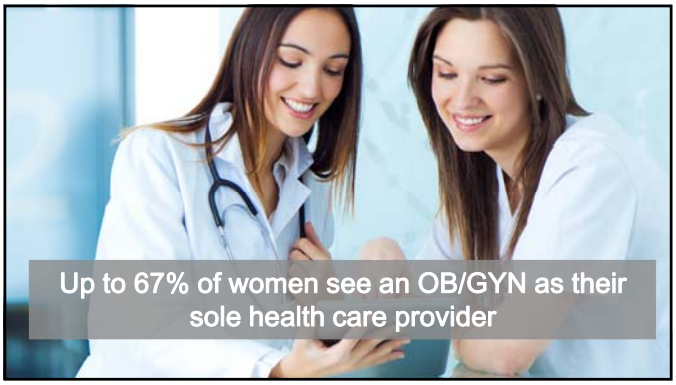
First pregnancies should be utilized as an early life stress test to identify women who may benefit from CVD preventive screening and management

From Research to Practice:

BROACH
Broadening the Role of OBGYNs in Assessing Cardiovascular Health


Eliminating untimely deaths of women from heart disease: Highlights from the Minnesota Women's Heart Summit

Idea spawned from a 2010 Women's Summit



BROACH Study

MN state-wide survey to understand the gaps of the CVD-related needs of women and practices of OBGYN practitioners

Results

- 43% reported following lipid screening guidelines
- 41% reported following glucose screening guidelines
- 10% reported prescribing blood pressure medications to those with hypertension

Lifestyle

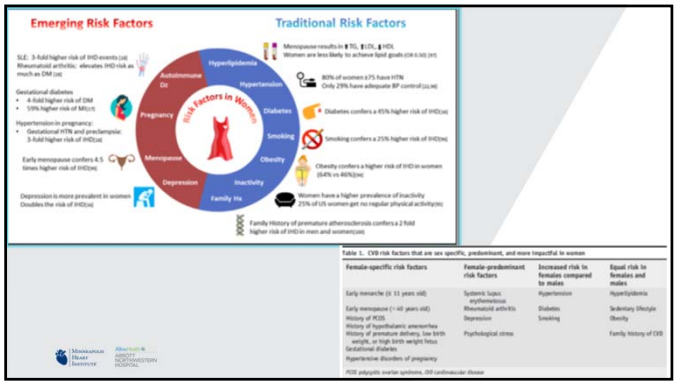
- 60% counseled on nutrition
- 40% counseled on stress management
- 98% discussed smoking cessation
- 85% encouraged more physical activity

AHA/ACOG PRESIDENTIAL ADVISORY

Promoting Risk Identification and Reduction of Cardiovascular Disease in Women Through Collaboration With Obstetricians and Gynecologists

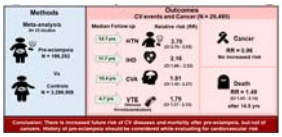
A Presidential Advisory From the American Heart Association and the American College of Obstetricians and Gynecologists

May 2018

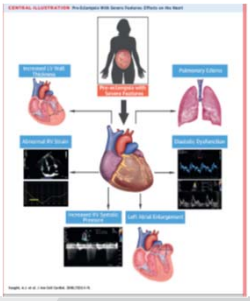


Peri/Post Partum: Preeclampsia and Gestational Hypertension

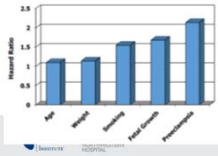
- Increased risk for developing hypertension
- Worsening endothelial dysfunction
  - 3.8x more likely to develop DM,
  - 11.6x more likely to develop HTN requiring Treatment
- Increase in HFpEF
- May increase risk for women for heart disease similar to risk in life long smokers
- Often not evaluated by physicians



GIH



Risk Factors and CVD Death



Gestational Complications

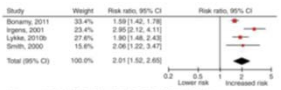
- Gestational diabetes (GDM)
  - Women who develop gestational diabetes are at higher risk of developing CVD and may be at risk for early atherosclerosis in midlife (even before the onset of type 2 diabetes).
  - Large multicenter review (nine large studies)
    - Women with GDM had a twofold higher risk of CVD (relative risk [RR], 1.98; 95% confidence interval [CI], 1.57-2.50) and meta-regression analysis showed that this risk was not affected by rates of incident type 2 diabetes (p = 0.34).
    - Women who did not develop type 2 diabetes remained at increased risk of CVD with RR 1.56 (95% CI, 1.04-2.32).
    - Within the first 10 years postpartum, GDM conferred a 2.3-fold risk of CVD (RR, 2.32; 95% CI, 1.57-3.39).

Gestational Complications

Placental abruption, preterm birth, small for gestational age

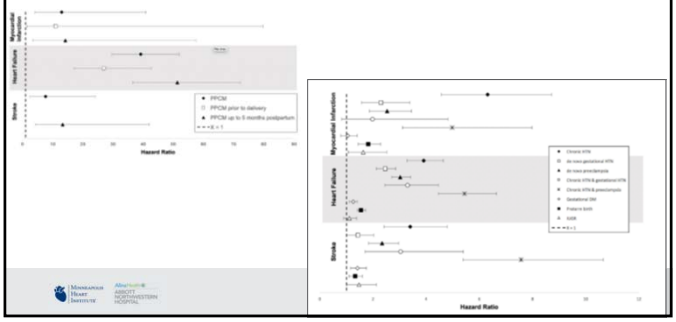
These pregnancy-related complications increase a woman's risk of CVD.
Medically indicated preterm birth puts a woman at significantly higher risk of CVD than a spontaneous preterm birth, but even a spontaneous preterm delivery is associated with increased risk.

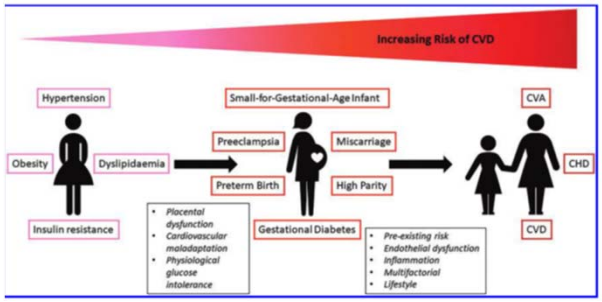
Preterm Delivery and Overall Cardiovascular Disease Later in Life

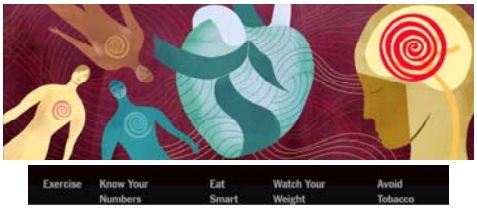


Heida et al. *Eur J Prev Cardiol* 2016;23:1863-79

APO and CV outcomes







Take a Deep Breath 80% of heart disease is preventable

Educational Materials

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

Messages you can share with your patients

Breastfeed, if possible
Breastfeeding may help you lose pregnancy weight and it lowers your risk for heart disease and diabetes. The longer you breastfeed, preferably one year, the more cardio-protective it is.

Be tobacco-free
Quitting smoking drops your risk dramatically and it continues to drop over days, weeks and years. Within five years, most smokers cut their risk of stroke to nearly that of a nonsmoker.

Move more ... sit less
Being moderately physically active for 30 minutes, five days a week or more decreases your risk of heart disease and it can be fun for you and your family. Engaging in less screen time and other sedentary activities improves your heart health.

Make healthier eating choices
Eating a variety of foods and mostly plants can protect your heart. Eat more whole foods – such as vegetables, fruits, whole grains – and more healthy fats. Eat fewer highly processed food, foods high in sugar (sugar-sweetened beverages), saturated fats and salt. The DASH (Dietary Approaches to Stop Hypertension) and Mediterranean eating plans are evidence-based eating patterns that can guide heart-healthy food choices.

Maintain or move toward a healthier weight
Losing 5-10 percent of your body weight will reduce your risk. More importantly, you'll feel better and have more energy to do the things you enjoy!

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Referral Guidelines

Risk factor	Exam/screening results	Refer patient to:
CVD symptoms	Cardiovascular symptoms (shortness of breath, dyspnea, chest pain, feeling faint, exertional intolerance, palpitation, swelling or syncope) are present	Cardiologist
Cholesterol	LDL is >190 mg/dl on initial screen.	Cardiologist
	LDL >130 with either family history of premature CAD (first degree relative with CV event age 60 or younger) or diagnosis of diabetes	Cardiologist
	LDL>130mg/dL with no additional risk factors	Internist or family practice provider
Blood pressure	Blood pressure is >130/80 mmHg, especially if their CVD risk score is >10%. In this case, chronic antihypertensive therapy should be initiated.	Internist or family practice provider
	Blood pressure is >140/90 regardless of their CVD risk score. Antihypertensive therapy should be initiated, keeping in mind that they may need to be on more than one medication to achieve blood pressure goal.	Internist or family practice provider
	Blood pressure remains >140/90 despite being on 3 antihypertensive medications.	Cardiologist
Blood glucose	Blood glucose remains elevated and/or screening A1c is >6.5%.	Internist or family practice provider
CVD risk score	In patients 40 or older, calculate CVD risk score. If score is >7.5% or their cholesterol is high, aggressive risk factor modification is likely needed.	Internist or family practice provider
Healthy eating and weight management		Dietitian
Increasing physical activity		Exercise specialist

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Understanding Women's Cardiovascular Disease (CVD) Cumulative Risk Throughout a Lifetime

RISKS

Smoking and e-cigs – Smoking causes 1 of 3 deaths from CVD
Smoking combined with birth control pills – The combination increases risk by 20%
Pregnancy weight not lost – After one year increases risk
Elevated LDL (bad) cholesterol – Nearly 1 in 2 women have high (or borderline) high cholesterol
Autoimmune disorders – Lupus & rheumatoid arthritis significantly increases risk
Menopause – Early menopause (<45 years) leads to 4-5x greater CVD risk

AGE: 20s 30s 40s 50s 60s

RISKS

Pregnancy conditions – Preeclampsia, gestational diabetes and pregnancy-induced hypertension lead to higher risk
Delivered premature or low birth-weight baby – <37 weeks or 5#, 8oz; ~1.5x increased risk of CVD
Depression – Higher incidence in young women; depression leads to greater risk
Cancer treatment – Link between cancer treatment and CVD
Type 2 Diabetes – 2-3x more likely to have CVD
High blood pressure – Affects 3 of 4 women 65+

Minneapolis Heart Institute Foundation

Special Thank You Boston Scientific

www.surveymonkey.com/r/PregnancyandCVDSurvey

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Thank you!

Visit our website for provider and patient materials:
mplsheart.org/women

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