MATERNAL MORBIDITY AND MORTALITY

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FINANCIAL DISCLOSURES

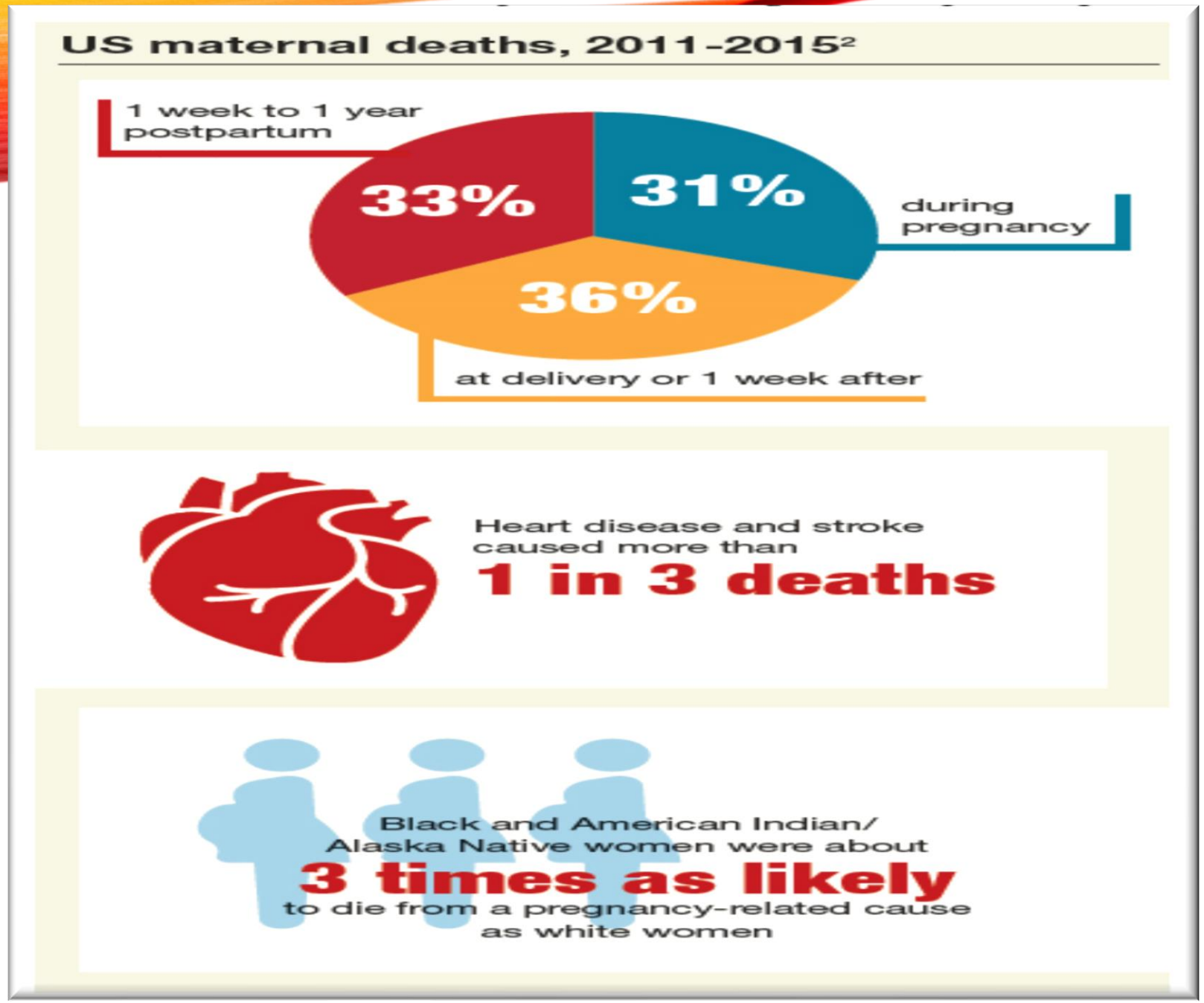
- No financial disclosures

OBJECTIVES

1. Understand the current state of maternal morbidity and mortality in the United States
2. Be able to explain those factors driving maternal mortality
3. Understand the impact of racial disparities on maternal mortality and cardiovascular disease
4. Explain current recommendations for referrals cardiology consultation and maternal fetal consultation
5. Understand risk stratification strategies and future direction

INCIDENCE

- 2004 – 2014 the maternal mortality ratio increased to 26%
- 18.8-23.8/100 000
- There has been a 2 fold increase in maternal morbidity (1994)



CDC

CENTERS FOR DISEASE CONTROL AND PREVENTION

PREVENTION VITAL SIGNS MAY 2019

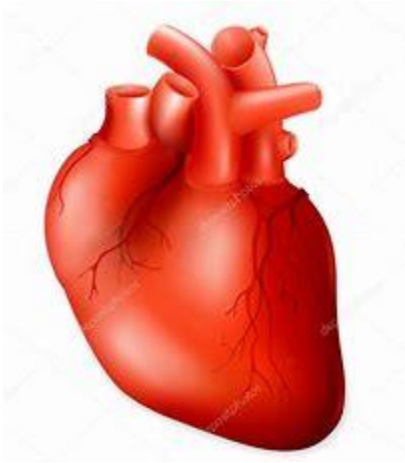
THE CENTERS FOR DISEASE CONTROL AND PREVENTION VITAL SIGNS MAY 2019

- Heart disease and stroke caused more **than 1 in 3 deaths (34%)**

- Black and American Indian/Alaska Native women were about **3 times** as likely to die from a pregnancy-related cause as white women

ETIOLOGY

- In the United States, disease and dysfunction of the heart and vascular system as "cardiovascular disease" is now the leading cause of death in pregnant women and women in the postpartum period
- 4.23 deaths per 100,000 live births
- A rate almost twice that of the United Kingdom



- Cardiovascular diseases constitute 26.5% of U.S. pregnancy-related deaths

- Cardiovascular disease affects approximately 1–4%
- Congenital heart disease and acquired heart disease is on the rise
- Linear increase greater than other developing countries

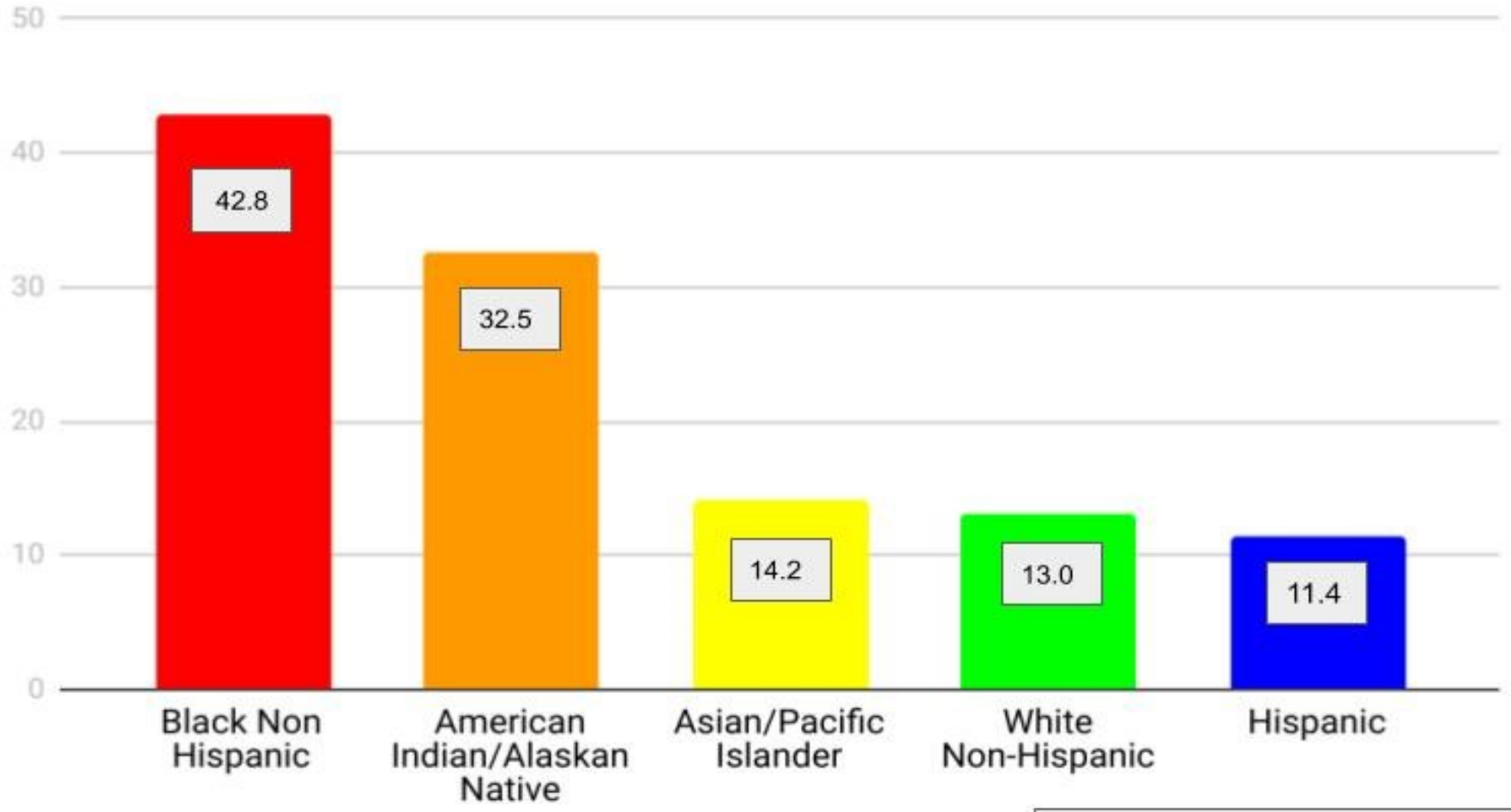
WHY THE SHIFT?

There are four key risk factors linked to cardiovascular disease-related maternal mortality:

1. **Race/Ethnicity**: Non-Hispanic black women have a 3.4 times higher risk of dying from cardiovascular disease-related pregnancy complications
   - Structural
   - Institutional
   - Systemic barriers
   - Cultural
   - Social determinants of care
   - Stressors

Figure 1

Maternal Death Rates per 100,000 By Ethnicity in the United States in 2015



Reference: Centers for Disease Control Pregnancy Mortality Surveillance System.

WHY THE SHIFT? CONTINUE

2. **Age**: Age older than 40 years increases the risk of heart disease-related maternal death 30 times the risk for women younger than 20 years
3. **Hypertension:** Hypertensive disorders affect up to 10% of pregnancies and can lead to maternal morbidity and mortality. Increases the incidence of **myocardial infarction and heart failure** is 13-fold and 8-fold higher
4. **Obesity**: Prepregnancy obesity increases maternal death risk due to a cardiac cause, especially if associated with moderate-to-severe **obstructive sleep apnea**

The presence of one or more of these risk factors should raise the threshold for suspicion that a patient is at-risk for maternal heart disease and pregnancy-related morbidity and mortality.

ANTEPARTUM


cardiac output
angiotensin
heart ventricles adapt
angiotensin
erythropoiesis
cardiac output
plasma volume
estrogen
thrombogenic
angiotensin
heart ventricles adapt
cardiac output
angiotensin
SVR
plasma volume
heart ventricles adapt
progesterone
erythropoiesis
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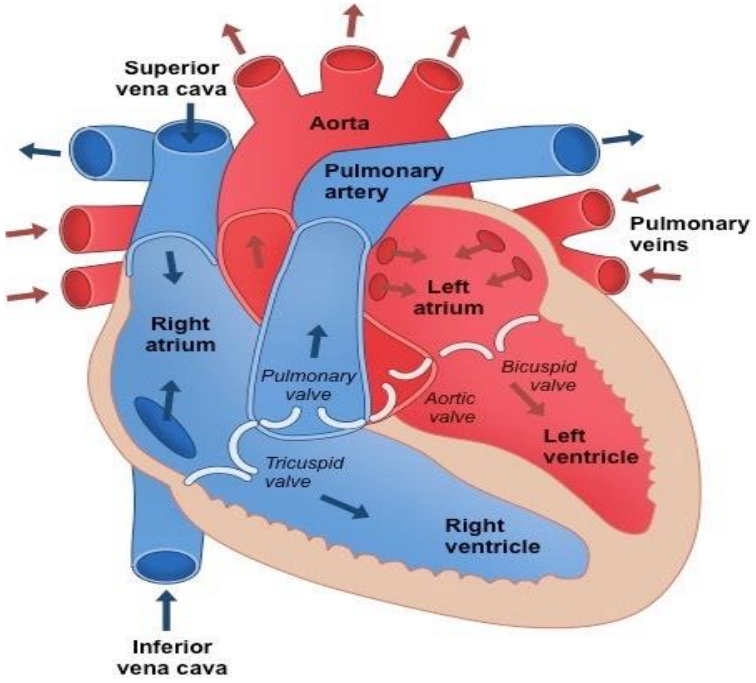
STRUCTURAL CHANGES

- The heart ventricles adapt to the plasma volume
- Left ventricular end diastolic volume
  - increases by approximately 10%
- Left and Right ventricular mass
  - increase 50% and 40%, respectively



- 20% of women have diastolic dysfunction at term, which may be associated with dyspnea on exertion
- Structural changes of the maternal heart will return 1 year postpartum.

INTRAPARTUM AND POSTPARTUM

- Heart rate and blood pressure normally decrease within 48 hours postpartum
- Blood pressure may increase again between days 3–6 due to fluid shifts
- Increased hydrostatic pressure and decreased colloid osmotic pressure render women with susceptible to pulmonary edema
- Increased maternal plasma atrial natriuretic peptide levels in the first week postpartum allow for postpartum diuresis
- Maternal hemodynamics return to a pre-pregnancy state 3–6 months after delivery

Table 1. Cardiovascular Changes in a Normal Pregnancy*

	First Trimester	Second Trimester	Third Trimester	Stage 1 Labor	Stage 2 Labor	Early Postpartum	3–6 months Postpartum
Cardiac output	↑5–10%	↑↑35–45%		↑30%	↑↑50%	↑↑↑60–80% immediately, then rapidly decreases within the first hour	Return to prepregnancy values
Heart rate	↑3–5%	↑10–15%	↑15–20%	During uterine contractions: ↑40–50%		↓5–10% within 24 hours; continues to decrease throughout the first 6 weeks	Return to prepregnancy values
Blood pressure	↓10%	↓5%	↑5%	During uterine contractions: ↑SBP 15–25% ↑DBP 10–15%		↓SBP 5–10% within 48 hours; may increase again between days 3–6 due to fluid shifts	Return to prepregnancy values
Plasma volume	↑	↑↑40–50%		↑	↑↑	↑↑↑500 mL due to autotransfusion	Return to prepregnancy values

SIGNS AND SYMPTOMS OF HEART DISEASE

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

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

MORBIDITY AND MORTALITY

- Morbidity = mortality
- Under estimated morbidity

RISK REDUCTION STRATEGIES

Preconception

Recognition and management of CVD risk factors in the

Antenatal / Intrapartum

- Appropriate cardiovascular assessment in the prenatal period:
    - Risk assessment
    - Congenital heart disease
    - Treatment plan in the ante and postpartum period
    - Appropriate delivery plan
    - High Obstetrics risk center
    - Multidisciplinary Pregnancy Heart Team approach
    - Adequate follow up

RISK REDUCTION STRATEGIES

- Postpartum
- Assessment is important in the first 1-2 weeks post delivery for women with high CVD risk features
  - **placental abruption, stillbirth, hypertensive disorders of pregnancy, gestational diabetes mellitus, and preterm births**

- Long term cardiovascular care
- Removal of barriers to access
- Raising awareness

FUTURE DIRECTIONS

- Increased collaboration between the Cardiologist and the Obstetrician **- Pregnancy Heart Team**

- Research collaborative called the Heart Outcomes in Pregnancy: **Expectations (HOPE) for Mom and Baby Registry**

- There is also a need for greater risk prediction tools
  - **CARPREG II score**

FUTURE DIRECTION

- Risk appropriate maternity care
- Address health care disparities
- Level IV maternal care centers
- Regionalization
- Predictive models

QUESTIONS

REFERENCES

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