# Cardiac Disease and Maternal Mortality

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# DISCLOSURES:

***No financial or other conflicts of interest related to this presentation***

# Cardiac Causes of Maternal Morbidity and Mortality


pregnancy
attractive
stomach
maternal
baby
standing
life
tummy
expectant
baby
female
expecting
birth
mom
mother
navel
pretty
mum
pregnancy
abdomen
female
waiting
birthing
parent
hoping
belly
touch
people
parenting
watching
touch
parenthood
fondle
body
healthy
motherhood
lady
navel
belly
prepared
happy
parent
birth
mother
waiting
pregnant
pregnant
attractive
woman
pretty
feminine
mum
beautiful
awaiting
expectant
medicine
parental
hoping
mom
body
life
lady
maternal
woman
people
tummy

# TOP MATERNAL MORTALITY CAUSES IN TEXAS

***The Joint Biennial Report*** of the state's Maternal Mortality and Morbidity Task Force and the Texas Department of State Health Services examined 189 maternal deaths in Texas during 2011–12. Cardiac events were the most common cause of death among those cases, according to the report, with drug overdoses the second most common.

| Cause of Death | Percentage |
|---|---|
| Cardiac event | 20.6 |
| Drug overdose | 11.6 |
| Hypertension/eclampsia | 11.1 |
| Hemorrhage | 9.0 |
| Sepsis | 9.0 |
| Homicide | 7.4 |
| Suicide | 5.3 |

# Causes of US Maternal Mortality

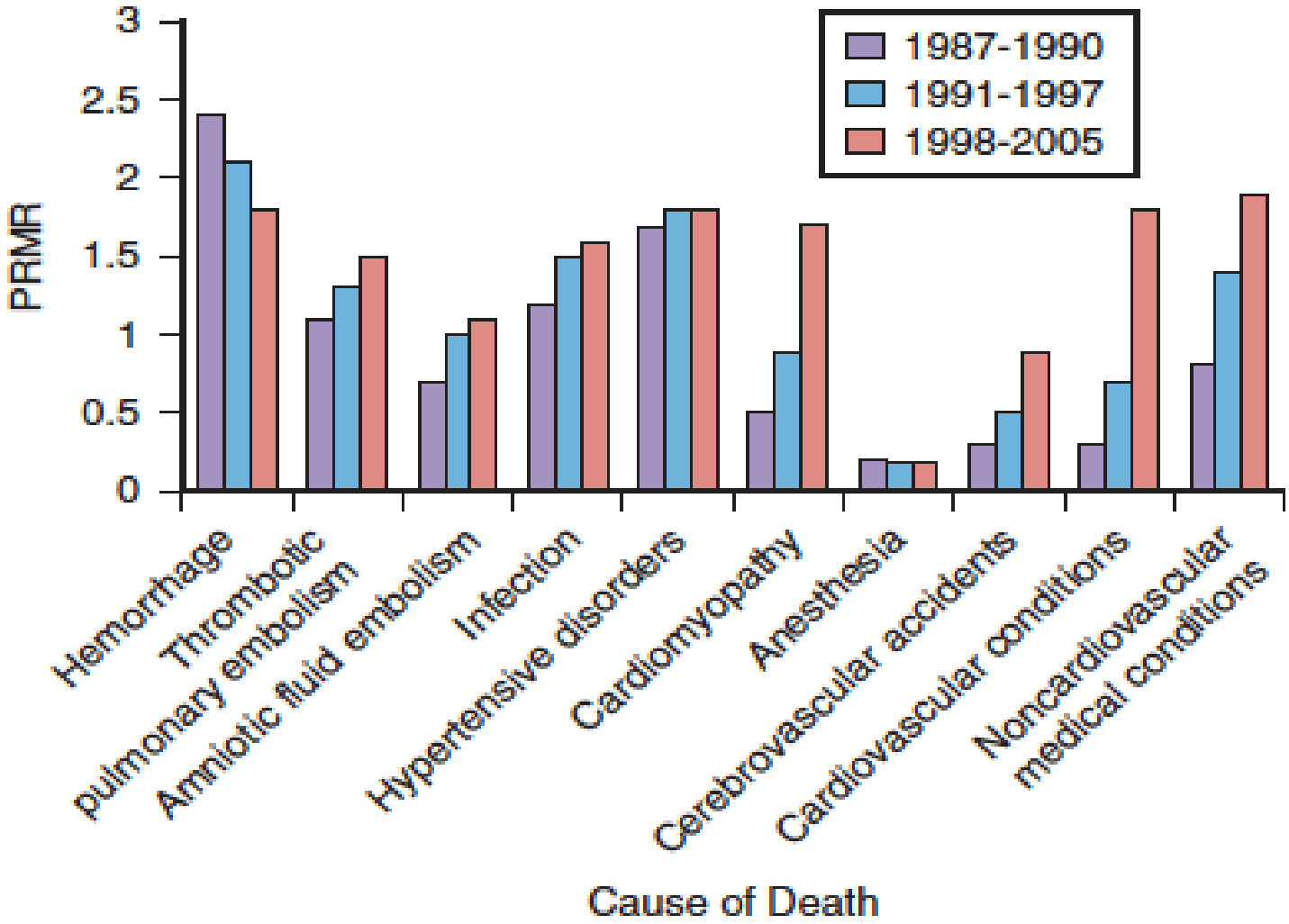


**Figure 50-4 Cause-specific, pregnancy-related mortality rates (PRMR) for 1987 to 1990, 1991 to 1997, and 1998 to 2005, in the United States.** *(From Callaghan WM: Overview of maternal mortality in the United States,* Semin Perinatol *36:2–6, 2012.)*

# Causes of US Maternal Mortality

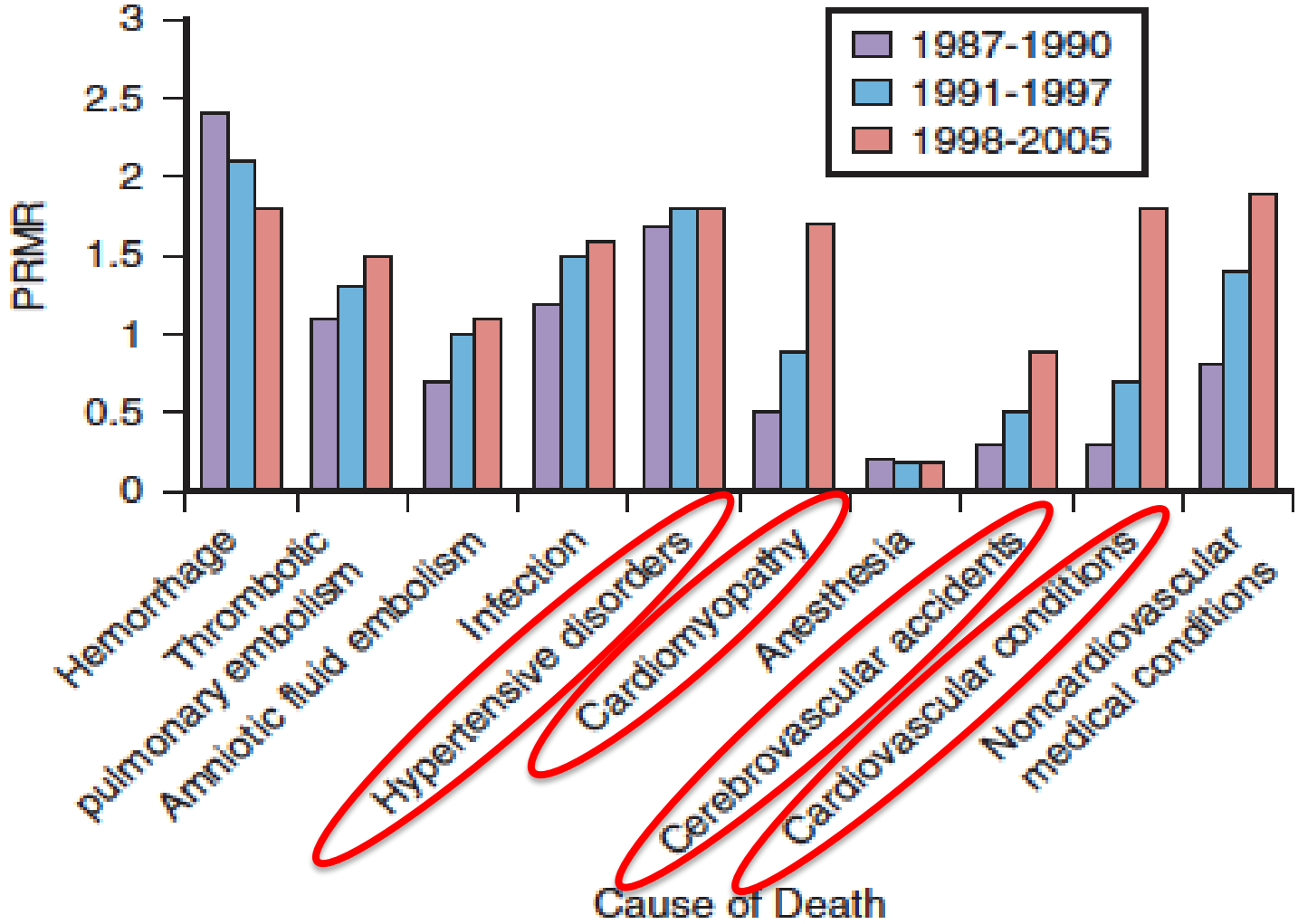


**Figure 50-4 Cause-specific, pregnancy-related mortality rates (PRMR) for 1987 to 1990, 1991 to 1997, and 1998 to 2005, in the United States.** *(From Callaghan WM: Overview of maternal mortality in*

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# Improving Health Care Response to Cardiovascular Disease in Pregnancy and Postpartum: A California Quality Improvement Toolkit

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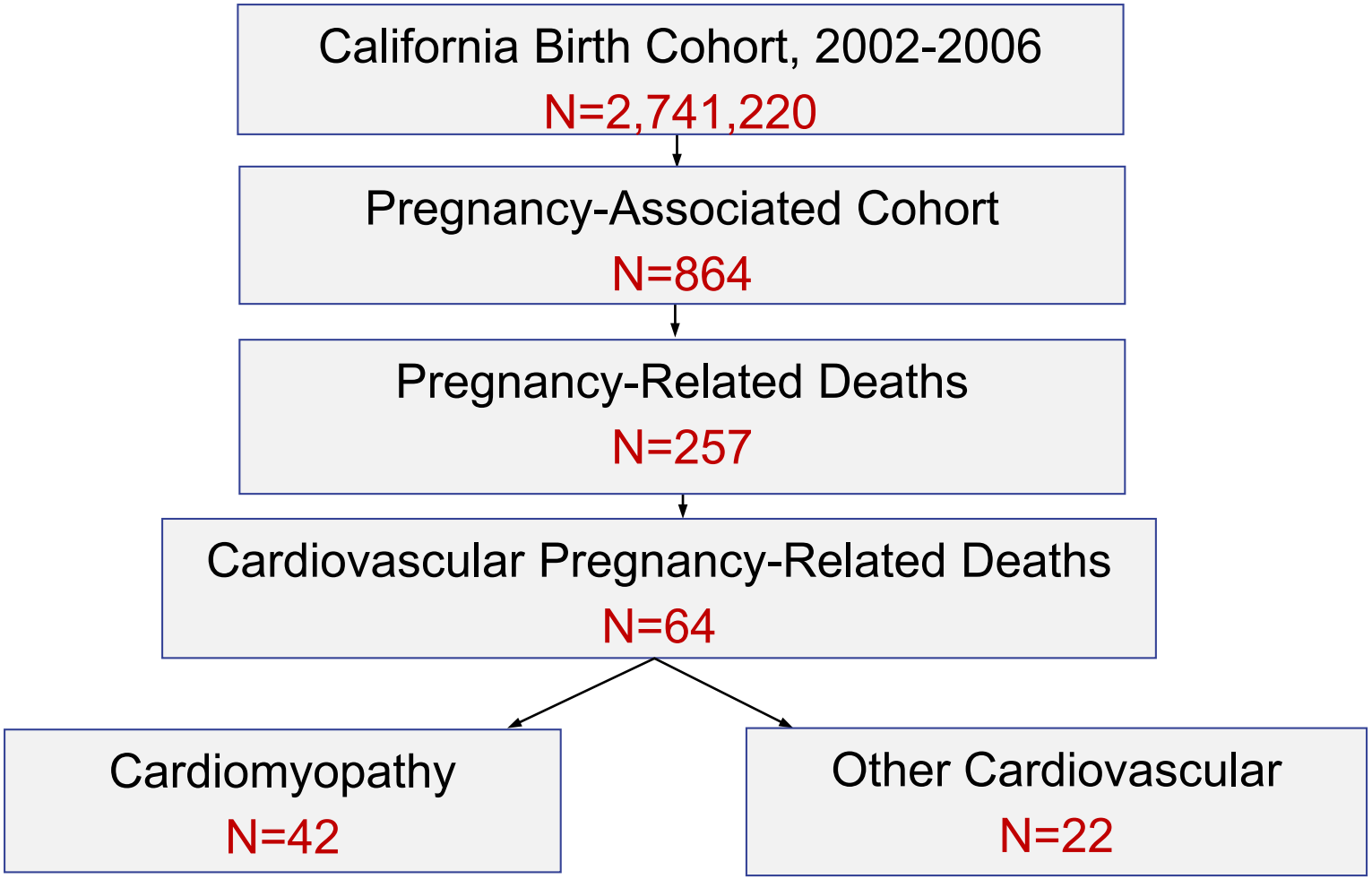
# CA-PAMR Findings

## Identification and Confirmation of CVD Pregnancy-Related Deaths 2002-2006




Hameed A, Lawton E, McCain CL, et al. Pregnancy-Related Cardiovascular Deaths in California: Beyond Peripartum Cardiomyopathy. *American Journal of Obstetrics and Gynecology* 2015; DOI: 10.1016/j.ajog.2015.05.008

# CA-PAMR Top 5 Causes of Death 2002-2006 (N=257)

| Grouped Cause of Death, *per CA-PAMR Committee* | Pregnancy-Related Deaths N (%) |
|---|---|
| Cardiovascular disease | 64 (25) |
| *Cardiomyopathy* | *42 (16)* |
| *Other cardiovascular* | *22 (9)* |
| Preeclampsia/eclampsia | 45 (18) |
| Obstetric hemorrhage | 25 (10) |
| Sepsis | 23 (9) |
| Venous thromboembolism | 22 (9) |
| **TOTAL** | **257** |

CVD Pregnancy-Related Mortality Rate: 2.4 deaths /100,000 live births

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# CA-PAMR Pregnancy-Related Deaths Causes of Death, by Race/Ethnicity

2002-2006 (N=257)

| Clinical Cause of Death | White, Non-Hispanic N (%) | African-American, Non-Hispanic N (%) | Hispanic N (%) | Asian N (%) | TOTAL |
|---|---|---|---|---|---|
| Cardiovascular Disease | 16 (24) | 25 (45) | 21 (19) | 2 (9) | 64 (25) |
| *Cardiomyopathy** | *11 (17)* | *18 (32)* | *11 (10)* | *2 (9)* | *42 (16)* |
| *Other cardiovascular* | *5 (8)* | *7 (13)* | *10 (9)* | *0* | *22 (9)* |
| Preeclampsia/eclampsia* | 11 (17) | 5 (9) | 27 (24) | 2 (9) | 45 (18) |
| Obstetric hemorrhage | 7 (11) | 2 (4) | 14 (13) | 2 (9) | 25 (10) |
| Venous thromboembolism | 6 (9) | 7 (13) | 9 (8) | 0 | 22 (9) |
| Sepsis | 5 (8) | 2 (4) | 11 (9) | 5 (22) | 23 (9) |
| All other causes | 21 (32) | 15 (27) | 30 (27) | 12 (52) | 78 (30) |
| TOTAL | 66 | 56 | 112 | 23 | 257 |



*p<.05

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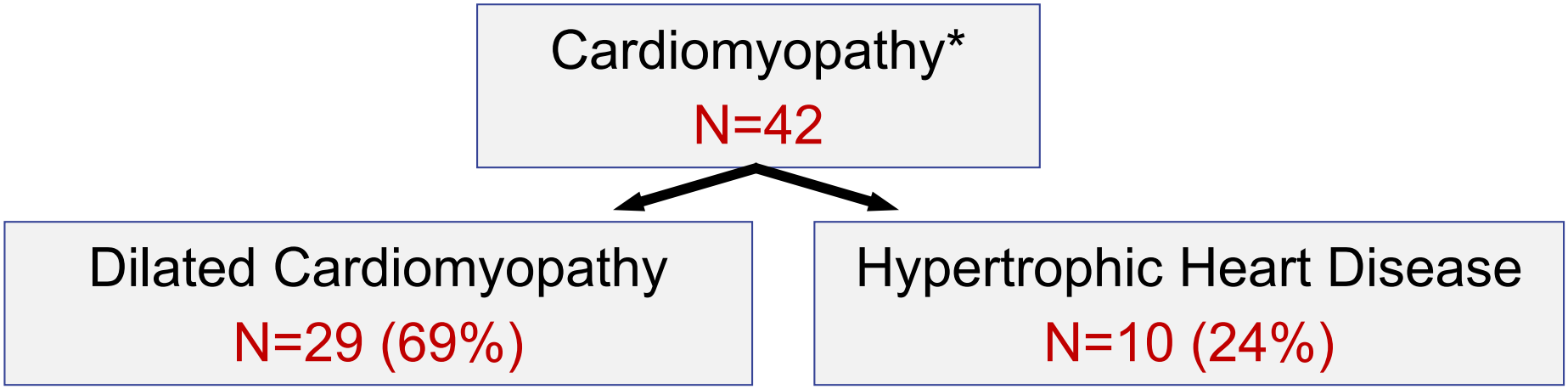
# CA-PAMR Findings

## Cardiomyopathy Subtypes

## 2002-2006




*The type of cardiomyopathy (dilated or hypertrophic) could not be determined in 3 (7%) cases.

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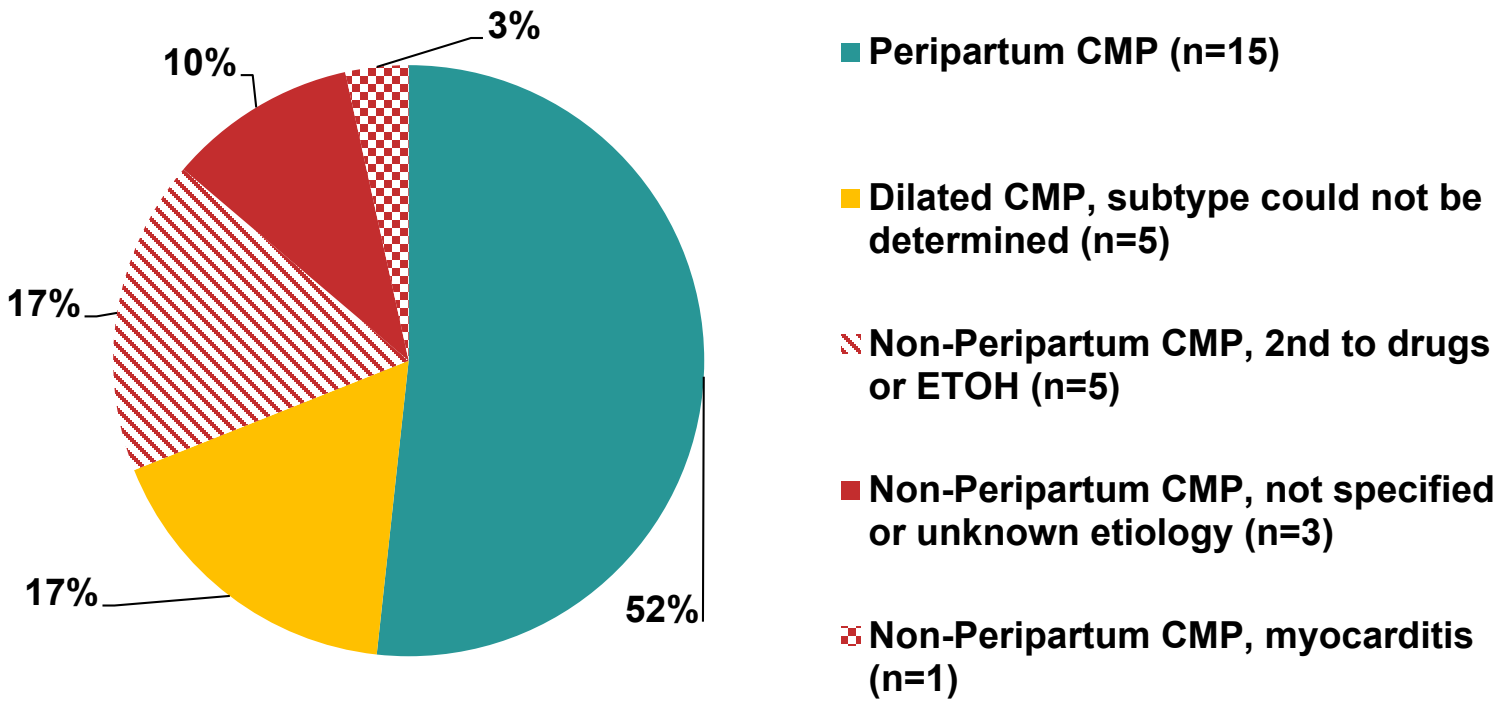
# CA-PAMR Findings

## Cardiomyopathy Subtypes, 2002-2006

**Dilated Cardiomyopathy**

**N=29 (69%)**

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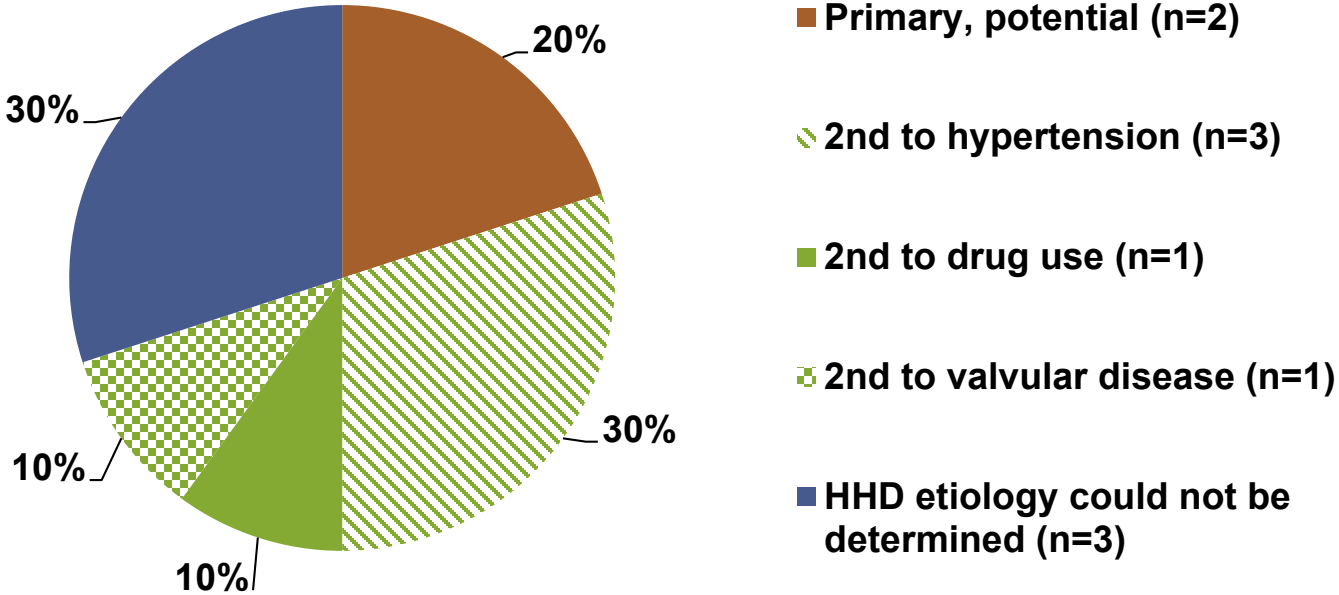
# CA-PAMR Findings

## Cardiomyopathy Subtypes, 2002-2006

**Hypertrophic Heart Disease**

**N=10 (24%)**




*The type of cardiomyopathy (dilated or hypertrophic) could not be determined in 3 cases.

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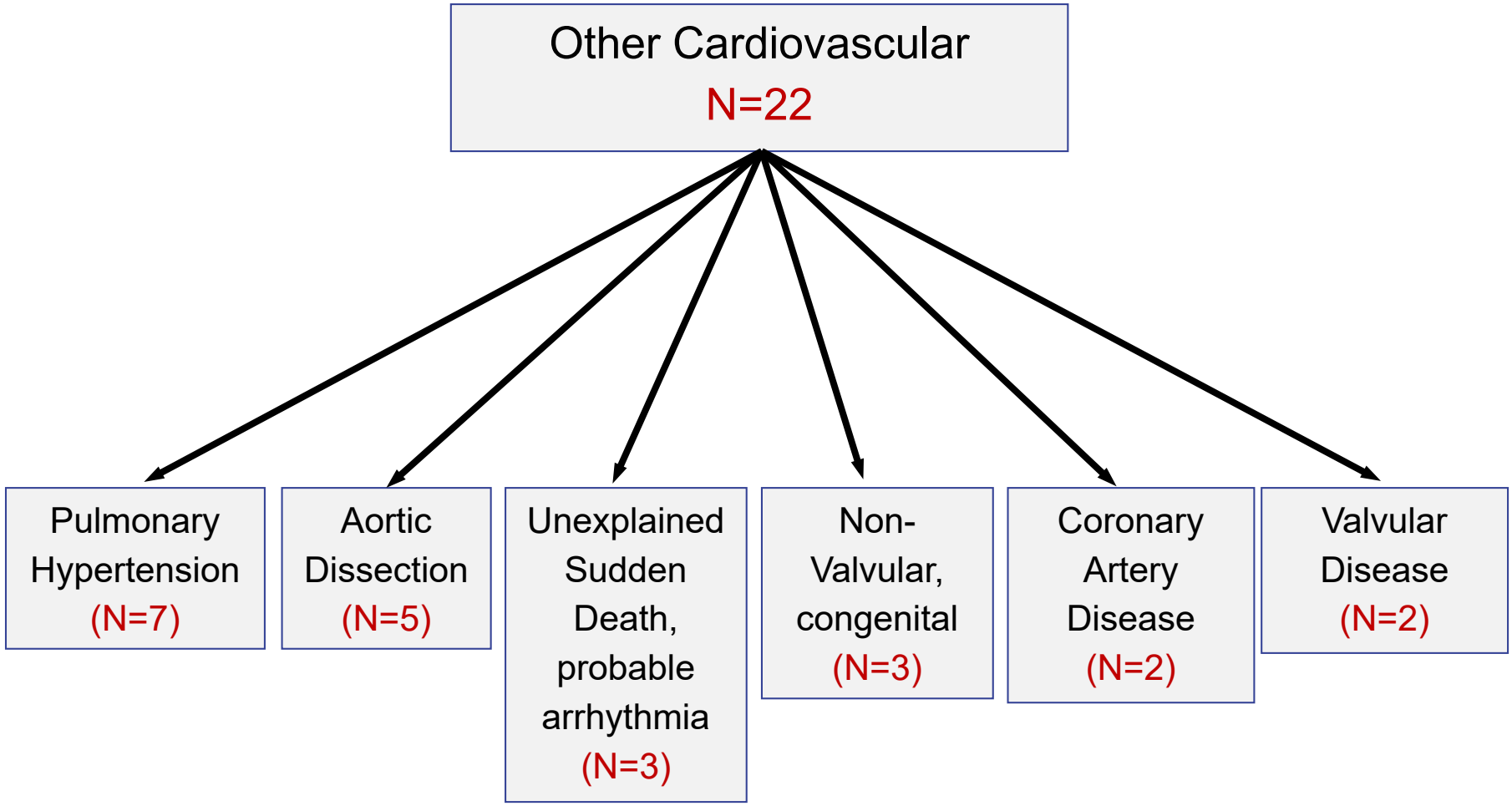
# CA-PAMR Findings
# Other Cardiovascular Disease Subtypes
## 2002-2006

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# Risk Factors and Presenting Signs/Symptoms

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# CA-PAMR Findings
# Presentation of Women with CVD
## 2002 - 2006

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

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# CA-PAMR Findings
# Presentation of Women with CVD
## 2002 - 2006

- Abnormal physical exam findings
  - HTN ≥140/90 (64%)
  - HR ≥120 (59%)
  - Crackles, S3 or gallop rhythm etc. (44%)
  - O2 ≤90% (39%)

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# CA-PAMR Findings
# Timing of Diagnosis and Death
# 2002-2006

- Timing of CVD Diagnosis (n=64)


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

- Timing of Death
  - 30% of all CVD deaths were >42 days from birth/fetal demise vs. 7.3% of non CVD pregnancy-related deaths
  - Driven by Cardiomyopathy deaths, with 42.9% deaths >42 days

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# CA-PAMR Findings
# Contributing Factors & Quality Improvement Opportunities (2002-2006) for CVD

## Health Care Provider Related

- Contributing Factors: (69% of all cases)
  - Delayed or inadequate response to clinical warning signs (61%)
  - Ineffective or inappropriate treatment (39%)
  - Misdiagnosis (37.5%)
  - Failure to refer or consult (30%)
- Quality Improvement Opportunities
  - Better recognition of signs and symptoms of CVD in pregnancy
    - Shortness of breath, fatigue
    - Tachycardia, blood pressure change, or low oxygen saturation
    - Improved management of hypertension

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# CA-PAMR Findings
# Contributing Factors & Quality Improvement Opportunities (2002-2006) for CVD

## Patient Related

- Contributing factors: (70% of all cases)
  - Presence of underlying medical conditions (64%)
  - Obesity (31%)
  - Delays in seeking care (31%)
  - Lack of recognition of CVD symptoms (22%)
- Quality improvement opportunities
  - Education around when to seek care for worrisome symptoms
  - Support for improving modifiable risk factors, such as attaining healthier weight and discontinuing drug use

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# CA-PAMR Findings
# Preventability
# 2002-2006

**24%** of ALL CVD pregnancy-related deaths (and 31% of cardiomyopathy deaths) were determined to be **potentially preventable**

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# Introduction to the CVD Toolkit

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# CVD Assessment Algorithm For Pregnant and Postpartum Women

**Red Flags**

- Shortness of breath at rest
- Severe orthopnea ≥ 4 pillows
- Resting HR ≥120 bpm
- Resting systolic BP ≥160 mm Hg
- Resting RR ≥30
- Oxygen saturations ≤94% with or without personal history of CVD

↓

**PROMPT EVALUATION** and/or hospitalization for acute symptoms

*plus*

**CONSULTATIONS** with MFM and Primary Care/Cardiology

**Personal History of CVD**

**Without Red Flags**

↓

**CONSULTATIONS** with MFM and Primary Care/Cardiology

# CARDIOVASCULAR DISEASE ASSESSMENT IN PREGNANT and POSTPARTUM WOMEN

(No Red Flags and/or no personal history of CVD, and hemodynamically stable)

## SYMPTOMS

*NYHA class > II

Suggestive of Heart Failure:
- Dyspnea
- Mild orthopnea
- Tachypnea
- Asthma unresponsive to therapy

Suggestive of Arrhythmia:
- Palpitations
- Dizziness/syncope

Suggestive of Coronary Artery Disease:
- Chest pain
- Dyspnea

## VITAL SIGNS

- Resting HR ≥110 bpm
- Systolic BP ≥140 mm Hg
- RR ≥24
- Oxygen sat ≤96%

## RISK FACTORS

- Age ≥40 years
- African American
- Pre-pregnancy obesity (BMI ≥35)
- Pre-existing diabetes
- Hypertension
- Substance use *(nicotine, cocaine, alcohol, methamphetamines)*
- History of chemotherapy

## **PHYSICAL EXAM

**ABNORMAL FINDINGS**

Heart: Loud murmur or

Lung: Basilar crackles

NO

YES

**≥ 1 Symptom + ≥ 1 Vital Signs Abnormal + ≥ 1 Risk Factor or**

**ANY COMBINATION ADDING TO ≥ 4**

**Consultation indicated:**

**MFM *and* Primary Care/Cardiology**

Obtain: **EKG and BNP**
- **Echocardiogram +/- CXR** if HF or valve disease is suspected, or if the BNP levels are elevated
- 24 hour Holter monitor, if arrhythmia suspected
- Referral to cardiologist for possible treadmill echo vs. CTA vs. alternative testing if postpartum

Consider: **CXR**, **CBC**, Comprehensive metabolic profile, Arterial blood gas, Drug screen, TSH, etc.

**Follow-up within one week**

**Results abnormal**

**CVD highly suspected**

**Results negative**

Signs and symptoms resolved

Reassurance and routine follow-up

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# CVD Algorithm Validation

- We applied the algorithm to 64 CVD deaths from 2002-2006 CA-PAMR.
- 56 out of 64 (88%) cases of maternal mortality would have been identified.
- Detection increased to 93% when comparison was restricted to 60 cases that were symptomatic.

Hameed, AB, Morton, CH and A Moore. Improving Health Care Response to Cardiovascular Disease in Pregnancy and Postpartum Developed under contract #11-10006 with the California Department of Public Health, Maternal, Child and Adolescent Health Division. Published by the California Department of Public Health, 2017.

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