Cardiovascular Disease
#1 Killer of Women
In Pregnancy Too?

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Cardiovascular Disease
Leading cause of death among women!

- > 500,000 women/yr
- 6 X breast cancer
- 1:2 die of CVD
- 1:4 die of CHD
CVD Accounts for More Deaths Than the Next “7” Leading Causes of Death In Women!


Adapted from Thom T et al. *Circulation* 2006;113:e85–e151.
PDAY study: US Adults 30-34 years of age

LAD Stenosis (>40% dia. lesion)
19% of men
8% of women

Male: black
Female: white

Prevalence of Cardiovascular Diseases in Americans Age 20 and Older by Age and Sex

NHANES: 1999-2002

Source: CDC/NCHS and NHLBI. These data include coronary heart disease, congestive heart failure, stroke and hypertension.
Women do worse with heart disease

- Higher chance of death when admitted to the hospital with heart attack
- Higher risk of not obtaining procedures
- Higher risk of complications with procedures
- Younger women do worse than younger men
All Age Groups ........

- **Young women**
  - Cardiac risk factors
  - Metabolic syndrome

- **Older women**
  - Prevention & treatment

- **Pregnant**
  - Diagnosed/undiagnosed cardiac disease
3 million women age 18-44 in the US have cardiac disease
~ 1-2% of pregnant women
Maternal Mortality Rate, California and United States; 1991-2008

Maternal Deaths per 100,000 Live Births

Background

- California’s maternal mortality rate nearly tripled from 1996 to 2006 - 5.6 to 16.9 /100,000 live births.

- The California Pregnancy-Associated Mortality Review (CA-PAMR) was started in 2006 by the California Department of Public Health in response to rising rates of maternal mortality with the goal of understanding and reducing maternal morbidity and mortality.

- Initial years of CA-PAMR found cardiovascular disease (CVD) to be the leading cause of pregnancy-related death in California.
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**Methods**

**STEP 1:** Hospital discharge data linked to birth, death certificates
Identifies women who died within one year postpartum from any cause
(*Pregnancy-Associated Cohort*)

**STEP 2:** Additional data gathered for each death
Coroner Reports, Autopsy Results, and additional information from the Death Certificate (e.g., multiple causes of death, recent surgeries, etc) are obtained

**STEP 3:** Cases selected for CA-PAMR Committee review
Documented (ICD-10 obstetric (“O”) code) and suspected pregnancy-related deaths are prioritized for review

**STEP 4:** Medical records abstracted and summarized
All available labor and delivery, prenatal, hospitalization, transport, and outpatient and emergency department records are obtained and summarized

**STEP 5:** Cases reviewed by CA-PAMR Committee
Committee determines whether the death was pregnancy-related, the cause of death, contributing factors and quality improvement opportunities
Methods

- Cardiologists re-reviewed all CVD pregnancy-related deaths to:
  - Confirm death was CVD and related to pregnancy
  - Further describe ‘Cardiomyopathy’ and ‘Other Cardiovascular’ subtypes
  - Identify evidence of clinical signs of CVD and timing of diagnosis
  - Determine risk and contributing factors, quality improvement opportunities

- Discrepancies adjudicated by a 3rd cardiologist
Results
Identification and Confirmation of CVD Pregnancy-Related Deaths

California Birth Cohort, 2002-2006
N=2,741,220

California Pregnancy-Associated Cohort
N=864

Pregnancy-Related Deaths
N=257

Cardiovascular Pregnancy-Related Deaths
N=64

Cardiomyopathy
N=42

Other Cardiovascular
N=22
Findings
Cardiomyopathy Subtypes

Cardiomyopathy*
N=42

Dilated Cardiomyopathy
N=29
- Peripartum CMP (n=15)
- Dilated CMP, subtype could not be determined (n=5)
- Non-Peripartum CMP, 2nd to drugs or ETOH (n=5)
- Non-Peripartum CMP, not specified or unknown etiology (n=3)
- Non-Peripartum CMP, myocarditis (n=1)

Hypertrophic Heart Disease
N=10
- Primary, potential (n=2)
- 2nd to hypertension (n=3)
- 2nd to drug use (n=1)
- 2nd to valvular disease (n=1)
- HHD etiology could not be determined (n=3)

*The type of cardiomyopathy (dilated or hypertrophic) could not be determined in 3 cases.
Findings
Other Cardiovascular Disease Subtypes

Other Cardiovascular
N=22

- Pulmonary Hypertension (N=7)
- Aortic Dissection (N=5)
- Unexplained Sudden Death, probable arrhythmia (N=3)
- Non-Valvular, congenital (N=3)
- Coronary Artery Disease (N=2)
- Valvular Disease (N=2)
Findings

Characteristics and Risk Factors

- Obese (BMI>=30)
- African-American, non-Hispanic
- Hypertension during pregnancy
- Methamphetamine or cocaine use (per toxicology report)

Cardiomyopathy (N=42)
Other Cardiovascular Disease (N=22)
All Other Pregnancy-Related Deaths (N=193)
Findings

Presentation of women with CVD

- Only 2 women entered pregnancy with known CVD
- CVD symptoms (SOB, wheezing, palpitations, edema, chest pain, dizziness, or extreme fatigue)
  - Prenatal period: 43%
  - Labor and delivery: 51%
  - Postpartum: 80%
Findings

Presentation of women with CVD

- Abnormal physical exam findings
  - HTN >140/90 (64%)
  - HR >120 (59%)
  - Crackles, S3 or gallop rhythm etc. (44%)
  - O2<90% (39%)
Findings
Timing of Diagnosis and Death

- Timing of CVD Diagnosis (n=64)

- Preexisting (prior to pregnancy)
- Prenatal period
- At labor and delivery
- Postpartum period
- Postmortem
Findings

Timing of Death

- 30% of all CVD deaths were late, i.e. >42 days from birth/fetal demise vs. 7.3% of non-CVD pregnancy-related deaths
- Driven by CMP deaths, i.e. 42.9% late deaths
Findings
Contributing Factors (CFs) and Quality Improvement Opportunities (QIOs)

23% of all CVD pregnancy-related deaths were determined to be potentially preventable (31% of cardiomyopathy deaths)

- **CFs related to Health Care Providers:**
  - Delayed or inadequate response to clinical warning signs
  - Ineffective or inappropriate treatment
  - Misdiagnosis, and
  - Inadequate post discharge follow-up

- **QIOs for Health Care Providers:**
  - Better recognition of signs of CVD in pregnancy such as
    - shortness of breath
    - fatigue
    - tachycardia
    - blood pressure change
    - or low oxygen saturation
  - Improved management of hypertension
Findings
Contributing Factors (CFs) and Quality Improvement Opportunities (QIOs)

- **CFs related to Patients:**
  - Presence of underlying medical conditions
  - Obesity
  - Lack of recognition of CVD symptoms and
  - Delays in seeking care

- **QIOs for Patients**
  - Education around when to seek care for worrisome symptoms
  - Support for improving modifiable risk factors, such as
    - attaining healthier weight and
    - discontinuing drug use.
CVD Pregnancy Task Force

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CVD Pregnancy Task Force

Rationale For Toolkit

- Leading cause of maternal mortality
- CVD is under-recognized in pregnant women
- Impact on maternal morbidity:
  - Based on the estimated 1% prevalence of CVD in childbearing age women and over 500,000 live births in California annually.
    - 5,000 pregnant women are projected to experience some form of cardiac disease each year in California.
    - 224 new cases of peripartum cardiomyopathy may be anticipated.
Goals of Toolkit

- To encourage obstetric and other healthcare providers to retain a high index of suspicion for CVD, particularly among women with risk factors who present with symptoms in late pregnancy or early postpartum period.

- To serve as resource for generalists who provide maternity care to women, with special emphasis on:
  - Prenatal visits
  - Postpartum encounters
  - Emergency room visits
CARDIAC SYMPTOMS IN NORMAL PREGNANCY

“Pregnancy Mimics Heart Disease”
Hemodynamic Changes During Pregnancy

Plasma Volume

Figure 1.1  Changes in plasma volume, erythrocyte volume, and hematocrit during pregnancy. Increase in plasma volume is more rapid than increase in erythrocyte volume, causing the “physiological anemia of pregnancy,” which can be partially corrected with iron supplements. (From Pitkin RM, Clin Obstet Gynecol 1976;19:489, with permission.)
Hemodynamic Changes During Pregnancy

Cardiac Output

Stroke volume $\times$ heart rate = cardiac output

Figure 1.4 Percent changes of heart rate, stroke volume, and cardiac output measured in the later-
Signs

- Edema
- JVD
- Murmurs

AUSCULTATION

- 96% have a “functional murmur”
  - Mid-systolic and low intensity - LUSB
- Third heart sound is common
Symptoms

- Reduction of exercise tolerance
- Hyperventilation - shortness of breath
- Reduction of exercise tolerance
- Orthopnea
- Palpitations
- Light headedness/dizziness
Physiologic changes

Signs and Symptoms of Pregnancy that mimic heart disease
Affect diagnostic tests
Cardiac Evaluation During Pregnancy

- Limitations of diagnostic tests:
  - Diagnostic yield
  - Potential risk to the fetus
- Interpretation of test results – account for physiologic changes
Cardiac Markers of Ischemia in Pregnancy

- 51 healthy pregnant women in labor
- Troponin I, myoglobin, creatine kinase and CK MB were measured
- Four measurements
  - During labor
  - 30 minutes
  - 12 hours and
  - 24 hours after delivery

Cardiac Markers of Ischemia in Pregnancy

- Myoglobin and CK increase two fold @ 30 minutes after delivery
  - Peak at 24 hours
- Troponin remained undetectable
CXR: Bilateral pulmonary infiltrates – cannot rule out pneumonia
Clinical correlation suggested

- DIFFERENTIAL DX
  - Cardiac
Key Points

- Cardiovascular disease is the leading cause of death among women
  - ~500,000 per year
  - 1400 deaths /day
  - 1 death/minute
  - 2/3 without previous symptoms

- Leading cause of maternal mortality in California during the years 2002-2006

- Major risk factors for CMP were low income, substance abuse, African-American race, obesity, and pregnancy-related hypertension/preeclampsia
Key Points

- Early recognition of a symptomatic patient and referral to a cardiologist by obstetrics provider may help prevent serious morbidity and mortality.
- Risk factors should be identified in women of all ages.
- Awareness and education is needed to modify cardiovascular risk profile.
Key Points

Ideal Cardiovascular Health

- Absence of clinical CVD
- BMI <25 kg/m2
- Blood pressure <120/80 mm Hg
- Total Cholesterol <200 mg/dl
- Fasting blood glucose <100 mg/dl
- Non-smoker
- Physical activity
- Healthy diet
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