PREGNANCY, HEART DISEASE & STROKE IN WOMEN

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Emory University School of Medicine
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### Pregnancy-Related Deaths in the US

**Leading underlying causes of pregnancy-related deaths**

<table>
<thead>
<tr>
<th>Condition</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hemorrhage</td>
<td>14.0</td>
</tr>
<tr>
<td>Cardiovascular and coronary conditions</td>
<td>14.0</td>
</tr>
<tr>
<td>Infection</td>
<td>10.7</td>
</tr>
<tr>
<td>Cardiomyopathy</td>
<td>10.7</td>
</tr>
<tr>
<td>Embolism</td>
<td>8.4</td>
</tr>
<tr>
<td>Preeclampsia and eclampsia</td>
<td>7.4</td>
</tr>
<tr>
<td>Mental health conditions</td>
<td>7.0</td>
</tr>
</tbody>
</table>

**Preventability among pregnancy-related deaths**

- 70.0% of pregnancy-related deaths from hemorrhage are preventable.
- 68.2% of pregnancy-related deaths from cardiovascular and coronary conditions are preventable.


[emoryhealthcare.org/womensheart](emoryhealthcare.org/womensheart)
Leading Underlying Causes of Pregnancy-Related Deaths, by Race-Ethnicity

- Hemorrhage: 10.5% (Non-Hispanic Black) vs. 14.4% (Non-Hispanic White)
- Cardiovascular and Coronary Conditions: 12.8% (Non-Hispanic Black) vs. 15.5% (Non-Hispanic White)
- Infection: 8.1% (Non-Hispanic Black) vs. 13.4% (Non-Hispanic White)
- Cardiomyopathy: 14.0% (Non-Hispanic Black) vs. 10.3% (Non-Hispanic White)
- Embolism: 9.3% (Non-Hispanic Black) vs. 5.2% (Non-Hispanic White)
- Preeclampsia and Eclampsia: 5.2% (Non-Hispanic Black) vs. 11.6% (Non-Hispanic White)
- Mental Health Conditions: 1.2% (Non-Hispanic Black) vs. 11.3% (Non-Hispanic White)

Source: CDC Foundation 2018

Note: The cause of death is unknown for 6.5% of all pregnancy-related deaths.
SYNCOPE DURING PREGNANCY

Average increase in incidence of 4%/year
Rate ratio 1.04 (95% CI: 1.03 – 1.05)
PREGNANCY COMPLICATIONS AND HEART DISEASE

Women who experience certain pregnancy and delivery complications are at a greater risk of heart disease and stroke later in life.

COMPPLICATIONS THAT CAN INCREASE RISK:

- High blood pressure (HBP)
- Pre-eclampsia (HBP with certain other signs or symptoms)
- Baby is pre-term (born before 37 weeks)
- Baby is small for gestational age (weighs much less than normal, given timing of delivery)
- Gestational diabetes (high blood sugar in pregnancy)

5 STEPS TO A HEART HEALTHY PREGNANCY:
1. Get early and regular prenatal care.
2. Exercise regularly and keep weight gain within general guidelines.
3. Do not smoke (ever!) or drink alcohol during pregnancy.
4. Eat regular, healthful meals and take prenatal vitamins with folate during pregnancy.
5. Limit salt and caffeine, which can increase blood pressure or cause an irregular heartbeat in the mother.

Talk to your health care provider about heart disease and stroke and #getHeartChecked.

AWHONN | WOMEN'S HEART ALLIANCE | ACOG

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PREGNANCY IS FIRST STRESS TEST

PREGNANCY COMPLICATIONS & HEART DISEASE RISK

PREGNANCY can be NATURE’S STRESS TEST ON THE HEART.

Women are at greater risk of having heart disease or a stroke if they had the following pregnancy complications:

- HIGH BLOOD PRESSURE OR PREECLAMPSIA
- GESTATIONAL DIABETES
- PRETERM BIRTH (BEFORE 37 WEEKS OF PREGNANCY)

WHAT YOU CAN DO

- Make sure your primary care doctor knows if you had these pregnancy complications.
- Know your risk for heart disease now and as you age.
- Adopt healthy habits: exercise daily, eat a heart-healthy diet, maintain a healthy weight.

Go to CardioSmart.org/Women to learn more about heart risk factors and tips to stay healthy.

Information provided for educational purposes only. Please consult your health care provider about your specific health needs.

CardioSmart
American College of Cardiology

EMORY WOMEN’S HEART CENTER

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PREGNANCY COMPLICATIONS

• Detailed pregnancy history integral component of risk assessment for women
• Pregnancy complications: preeclampsia, gestational diabetes, pregnancy-induced hypertension, preterm delivery are early indicators ↑ CV risk
• Cardiovascular, metabolic stress of pregnancy → potential for early prediction future CV risk
• Preeclampsia, gestational hypertension →↑ CVD risk
  – 3-6X ↑ subsequent hypertension
  – 2x ↑ ischemic heart disease, stroke
  – Residual endothelial dysfunction, association with ↑ CAC
• Gestational diabetes → 7x ↑ risk type 2 DM
Hypertensive Disorders of Pregnancy

- Chronic hypertension
  - 370% increase

- Stroke
  - 81% increase

- Atrial arrhythmias
  - 50% increase

- Coronary heart disease
  - 250% increase

- Heart failure
  - 400% increase

- All-cause death
  - 50% increase

- Cardiovascular death
  - 221% increase

Coutinho T et al. Curr Treat OptionsCardiovasc Med. 2018

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EMORY
WOMEN'S HEART CENTER
RISK FACTORS FOR PREGNANCY-INDUCED HTN

- Obesity
- Chronic HTN
- Gestational HTN
- First time pregnancy
- Multiple pregnancy
- Pre-existing vascular disease
- Personal or family hx of preeclampsia
- Collagen (connective tissue) vascular disease
- Age >40 years
- Diabetes
- Renal disease

Bushnell 2014 Circ and JACC
Table 2. How to Differentiate Common Signs and Symptoms of Normal Pregnancy Versus Those That Are Abnormal and Indicative of Underlying Cardiac Disease

<table>
<thead>
<tr>
<th></th>
<th>Routine Care</th>
<th>Caution*†</th>
<th>Stop‡</th>
<th>Prompt Evaluation Pregnancy Heart Team</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>History of CVD</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Self-reported symptoms</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Shortness of breath</td>
<td>None</td>
<td>None</td>
<td>Yes</td>
<td>Reflux related that resolves with treatment; atypical</td>
</tr>
<tr>
<td></td>
<td>None or mild</td>
<td>Yes</td>
<td>Yes</td>
<td>with moderate exertion, new-onset asthma, persistent cough, or moderate or severe OSA‡</td>
</tr>
<tr>
<td>Chest pain</td>
<td>Atypical</td>
<td>Atypical</td>
<td>At rest or with minimal exertion; paroxysmal nocturnal dyspnea or orthopnea; bilateral chest infiltrates on CXR or refractory pneumonia</td>
<td></td>
</tr>
<tr>
<td>Palpitations</td>
<td>Brief, self-limited episodes; no lightheadedness or syncope</td>
<td>Associated with near syncope</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Syncope</td>
<td>Dizziness only with prolonged standing or dehydration</td>
<td>Vasovagal</td>
<td>Exertional or unprovoked</td>
<td></td>
</tr>
<tr>
<td>Fatigue</td>
<td>Mild</td>
<td>Mild or moderate</td>
<td>Extreme</td>
<td></td>
</tr>
<tr>
<td><strong>Vital signs</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>HR (beats per minute)</td>
<td>Normal</td>
<td>90–119</td>
<td>≥120</td>
<td></td>
</tr>
<tr>
<td>Systolic BP (mm Hg)</td>
<td>120–139</td>
<td>140–159</td>
<td>≥160 (or symptomatic low BP)</td>
<td>≥25</td>
</tr>
<tr>
<td>RR (per minute)</td>
<td>12–15</td>
<td>16–25</td>
<td>≥25</td>
<td></td>
</tr>
<tr>
<td>Oxygen saturation</td>
<td>≥97%</td>
<td>95–97%</td>
<td>&lt;95% (unless chronic)</td>
<td></td>
</tr>
<tr>
<td><strong>Physical examination</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>JVP</td>
<td>Normal</td>
<td>Not visible</td>
<td>Visible &gt;2 cm above clavicle</td>
<td></td>
</tr>
<tr>
<td>Heart</td>
<td>S3, barely audible soft systolic murmur</td>
<td>S3, systolic murmur</td>
<td>Loud systolic murmur, diastolic murmur, S4</td>
<td>Wheezing, crackles, effusion</td>
</tr>
<tr>
<td>Lungs</td>
<td>Clear</td>
<td>Clear</td>
<td>Clear</td>
<td>Marked</td>
</tr>
<tr>
<td>Edema</td>
<td>Mild</td>
<td>Moderate</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Abbreviations: BP, blood pressure; CVD, cardiovascular disease; CXR, chest x-ray; HR, heart rate; JVP, jugular venous pressure; OSA, obstructive sleep apnea; RR, respiratory rate.

*If unclear, any combination of factors in the yellow column that add up to 4 or more should prompt further evaluation.
**Figure 1.** Cardiovascular Disease Assessment in Pregnant and Postpartum Women. *The NYHA Functional Classification is available at [http://www.heart.org/HEARTORG/Conditions/HeartFailure/AboutHeartFailure/Classes-of-Heart-Failure_UCM_306328_Article.jsp](http://www.heart.org/HEARTORG/Conditions/HeartFailure/AboutHeartFailure/Classes-of-Heart-Failure_UCM_306328_Article.jsp). Abbreviations: BMI, body mass index; BNP, brain natriuretic peptide; BP, blood pressure; CBC, complete blood count; CVD, cardiovascular disease; CXR, chest x-ray; EKG, electrocardiogram; HR, heart rate; MFM, maternal-fetal medicine; TSH, thyroid stimulating hormone; NYHA, New York Heart Association; RR, respiratory rate. (Modified from California Department of Public Health, 2017; supported by Title V funds. Developed in partnership with California Maternal Quality Care Collaborative Cardiovascular Disease in Pregnancy and Postpartum Taskforce. Visit [www.CMQCC.org](http://www.CMQCC.org) for details.)
<table>
<thead>
<tr>
<th>Condition and Background</th>
<th>Postpartum Test and Screening</th>
<th>Management Considerations</th>
<th>Long-Term Goals</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Gestational Diabetes</strong></td>
<td>Fasting plasma glucose or 75-g, 2-hour OGTT at 4-12 weeks postpartum; screening should happen every 3 years. If the initial test in the postpartum shows prediabetes, they should be screened for diabetes yearly.</td>
<td>Encourage breastfeeding Women with impaired fasting glucose, impaired glucose tolerance, or diabetes should be referred for preventive or medical therapy.</td>
<td>Early detection of overt diabetes; diabetes prevention</td>
</tr>
<tr>
<td><strong>Diabetes</strong></td>
<td>Patients should demonstrate good control of blood sugars with hemoglobin A1c &lt; 6.5</td>
<td>Weight management Referral for preventive and medical therapy For women with type 1 diabetes, thyroid screening once if never completed. In subsequent pregnancies, consider low-dose aspirin 81 mg QD to reduce preeclampsia risk</td>
<td>Goal Hemoglobin A1c: 6.0-6.5% (42-48 mmol/L) recommended Achieve without hypoglycemia</td>
</tr>
<tr>
<td><strong>Preeclampsia and Gestational Hypertension</strong></td>
<td>Blood pressure monitoring for 72 hours postpartum Blood pressure monitoring 7-10 days after delivery Postpartum blood pressure check</td>
<td>In subsequent pregnancies, consider low-dose aspirin 81 mg QD to reduce preeclampsia risk</td>
<td>Maintain blood pressure &lt;120/80 Maintain healthy weight</td>
</tr>
<tr>
<td><strong>Chronic Hypertension</strong></td>
<td>Blood pressure monitoring for 72 hours postpartum</td>
<td>In subsequent pregnancies, consider low-dose aspirin 81 mg QD to reduce preeclampsia risk</td>
<td>Maintain blood pressure &lt;120/80</td>
</tr>
</tbody>
</table>
HTN- CLASS I RECOMMENDATIONS

- Women with chronic primary or secondary hypertension, or previous pregnancy-related hypertension, should take low dose aspirin from the 12th week of gestation until delivery.

- Calcium supplementation (of at least 1g/d, orally) should be considered for women with low dietary intake of calcium (<600 mg/d) to prevent preeclampsia.
HTN- CLASS I RECOMMENDATIONS

Severe hypertension in pregnancy should be treated with safe & effective antihypertensive medications such as methyldopa, labetalol and nifedipine, with consideration of maternal & fetal side effects.
RECOMMENDATIONS: TREATMENT OF HTN POSTPARTUM

Due to the increased risk of future HTN & stroke 1-30 years after delivery in women with a history of preeclampsia it is reasonable to:

(1) evaluate all women starting 6 mo to 1 year postpartum & all those with a HX of preeclampsia/eclampsia

(2) document their history is a CVD risk factor

(3) Evaluate & treat for CVD risk factors including hypertension, obesity, smoking & dyslipidemia
STROKE & PREGNANCY

• Pregnancy-related HTN is the leading cause of both hemorrhagic & ischemic stroke in pregnant & post partum women
• Stroke is not common during pregnancy
• Risk for stroke is higher in pregnant women (34 per 100K) vs nonpregnant women (21 per 100K)
• Highest risk in the 3rd trimester & post partum
## PREGNANCY SCAD & NON-PREG SCAD

<table>
<thead>
<tr>
<th></th>
<th>P-SCAD -54</th>
<th>NP-SCAD -269</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Presentation</strong></td>
<td>STEMI- 57%</td>
<td>STEMI- 36%</td>
</tr>
<tr>
<td></td>
<td>EF&lt;35%- 26%</td>
<td>EF&lt;35%- 10%</td>
</tr>
<tr>
<td><strong>Assoc with FMD</strong></td>
<td>42%</td>
<td>64%</td>
</tr>
<tr>
<td><strong>Pregnancy Hx</strong></td>
<td>Multiparous-</td>
<td>91%</td>
</tr>
<tr>
<td></td>
<td>Infertility tx-</td>
<td>28%</td>
</tr>
<tr>
<td></td>
<td>Pre-eclampsia-</td>
<td>11%</td>
</tr>
<tr>
<td><strong>LM SCAD</strong></td>
<td>24%</td>
<td>5%</td>
</tr>
<tr>
<td><strong>Multivessel SCAD</strong></td>
<td>33%</td>
<td>14%</td>
</tr>
<tr>
<td><strong>Age</strong></td>
<td>35 yrs</td>
<td>47 yrs</td>
</tr>
<tr>
<td><strong>Race</strong></td>
<td>89% Caucasian</td>
<td>97 Caucasian</td>
</tr>
</tbody>
</table>

Tweet, JACC July 2017
**CENTRAL ILLUSTRATION:** Features of Pregnancy-Associated Spontaneous Coronary Artery Dissection

<table>
<thead>
<tr>
<th>Spontaneous Coronary Artery Dissection (SCAD)</th>
<th>Pregnancy-associated SCAD (P-SCAD)</th>
<th>Recommended areas of P-SCAD research:</th>
</tr>
</thead>
<tbody>
<tr>
<td>A coronary artery hematoma ± tear limits coronary blood flow to the myocardium</td>
<td>• Frequently occurs in first month postpartum (majority of these within first week after delivery)</td>
<td>Hemodynamic stressors</td>
</tr>
</tbody>
</table>
| Tear in arterial wall | • P-SCAD presentation often severe:  
- ST-segment elevation myocardial infarction  
- Reduced left ventricular function  
- Left main and/or multivessel SCAD | Hormonal fluctuations |
| | • Compared to non-pregnancy-associated SCAD:  
- P-SCAD has a higher risk presentation  
- P-SCAD patients are older at time of first childbirth and more frequently have history of multiple pregnancies  
- P-SCAD patients have fewer extracoronary vascular abnormalities | Oxytocin release in breastfeeding mothers |
| | | Older, multiparous mothers |
| | | Relationship to:  
- Eclampsia/ pre-eclampsia  
- Peripartum cardiomyopathy  
- Fibromuscular dysplasia and other extracoronary vascular abnormalities |

PREVENTION OF HEART DISEASE IN WOMEN
Statistics for CVD in America

- 840,678 Americans died of cardiovascular disease (CVD=Heart & Stroke) in 2016
- Every 40 seconds, someone has a heart attack AND someone has a stroke
- Nearly half of all Americans adults have some form of CVD (Coronary disease, High blood pressure and Stroke)
- AHA Heart Disease and Stroke Stats- 2019 Update/ Circulation
AHA STATISTICAL UPDATE 2019

CVD excludes congenital cardiovascular defects (International Classification of Diseases, 10th Revision [ICD-10] codes I00–I99). The overall comparability for cardiovascular disease between the International Classification of Diseases, 9th Revision (1979–1998) and ICD-10 (1999–2015) is 0.9962. No comparability ratios were applied.
Source: National Center for Health Statistics and National Heart, Lung, and Blood Institute.

EJ Benjamin, Circulation March 2019
PATIENT AWARENESS, STIGMA, AND PHYSICIAN AWARENESS AND TRAINING EFFECT CVD CARE IN WOMEN

CENTRAL ILLUSTRATION: Knowledge, Attitudes and Beliefs Regarding Cardiovascular Disease in Women: The Women’s Heart Alliance

1. Cardiovascular disease (CVD) is the top cause of death in women in the U.S. CVD kills more women than all cancers combined.

400,000 women died from CVD in 2016 (U.S.A.)

And yet ...

- Only 45% of women know CVD is #1 killer
- 26% of women find CVD embarrassing, assuming risk is solely linked to weight
- Only 40% of routine care includes a heart risk check
- Only 39% of primary care physicians (PCPs) make CVD a top priority
- Only 22% of PCPs and 42% of cardiologists feel well prepared to assess CVD risk

A need to raise awareness of risk and symptoms of heart disease
A need to de-stigmatize the disease risk by countering stereotypes with facts
A need to invest in women’s CVD research and physician education/training

Emerging Risk Factors

- SLE: 3-fold higher risk of IHD events
- Rheumatoid arthritis: elevates IHD risk as much as DM
- Gestational diabetes: 4-fold higher risk of DM, 59% higher risk of MI
- Hypertension in pregnancy:
  - Gestational HTN and preclampsia: 3-fold higher risk of IHD
- Early menopause confers 4.5 times higher risk of IHD
- Depression is more prevalent in women: Doubles the risk of IHD

Traditional Risk Factors

- Menopause results in TG, LDL, HDL
- Women are less likely to achieve lipid goals (OR 0.50)
- 80% of women ≥75 have HTN
- Only 29% have adequate BP control
- Diabetes confers a 45% higher risk of IHD
- Smoking confers a 25% higher risk of IHD
- Obesity confers a higher risk of IHD in women (64% vs 46%)
- Women have a higher prevalence of inactivity: 25% of US women get no regular physical activity

Risk Factors in Women

- Hyperlipidemia
- Hypertension
- Autoimmune Dz
- Pregnancy
- Menopause
- Depression
- Inactivity
- Family Hx
- Obesity
- Smoking
- Diabetes

Family History of premature atherosclerosis confers a 2 fold higher risk of IHD in men and women

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SEX-BASED DISPARITIES IN OUTCOMES & QUALITY OF CARE

• Less diagnostic testing or angiography
• Delay in Reperfusion
• Fewer Revascularizations
• Less Pharmacotherapy
• Less Cardiac Rehab referral & completion
• Higher morbidity after MI
• Higher in-hospital mortality with angina, STEMI & ACS
• Higher mortality in younger women (<55yrs)
CVD IN WOMEN

• Women have a higher prevalence of angina
• Women have a lower burden of obstructive CAD
• Women have a poorer prognosis compared to men
• Clinical presentation- chest pain most common but also weakness, dyspnea, nausea, and neck, jaw and back pain

WISE investigators, NHLBI WISE study, Am Heart Journal 2001;141:735-741

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RECOMMENDATIONS FOR PREVENTION OF HEART DISEASE

• Evaluation after pregnancy complication—Gest DM, HTN, Preeclampsia, Eclampsia
• Evaluation of CVD risks in Rheumatic/Autoimmune disorders
• Close observation after Breast Cancer, Chemotherapy, Radiation
• Close observation with Depression/Stress, domestic violence, trauma, etc

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RECOMMENDATIONS FOR PREVENTION OF HEART DISEASE IN ALL WOMEN

• HTN control
• DM control
• Lipid control
• Smoking Cessation
• Obesity- BMI<25 ideal
• Lifestyle- Diet and Physical activity
Fig. 3:

**Primary Prevention:**
Assess ASCVD Risk in Each Age Group
Emphasize Adherence to Healthy Lifestyle

- **Age 0-19 y**
  - Lifestyle to prevent or reduce ASCVD risk
  - Diagnosis of Familial Hypercholesterolemia → statin

- **Age 20-39 y**
  - Estimate lifetime risk to encourage lifestyle to reduce ASCVD risk
  - Consider statin if family history premature ASCVD and LDL-C ≥160 mg/dL (≥4.1 mmol/L)

- **Age 40-75 y and LDL-C ≥70-<190 mg/dL (≥1.8-<4.9 mmol/L)**
  - 10-year ASCVD risk percent begins risk discussion
  - No risk assessment; High-intensity statin (Class I)

- **Age >75 y**
  - Clinical assessment, Risk discussion

**ASCVD Risk Enhancers:**
- Family history of premature ASCVD
- Persistently elevated LDL-C ≥160 mg/dL (≥4.1 mmol/L)
- Chronic kidney disease
- Metabolic syndrome
- Conditions specific to women (e.g., preeclampsia, premature menopause)
- Inflammatory diseases (especially rheumatoid arthritis, psoriasis, HIV)
- Ethnicity (e.g., South Asian ancestry)

**Lipid/Biomarkers:**
- Persistently elevated triglycerides (≥175 mg/dL, ≥2.0 mmol/L)

In selected individuals if measured:
- hs-CRP ≥2.0 mg/L
- Lp(a) levels >50 mg/dL or >125 nmol/L
- apoB ≥130 mg/dL
- Ankle-brachial index (ABI) <0.9

**Risk decision: If risk decision is uncertain:**
- Consider measuring CAC in selected adults:
  - CAC = zero (lowers risk; consider no statin, unless diabetes, family history of premature CHD, or cigarette smoking are present)
  - CAC = 1-99 favors statin (especially after age 55)
  - CAC = 100+ and/or ≥75th percentile, initiate statin therapy

**Risk discussion:**
- <5% “Low Risk”
- 5% - <7.5% “Borderline Risk”
- ≥7.5% - <20% “Intermediate Risk”
- ≥20% “High Risk”

  - Risk discussion: Emphasize lifestyle to reduce risk factors (Class I)
  - Risk discussion: If risk enhancers present then risk discussion regarding moderate-intensity statin therapy (Class IIb)
  - Risk discussion: If risk estimate + risk enhancers favor statin, initiate moderate-intensity statin to reduce LDL-C by 30% - 49% (Class I)
  - Risk discussion: Initiate statin to reduce LDL-C ≥50% (Class I)
Circulation

February 2019 Go Red For Women® Issue

Twenty Year Trends and Sex Differences in Young Adults Hospitalized with Acute Myocardial Infarction: The ARIC Community Surveillance Study

Sameer Arora MD¹, George A Stouffer MD¹, Anna M. Kucharska-Newton PhD², Arman Qamar MD³, Muthiah Vaduganathan MD MPH³, Ambarish Pandey MD⁴, Deborah Porterfield MD MPH⁵, Ron Blankstein MD³,⁶, Wayne D. Rosamond PhD², Deepak L. Bhatt MD MPH³, Melissa C. Caughey PhD¹
Burden of cardiovascular risk factors has increased among young adults

Gupta et al. J Am Coll Cardiol. 2014;64:337-45
# Characteristics of Young Patients with AMI

Young Women were more likely to be black, to present with non-STEMI and to have higher prevalence of hypertension, diabetes, and prior stroke

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Women (N=2884)</th>
<th>Men (N=5853)</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (mean)</td>
<td>48 ± 0.2</td>
<td>48 ± 0.1</td>
<td>0.2</td>
</tr>
<tr>
<td>Black</td>
<td>52%</td>
<td>41%</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>Hypertension</td>
<td>71%</td>
<td>64%</td>
<td>0.0005</td>
</tr>
<tr>
<td>Diabetes mellitus</td>
<td>39%</td>
<td>26%</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>Stroke</td>
<td>10%</td>
<td>6%</td>
<td>0.0003</td>
</tr>
<tr>
<td>ST-segment elevation‡</td>
<td>16%</td>
<td>26%</td>
<td>&lt;0.0001</td>
</tr>
</tbody>
</table>
Treatment Disparities: Young Women vs. Men with AMI

- Young women were less likely to receive evidence-based AMI medications

![Bar chart showing medical management comparison between women and men for different medications: Aspirin, Non-Aspirin Antiplatelet, Lipid Lowering Agent, Beta Blocker, ACEi / ARB.](chart.png)

- Aspirin: Women 86%, Men 89%  
- Non-Aspirin Antiplatelet: Women 51%, Men 62%  
- Lipid Lowering Agent: Women 63%, Men 72%  
- Beta Blocker: Women 81%, Men 84%  
- ACEi / ARB: Women 59%, Men 64%

- Significance levels:  
  - Aspirin: $P = 0.09$  
  - Non-Aspirin Antiplatelet: $P < 0.0001$  
  - Lipid Lowering Agent: $P < 0.0001$  
  - Beta Blocker: $P = 0.04$  
  - ACEi / ARB: $P = 0.02$
Plaque rupture

Plaque erosion

In-situ thrombosis

SCAD

Supply-demand mismatch

Epicardial coronary vasospasm

Coronary microvascular dysfunction
PLAQUE EROSION VS RUPTURE
WOMEN AND ACUTE MI

• In women older than 50 years, plaque rupture is the most common cause of acute MI
  – Associated with hyperlipidemia
  – Plaque is vulnerable with a thin fibrous cap overlying a necrotic core

• In younger women, plaque erosion is more often responsible for infarction
  – Associated with smoking
  – Estrogen may protect against plaque rupture
  – Eroded plaque is rich in smooth muscle cells and proteoglycans
  – Associated with less obstruction and calcification
TAKOTSUBO/ STRESS CM IN WOMEN

- Mainly affects postmenopausal women
- Generally after extreme emotional or exertional trigger
- ACS with no obstructive CAD & effects multiple artery territories

Templin C, NEJM 2015
MCCROVASCULAR/ ENDOTHelial DYSFUNCTION

- Defined as limited coronary flow reserve and endothelial dysfunction
- Associated with worse outcome
- Increased rate of cardiac death, stroke and heart failure
- Annual MACE event rate of 2.5% in women

Wei J, Mehta PK, Results from WISE, JACC Intervention 2012
MI WITH NONOBSERVED CORONARY ARTERIES (MINOCA)

- MI with nonobstructive CAD
  - Found in 6% of all MIs
  - Median age 58
  - 50% women
  - Possibly due to structural dysfunction, vasospasm, and thrombotic disorders
  - Has guarded prognosis with better 12 mo mortality compared to obstructive CD

Beltrame JF, J Intern Med 2013
PREVENTION OF STROKE IN WOMEN

UNDERSTANDING STROKE

What is a STROKE?

- A stroke occurs when a blood vessel in the brain is blocked or burst.
- Without oxygen carried by the blood, the brain begins to die.
- A stroke occurs every 40 seconds in the U.S.

Watch for the SIGNS

- Severe headache & confusion
- Numbness, tingling or weakness
- Loss of balance
- Vision changes
- Trouble speaking
- Loss of movement in face or limbs, especially on one side

Stroke symptoms appear quickly and suddenly, so it’s important to know the signs and act fast.

Reduce YOUR RISK

Adopt a healthy lifestyle, including proper diet and exercise.

Lower your blood pressure, and cholesterol.

If you smoke, quit, and follow all recommendations.

For more information, visit CardioSmart.org/Stroke

If you think you or someone you know has a stroke, call 911 immediately.

CardioSmart.org/Stroke

Find a brain healthy practice near you.

Emory Women’s Heart Center

emoryhealthcare.org/womensheart
SCOPE OF THE PROBLEM

• 200K more disabled women than men after stroke

• Women are more likely to be living alone & widowed before stroke

• Women are more often institutionalized after stroke & have poorer recovery

• Nearly half of stroke survivors have residual deficits 6 mo after strokes
FIRST STROKE PREVENTION
GUIDELINES FOR WOMEN - 2014

Guidelines for the Prevention of Stroke in Women
A Statement for Healthcare Professionals From the American Heart Association/American Stroke Association

The American Academy of Neurology affirms the value of this guideline as an educational tool for neurologists.
Endorsed by the American Association of Neurological Surgeons and Congress of Neurological Surgeons

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Matthew R. Walters, MD, MBChB, MSc; on behalf of the American Heart Association Stroke
Council, Council on Cardiovascular and Stroke Nursing, Council on Clinical Cardiology, Council on
Epidemiology and Prevention, and Council for High Blood Pressure Research
<table>
<thead>
<tr>
<th>Risk Factor</th>
<th>Sex-Specific Risk Factors</th>
<th>Risk Factors That Are Stronger or More Prevalent in Women</th>
<th>Risk Factors With Similar Prevalence in Men and Women but Unknown Difference in Impact</th>
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<tbody>
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<td>Pregnancy</td>
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<td>Preeclampsia</td>
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<td>Gestational diabetes</td>
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<td>Oral contraceptive use</td>
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<td>Postmenopausal hormone use</td>
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<td>Changes in hormonal status</td>
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<td>Migraine with aura</td>
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<td>Atrial fibrillation</td>
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<td>Metabolic syndrome</td>
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<td>Depression</td>
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<td>Psychosocial stress</td>
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KEY POINTS: UPDATE ON 2014 AHA/ASA GUIDELINE FOR PREVENTION OF STROKE IN WOMEN

- Women experience more prevalent stroke, more death from stroke and more disability from stroke
- HTN worse with age & race in women
- Afib associated with higher risk of stroke, cardiac events, and mortality in women
• Women with DM have higher risk of stroke compared to men with DM
• Evidence lacking for stroke risk and abnormal lipids (TC, LDL, HDL, TG)
• Migraine is more common in women & migraine with aura assoc with ischemic stroke
• Estrogen-containing OCP may increase risk of stroke in migraine with aura
SUMMARY - CVD IN WOMEN

Unique risk factors for stroke & heart disease in women:

- Pregnancy - gestational diabetes, preeclampsia, eclampsia,
- Hormone therapy
- More hypertension at ≥age 65 females
- More sedentary, obese females
- More high cholesterol in females
Q&A
Did you know heart disease, the leading cause of death in women, is preventable?

Schedule a comprehensive cardiac risk assessment to find out if you are at risk.

404-778-7777
emoryhealthcare.org/womensheart

EMORY
WOMEN'S HEART CENTER
We're all in this together.

emoryhealthcare.org/womensheart