

Pregnancy: The Fourth Trimester and Cardiovascular Risk

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American
Heart
Association.

Pregnancy and CV Risk

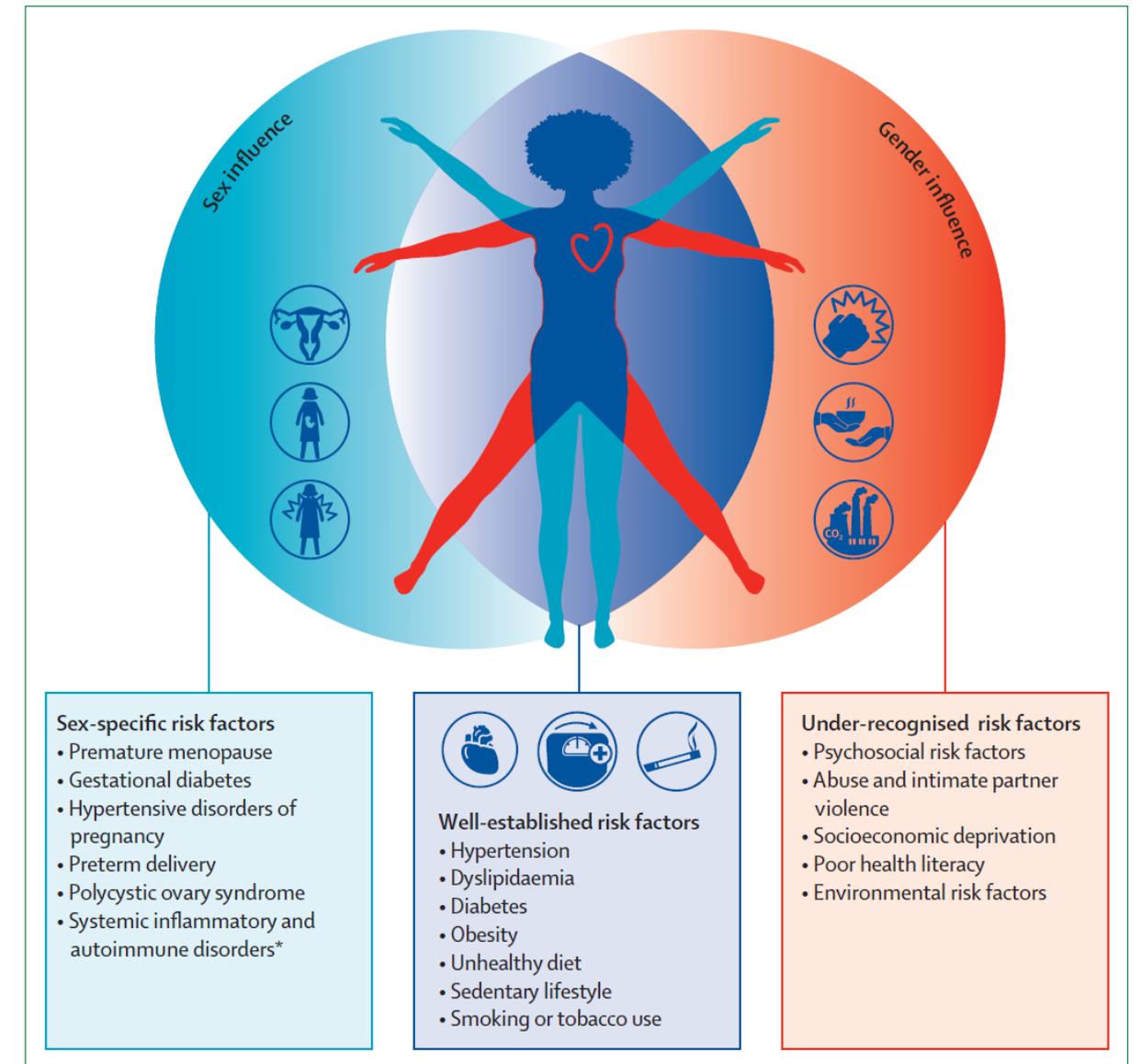
Risk Enhancing Factors

Retu Saxena, MD, FACC



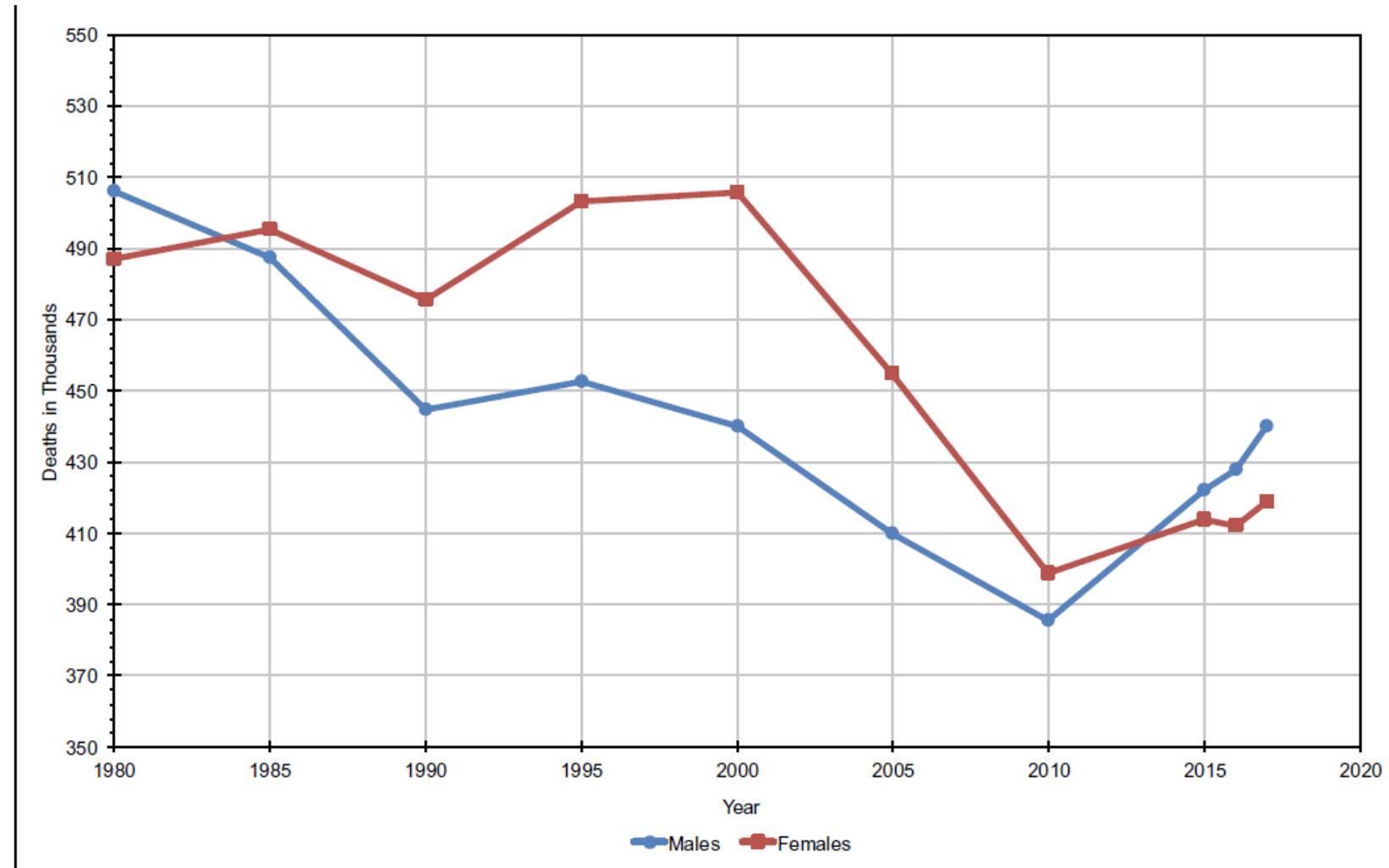
Objectives

- CVD in women
- Adverse Pregnancy Outcomes and CVD Risk
- Recommendations for screening and management



Heart Disease in Women

- In 2017, CVD was the cause of death in 418,665 females (all ages). Represents 49% of deaths from CVD.
- CVD causes about 1 death every 1 minute 16 seconds among females.
- 2017, CVD was the first listed diagnosis of about 2.2 million females discharged from short-stay hospitals.



Heart Disease in Women

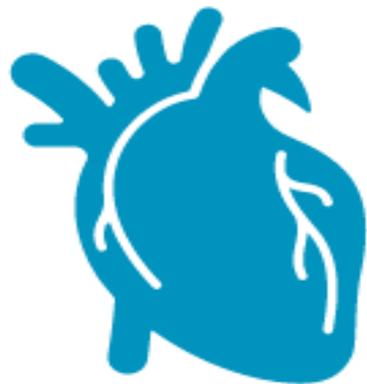
Cardiovascular disease in women

35%

of all deaths in women worldwide are caused by cardiovascular disease

Cardiovascular disease among women is

understudied, under-recognised, underdiagnosed, undertreated, and women are **under-represented** in clinical trials.



275 million

women were diagnosed with cardiovascular disease in 2019

8.9 million

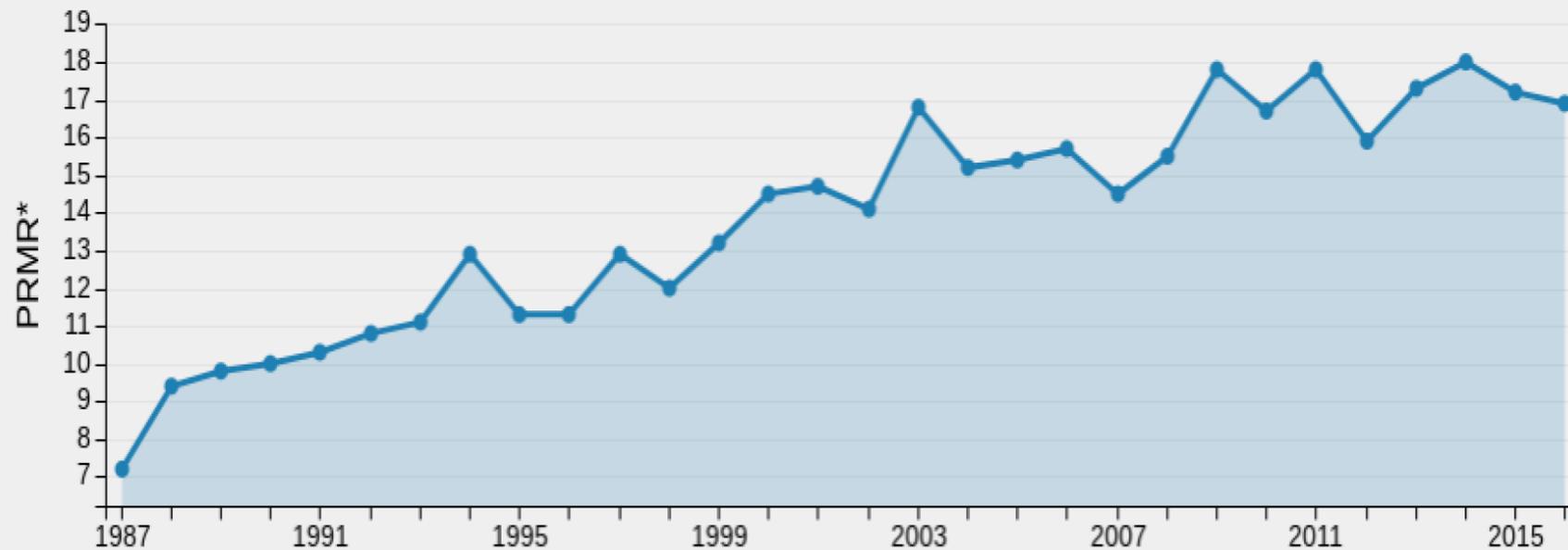
women died from cardiovascular disease in 2019

Read more:

The *Lancet* women and cardiovascular disease Commission: reducing the global burden by 2030

Pregnancy and Mortality

Trends in pregnancy-related mortality in the United States: 1987-2016



*Number of pregnancy-related deaths per 100,000 live births per year

■ Pregnancy-related mortality ratio

Maternal morbidity and mortality rate has steadily increased over the last 2 decades.

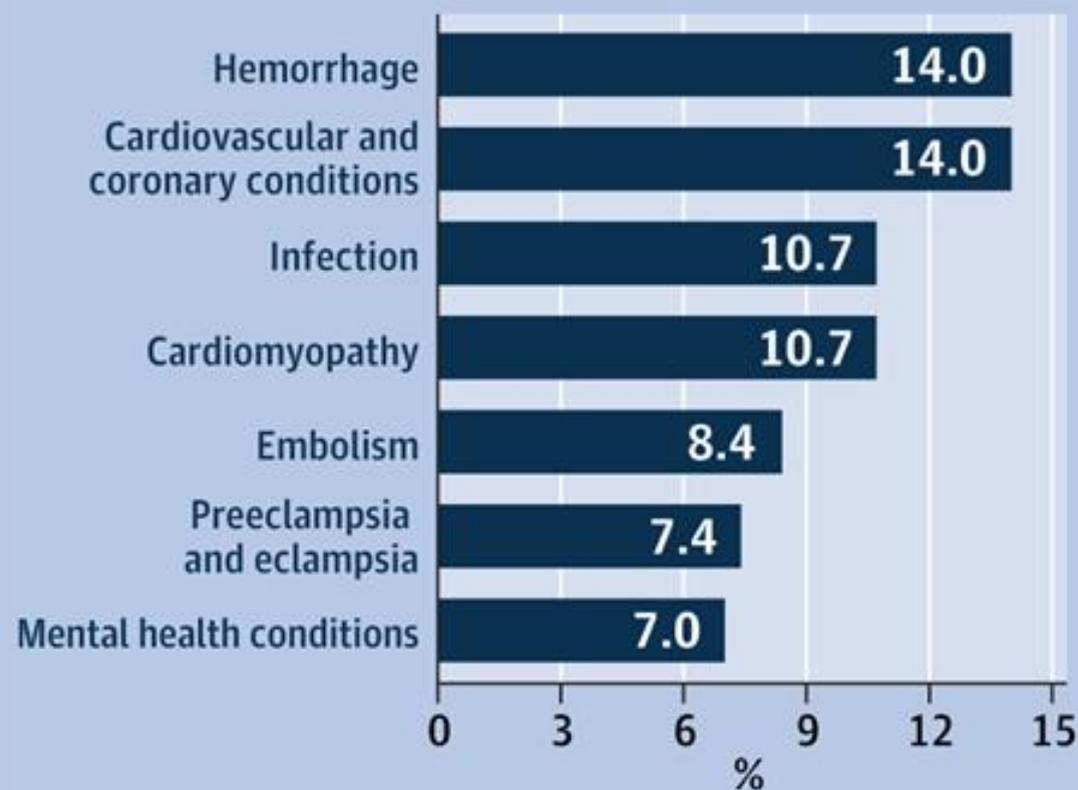
Cardiovascular disease (CVD) is the leading cause of pregnancy-related mortality in the United States and has gradually increased over time (from 7.2 to 17.2 deaths per 100 000 live births from 1987–2015).

Despite advances in health care in the United States (US) maternal morbidity and mortality remains significantly higher in the US relative to other developed nations.

Maternal Mortality

Pregnancy-Related Deaths in the US

Leading underlying causes of pregnancy-related deaths



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

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%).**

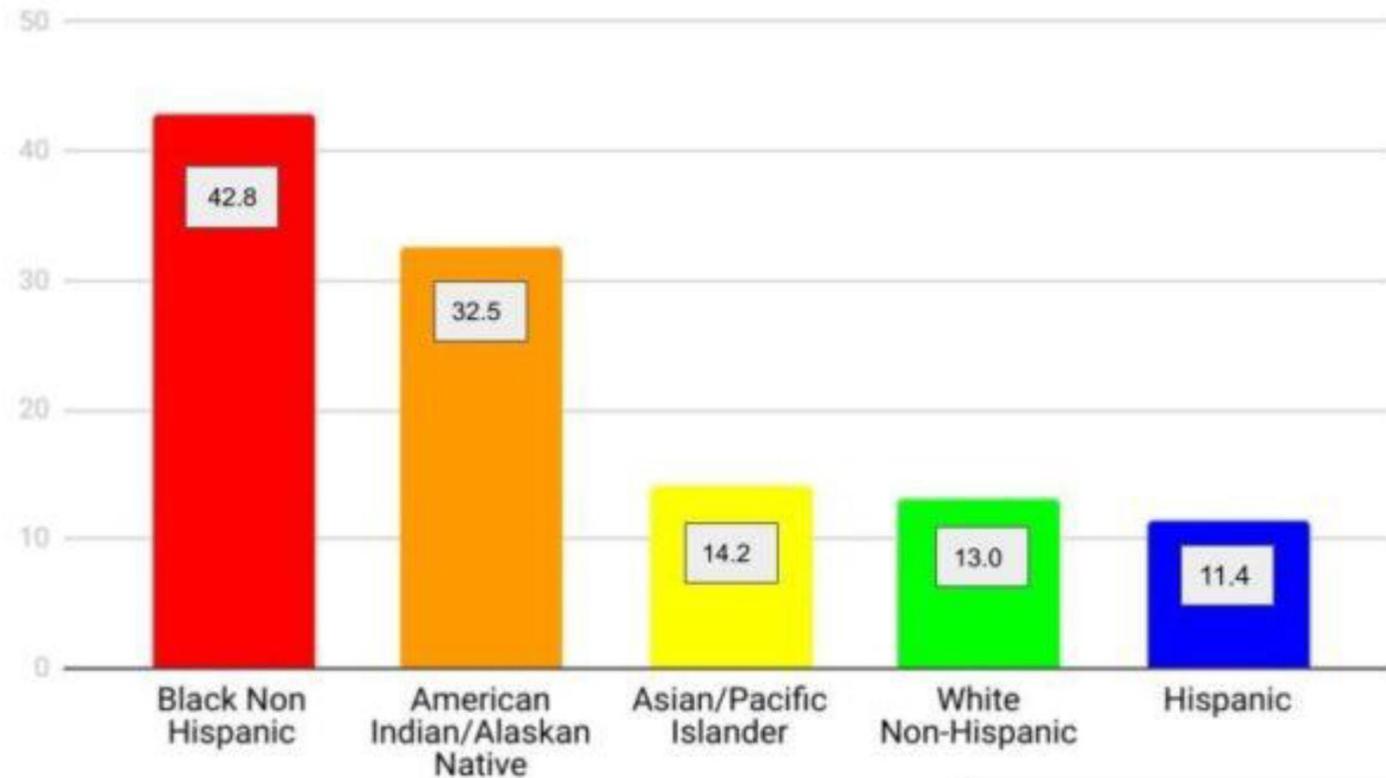
Source: Review to Action. *Report From Nine Maternal Mortality Review Committees.*
<https://reviewtoaction.org>. Published 2018.

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Minneapolis Heart Institute Foundation
Creating a world without heart and vascular disease

Maternal Mortality and Disparities

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

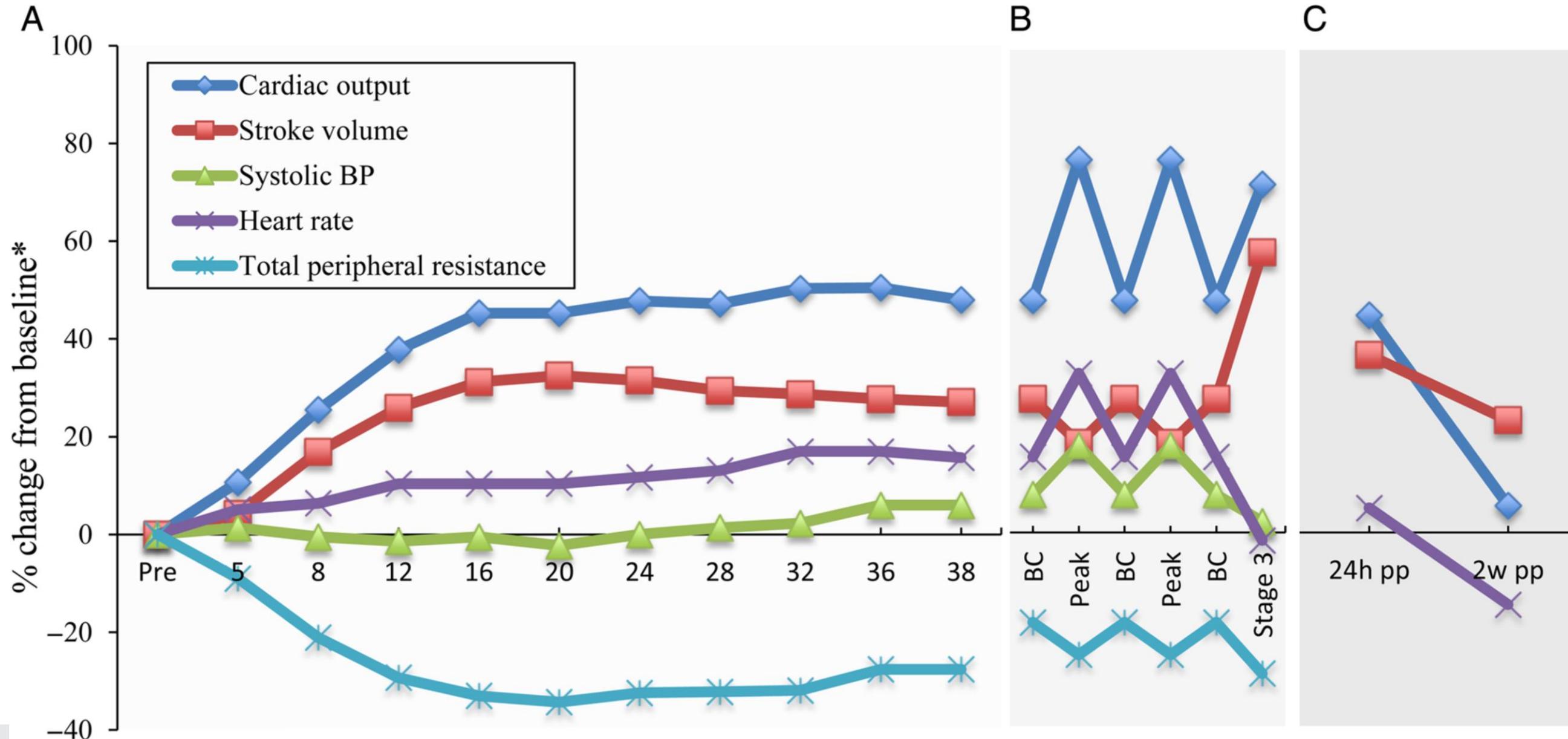


Reference: Centers for Disease Control Pregnancy Mortality Surveillance System.

- **Black women have a greater than 3 fold higher death rate compared to White, non-Hispanic women.**
- **A black woman is 22% more likely to die from heart disease**

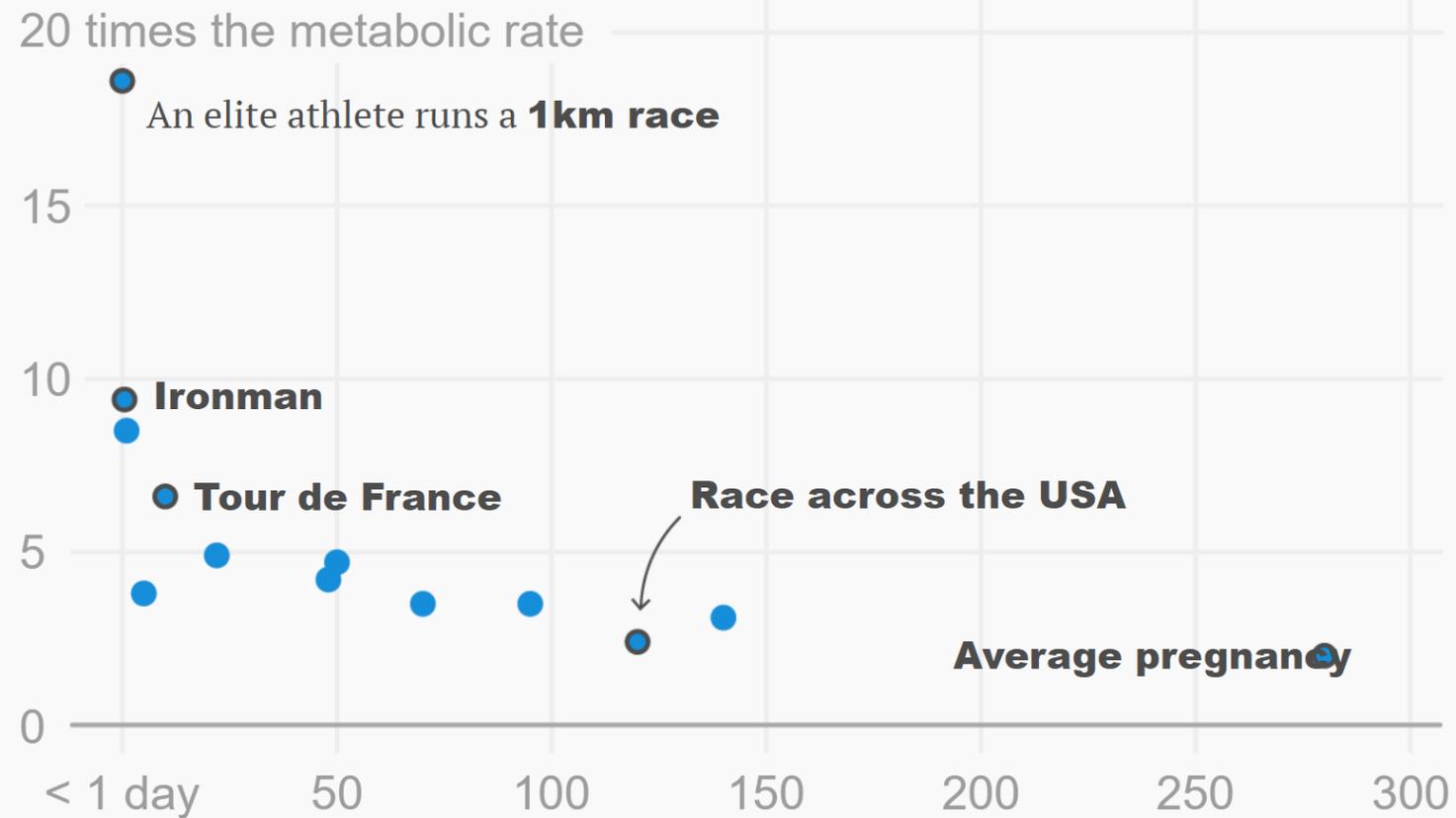
First pregnancies should be utilized as an early life stress test to identify women who may benefit from CVD prevention

Pregnancy – A Stress Test



Metabolic Cap/Endurance Races

The longer our bodies endure, the more our metabolism



Quartz | qz.com

Data: Thurber et al, 2019

Event	Duration (days)	Metabolic rate
Elite 800 m dash (estimate) 🏃	0.001	18.6
Kona Ironman 🏃🚴🏊	0.55	9.4
Western States 100 🏃	1.12	8.5
Antarctic trekking ❄️❄️	5	3.8
Tour de France cyclists 🚴	10	6.6
Antarctic trekking ❄️❄️	22	4.9
North pole trekking ❄️❄️	48	4.2
Race Across USA, Week 1 🏃	50	4.7
Antarctic trekking ❄️❄️	70	3.5
Antarctic trekking ❄️❄️	95	3.5
Race Across USA, cumulative avg. 🏃	120	2.4
Gambian farmers – harvest season 🌾	140	3.1
Typical pregnancy 🤰	280	2

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

- **Up to 67% of women see an OB/GYN as their sole health care provider**
- **Prevention guideline fund of knowledge is low in OB**
- **CVD guidelines applied < 55%, in pcp, cardiologists and OB**
- **<10% of internists and 38% of Ob's counsel patients with APO (adverse pregnancy outcome) about their future CVD risk**

Emerging Risk Factors

Traditional Risk Factors

SLE: 3-fold higher risk of IHD events [18]
 Rheumatoid arthritis: elevates IHD risk as much as DM [18]



Gestational diabetes
 • 4-fold higher risk of DM
 • 59% higher risk of MI [17]



Hypertension in pregnancy:
 • Gestational HTN and preclampsia:
 3-fold higher risk of IHD [18]



Early menopause confers 4.5 times higher risk of IHD [99]



Depression is more prevalent in women
 Doubles the risk of IHD [16]



Menopause results in ↑TG, ↑LDL, ↓HDL
 Women are less likely to achieve lipid goals (OR 0.50) [97]



80% of women ≥75 have HTN
 Only 29% have adequate BP control [22,98]



Diabetes confers a 45% higher risk of IHD [16]



Smoking confers a 25% higher risk of IHD [96]



Obesity confers a higher risk of IHD in women (64% vs 46%) [94]



Women have a higher prevalence of inactivity
 25% of US women get no regular physical activity [95]



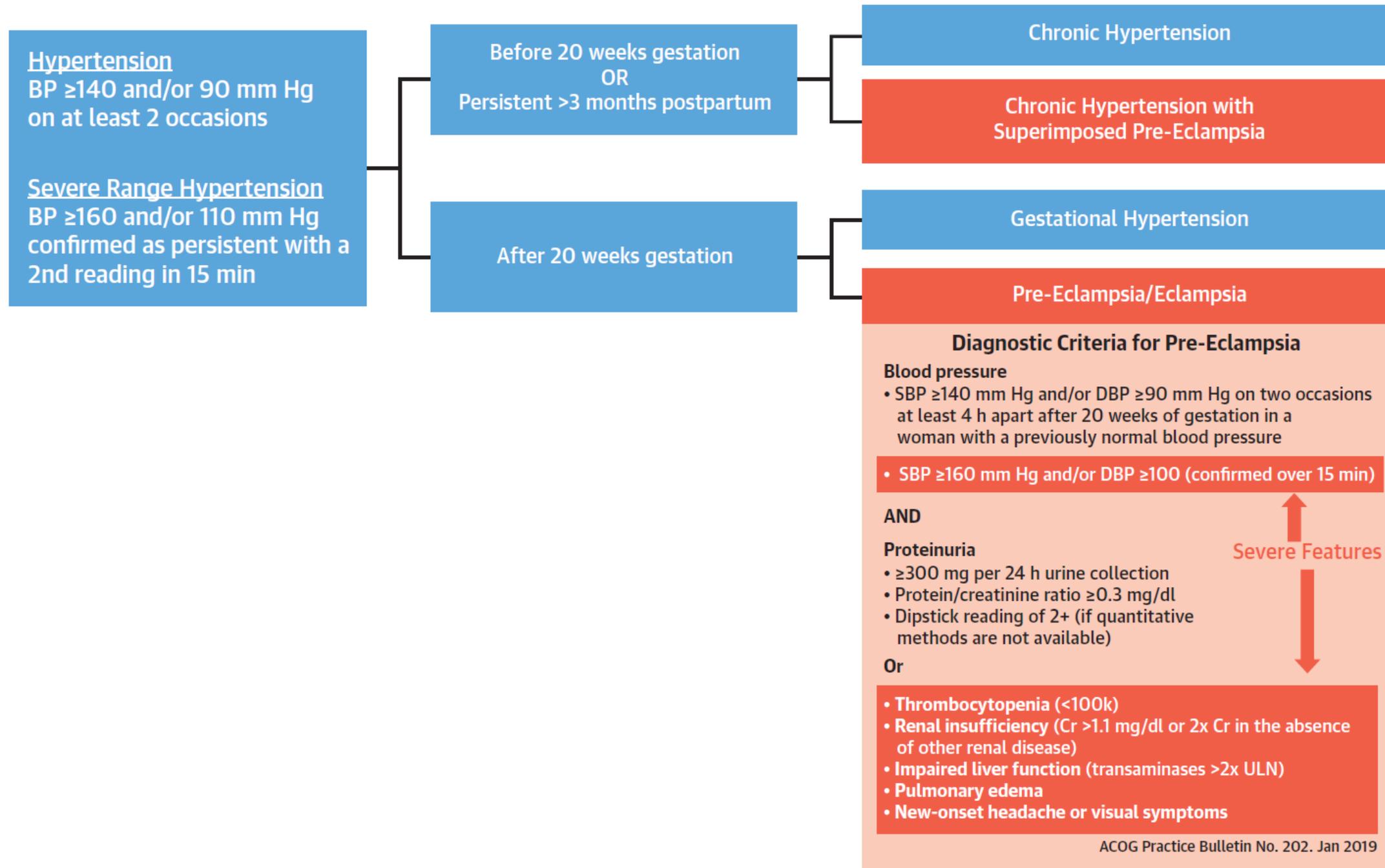
Family History of premature atherosclerosis confers a 2 fold higher risk of IHD in men and women [100]

Table 1. CVD risk factors that are sex specific, predominant, and more impactful in women

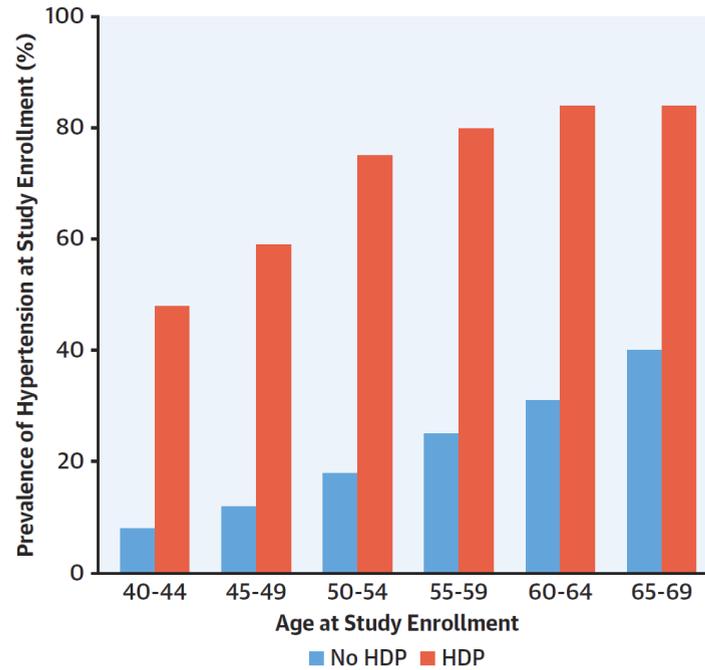
Female-specific risk factors	Female-predominant risk factors	Increased risk in females compared to males	Equal risk in females and males
Early menarche (≤ 11 years old)	Systemic lupus erythematosus	Hypertension	Hyperlipidemia
Early menopause (< 40 years old)	Rheumatoid arthritis	Diabetes	Sedentary lifestyle
History of PCOS	Depression	Smoking	Obesity
History of hypothalamic amenorrhea	Psychological stress		Family history of CVD
History of premature delivery, low birth weight, or high birth weight fetus			
Gestational diabetes			
Hypertensive disorders of pregnancy			

PCOS polycystic ovarian syndrome, CVD cardiovascular disease

Adverse Pregnancy Outcomes - Hypertensive Disorders 5-10% of all births



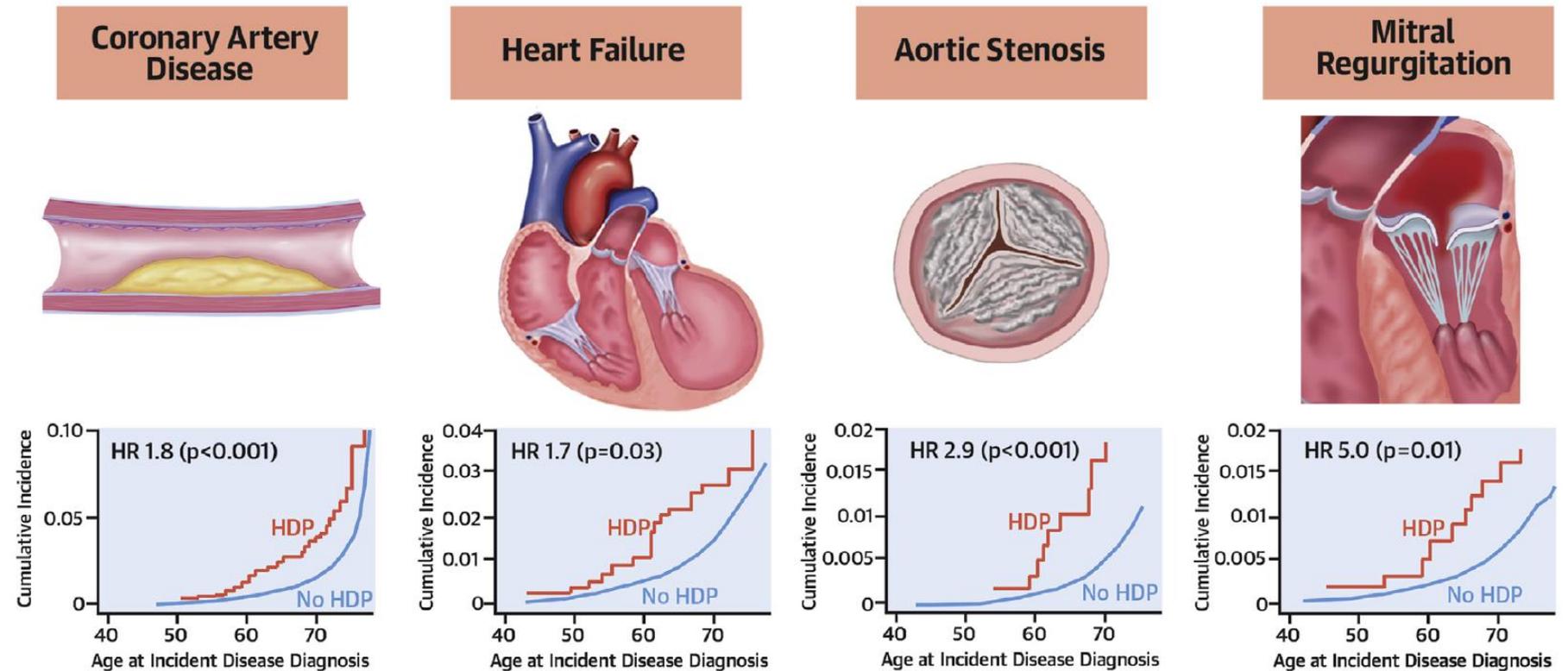
Hypertensive disorders



Chronic hypertension accounts for one-half to two-thirds of the excess cardiovascular disease risk in women with prior HDP

Only about 33% of women with prior HDP are on antihypertensives

CENTRAL ILLUSTRATION Hypertensive Disorders of Pregnancy Are Associated With Long-Term Risk of Diverse Cardiovascular Diseases



Honigberg, M.C. et al. J Am Coll Cardiol. 2019;74(22):2743-54.

APO – Gestational Diabetes ~6-7% of pregnancies

Gestational Diabetes:

- fasting plasma glucose 5.1–6.9 mmol/L (92–125 mg/dL)
- 1-hour plasma glucose 10.0 mmol/L (180 mg/dL) following a 75 g oral glucose load
- 2-hour plasma glucose 8.5–11.0 mmol/L (153–199 mg/dL) following a 75 g oral glucose load

Diabetes mellitus in pregnancy should be diagnosed if one or more of the following criteria are met:

- fasting plasma glucose 7.0 mmol/L (126 mg/dL)
- 2-hour plasma glucose 11.1 mmol/L (200 mg/dL) following a 75 g oral glucose load
- random plasma glucose 11.1 mmol/L (200 mg/dL) in the presence of diabetes symptoms.

Diabetes mellitus in pregnancy differs from GDM in that the hyperglycemia is more severe and does not resolve after pregnancy as it does with GDM.

Adverse Pregnancy Outcomes

- 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)
 - 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).

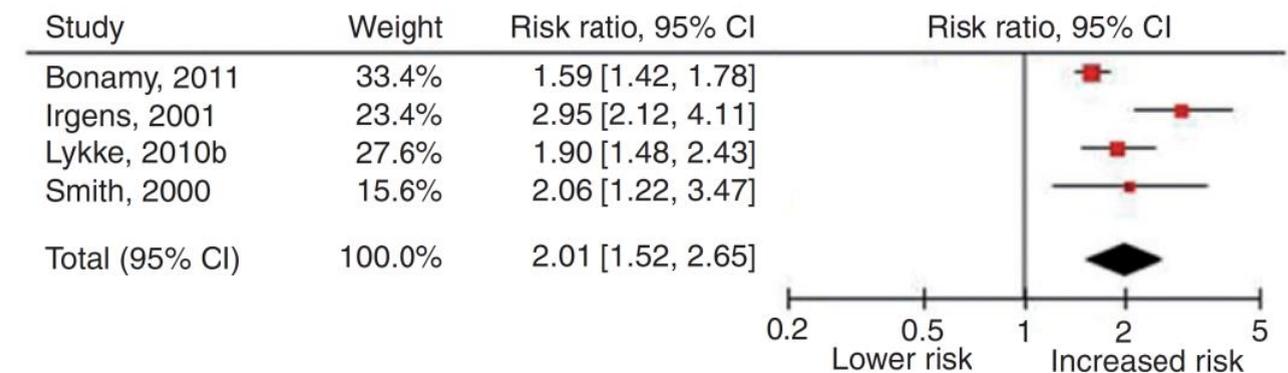
APO: Preterm Labor ~10% pregnancies

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



Heterogeneity: $\tau^2 = 0.06$; $\text{Chi}^2 = 13.06$, $\text{df} = 3$ ($P = 0.005$); $I^2 = 77\%$
Test for overall effect: $Z = 4.96$ ($P < 0.00001$)

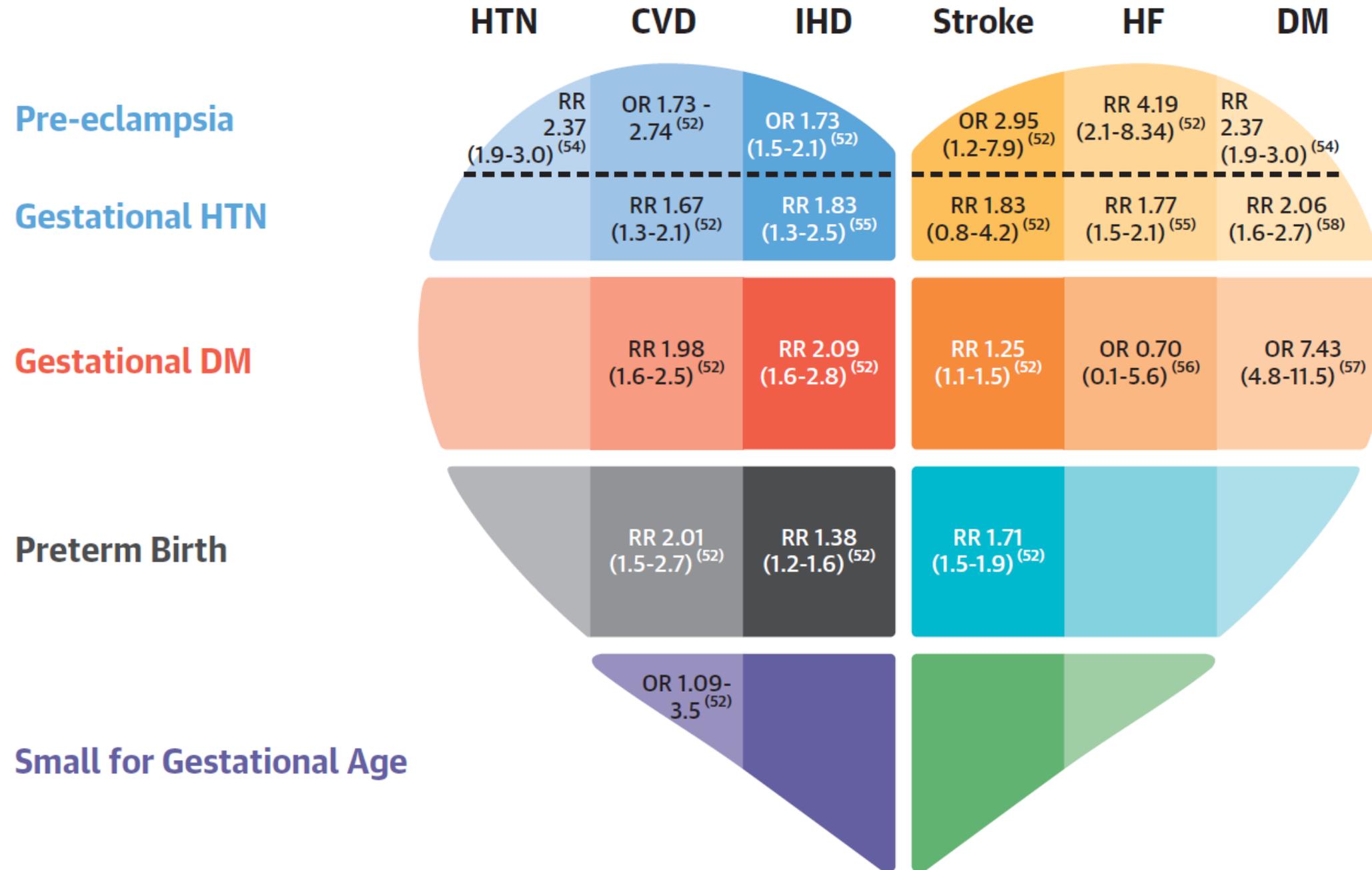
Heida et al. *Eur J Prev Cardiol* 2016;23:1863-79

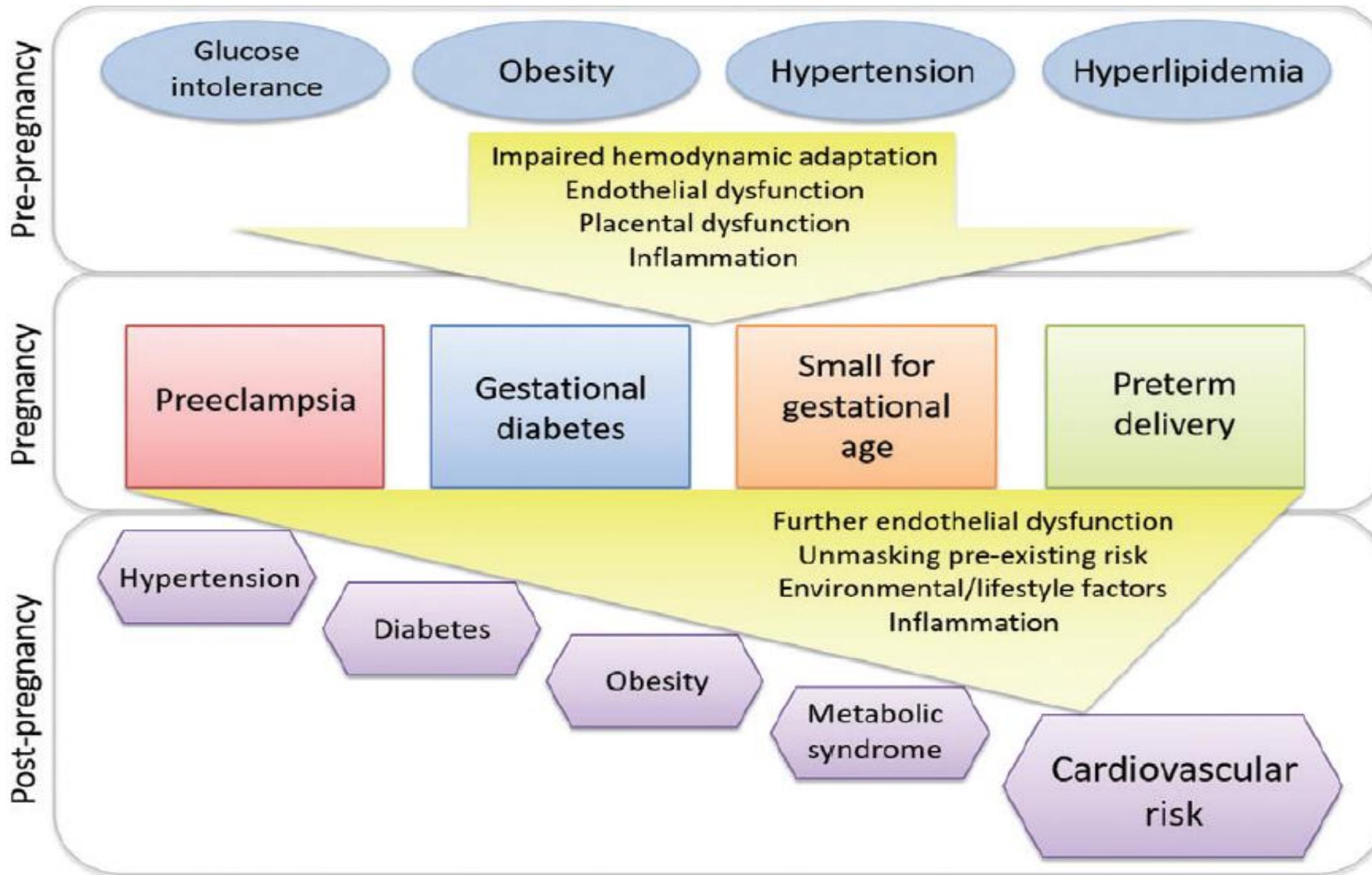
APO and CVD Risk

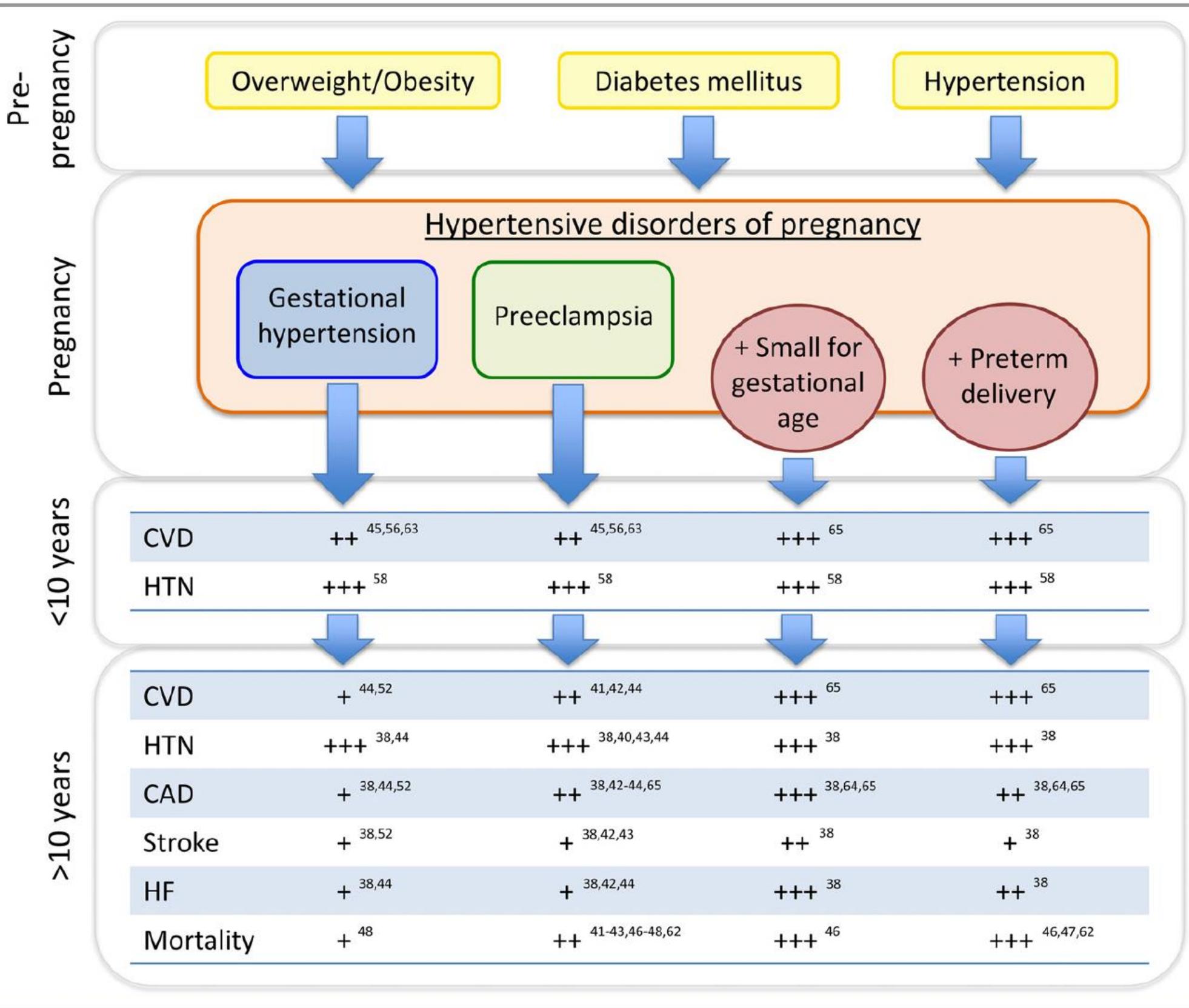
Term/condition	Definition	Women with condition, %
APO	One of several maternal or fetal complications, including preeclampsia, gestational hypertension, GD, preterm delivery, fetal growth restriction, having a neonate with a low birth weight or a low birth weight indexed to a referent sample based on gestational age (SGA), and placental abruption.	10–15 ^{6,7*}
Preeclampsia	Pregnancy disorder associated with new-onset hypertension, which occurs most often after 20 wk of gestation and frequently near term. It is often but not always accompanied by new-onset proteinuria.	2–8 ^{8†}
Gestational hypertension	Defined as a systolic blood pressure of ≥ 140 mm Hg, a diastolic blood pressure of ≥ 90 mm Hg, or both on 2 occasions at least 4 h apart after 20 wk of gestation in a woman with a previously normal blood pressure.	2–3 ^{9†}
Hypertensive disorder of pregnancy ¹⁰	Preeclampsia, chronic hypertension, chronic hypertension with superimposed preeclampsia, eclampsia, or gestational hypertension.	6–8 ^{11†}
GD	Any degree of glucose intolerance with onset or first recognition during pregnancy.	2–10 ¹²
Gestational age	Time elapsed since the first day of the last menstrual period (also known as menstrual age).	...
Placental abruption	Premature separation of a normally implanted placenta from the uterus before delivery of the fetus.	1 ^{13†}
Preterm delivery	After 20 wk gestation and before the completion of 37 wk of gestation regardless of birth-weight.	10 ^{14†}
Low birth weight	Neonate with birthweight <2500 g (or <5 lb 8 oz).	8 ^{14†}
SGA	Neonate whose weight is below the 10th percentile for the gestational age based on a reference standard (often national reference standards for weight for gestational age. Other defined cut points include weight below the third percentile). Some published cut points are sex and race specific. Reference standards generally have excluded nonsingleton deliveries and congenital malformations. ¹⁵	10 ¹⁶
Large for gestational age	Neonate whose weight is above the 90th percentile for the gestational age.	8–13 ¹⁷
Fetal growth restriction (intrauterine growth restriction)	Condition in which a fetus is unable to achieve its genetically determined potential size. ^{18,19} Fetal growth restriction describes fetuses with an estimated fetal weight that is less than the 10th percentile for gestational age. To assess for fetal growth restriction, 4 biometric measures are commonly used: (1) biparietal diameter, (2) head circumference, (3) abdominal circumference, and (4) femur length. The biometric measurements can be combined to generate an estimated fetal weight. ²⁰	5–15 ^{8,19†}

APO and Future CV risk

FIGURE 7 APOs and Future Cardiovascular Risk







Educational Materials

Pregnancy-induced Cardiovascular Risk

A Provider Resource

Pregnancy and Heart Health

What to know to live healthfully beyond your pregnancy



Pregnancy is an exciting time in a woman's life filled with anticipation of what's to come. Many people believe that conditions that occur during pregnancy resolve themselves when the baby is born, but often, that's not the case.

The reality: Many pregnancy-induced conditions increase a woman's health risks immediately following delivery and for many years to come. In fact, pregnancy is often thought of as a woman's first "stress test" that can unmask underlying heart and vascular problems and future risk.

For women who are pregnant, it's important to understand the long-term heart and vascular impacts that can result from pregnancy-induced conditions.



Unique heart disease risk factors in pregnancy

High blood pressure during pregnancy

How common is it?

- Pregnancy-induced hypertension (or high blood pressure) affects about 10-15 percent of pregnancies.

What are the health concerns it causes?

Gestational diabetes

What is it?

- Gestational diabetes is diabetes that develops during pregnancy and usually resolves after delivery.

What are the health concerns it causes?

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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: <ul style="list-style-type: none"> • 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

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

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.

Assessing Risk

Step 1

Screen for Sex-specific Risk Factors:

- Prematurity
- Age at menarche
- Polycystic ovarian syndrome
- Hormone-based contraceptive use
- Recurrent spontaneous pregnancy loss
- Gestational diabetes
- Gestational HTN
- Pre-eclampsia
- Pre-term delivery
- Delivery of small for gestational age infant
- Early menopause/ premature ovarian failure

Stepping to Success:

Reducing CVD Risk in Women

Step 2

If sex-specific risk factors are present:

1. Assess for traditional CVD risk factors early and more frequently
2. Screen for, prevent, & treat intermediate phenotypes

Hypertension
Diabetes
Hyperlipidemia
Metabolic Syndrome

Step 3

Begin aggressive risk factor management

Implement lifestyle modifications with AHA's Life's Simple 7:

1. Manage blood pressure
2. Control cholesterol
3. Reduce blood sugar
4. Stay active
5. Eat Healthy
6. Lose weight
7. Stop Smoking



Step 4

Estimate risk & treat accordingly with consideration of sex-specific risk factors:

1. Assess 10-year ASCVD Risk/ Lifetime risk
2. Treat early if borderline or intermediate risk and if sex-specific risk factors are present

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

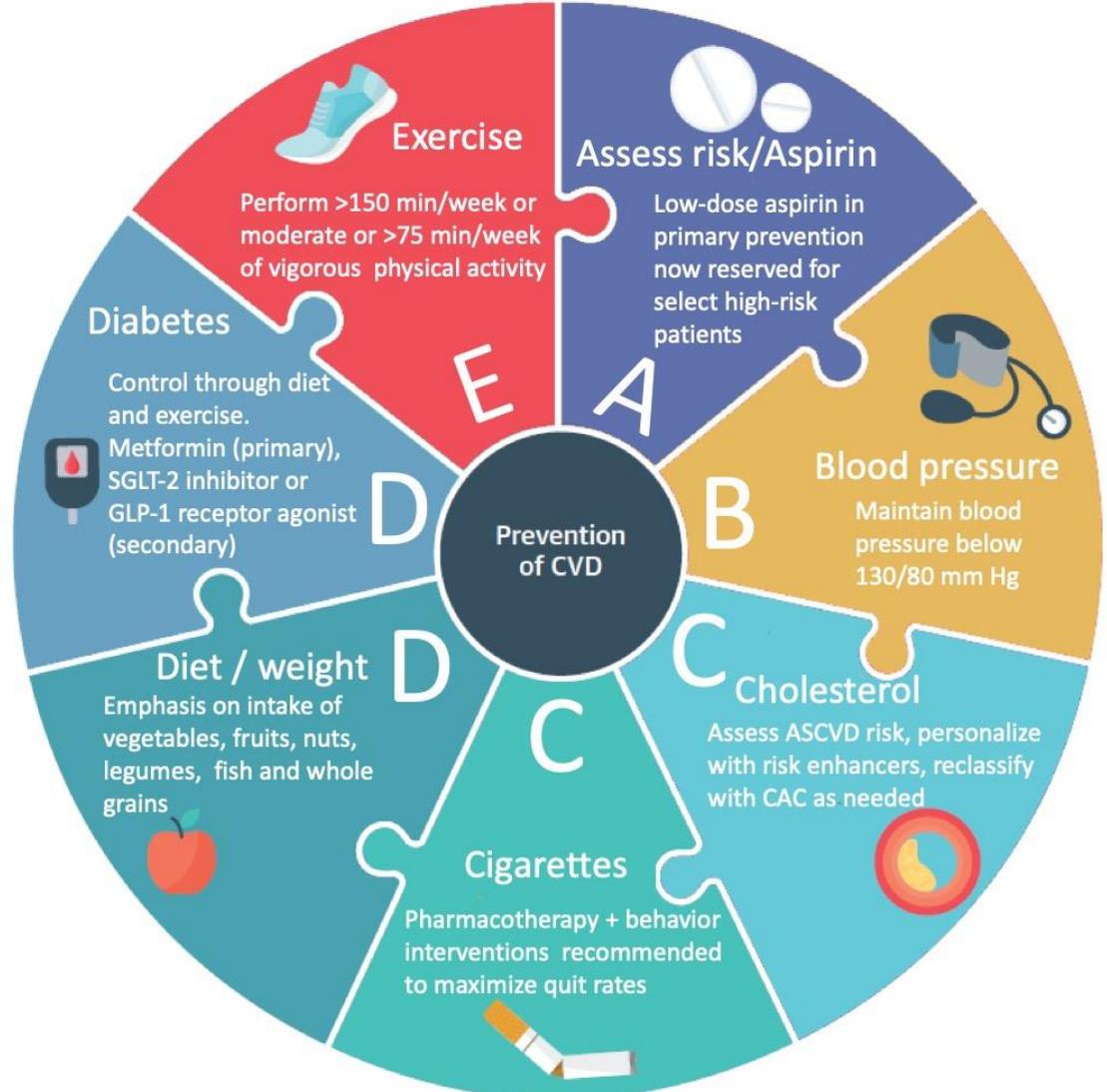
Eating a variety of foods and mostly plants can protect your heart. Eat more whole foods – such as vegetables, fruits, whole grains – and more healthy fats. Eat fewer highly processed food, foods high in sugar (sugar-sweetened beverages), saturated fats and salt. The DASH (Dietary Approaches to Stop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



Maintain or move toward a healthier weight

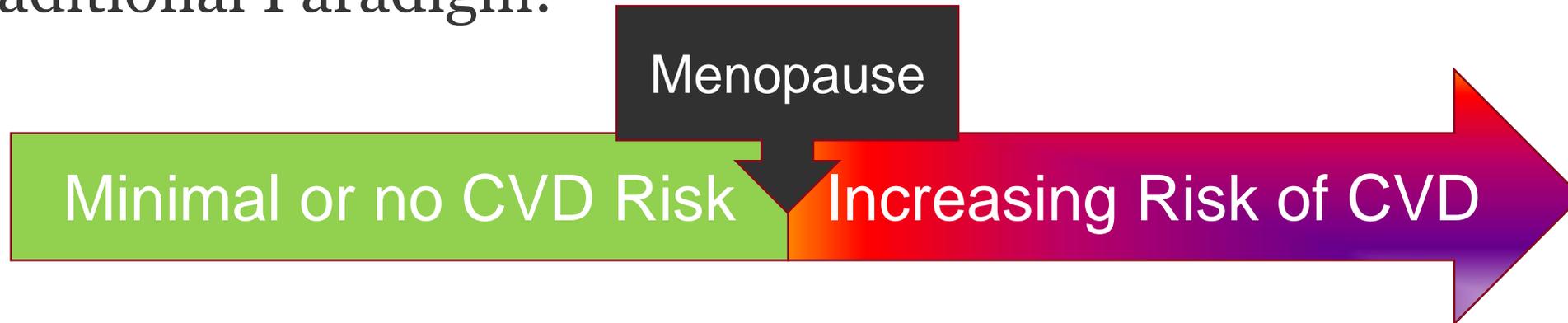
Losing 5-10 percent of your body weight will reduce your risk. More importantly, you'll feel better and have more energy to do the things you enjoy!

ABCDE of Primary Prevention: Lifestyle Changes and Team-Based Care

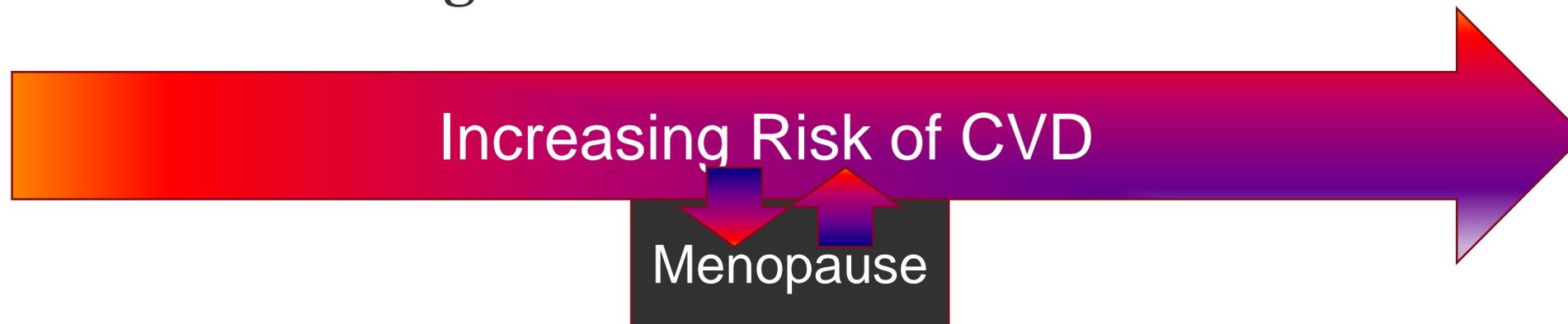


Heart Disease in Women

Traditional Paradigm:



Alternative Paradigm:



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



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

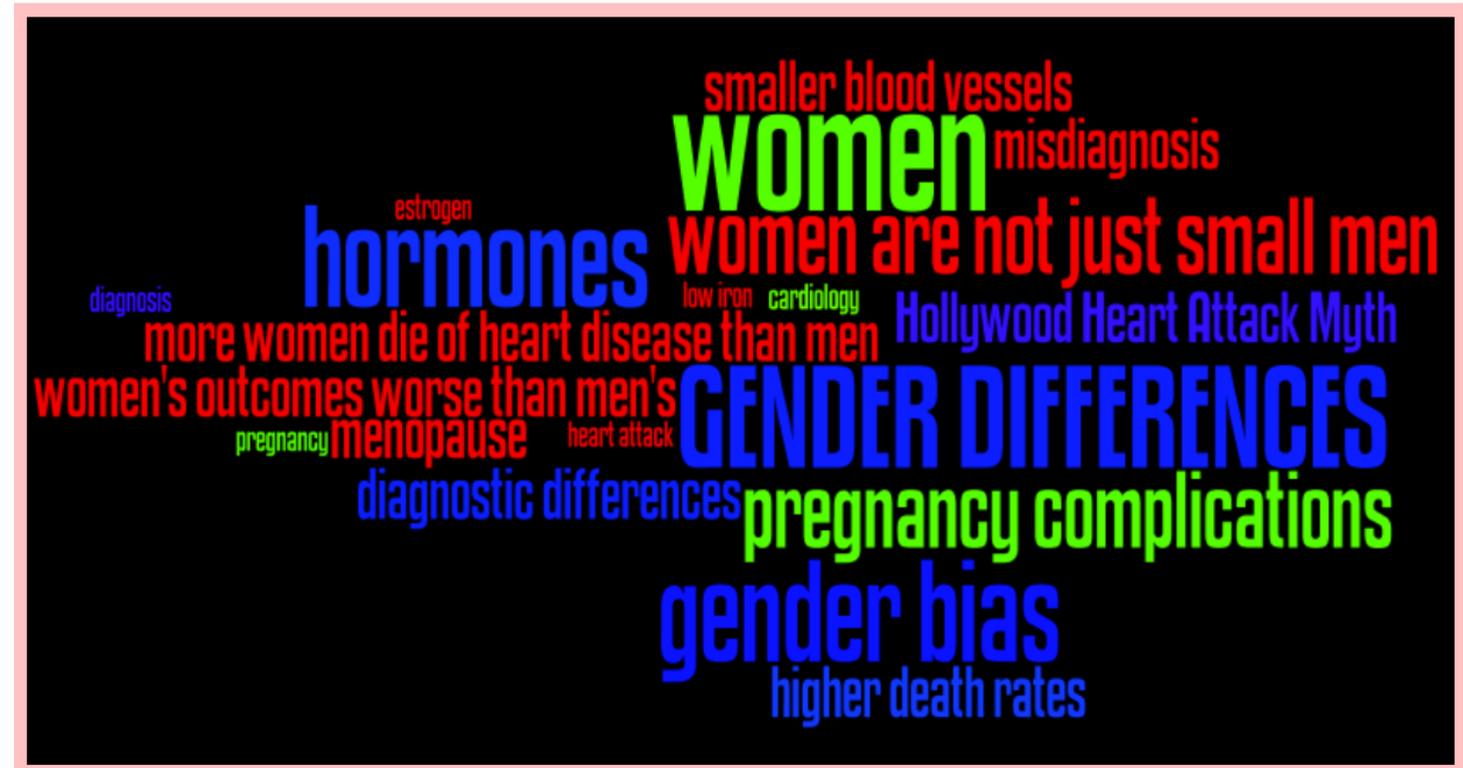


High blood pressure
Affects 3 of 4 women 65+

RISKS

Conclusions

- ♥ CVD remains the leading cause of morbidity and mortality in women.
- ♥ Women have unique risk factors for CVD—such as PCOS and pregnancy-associated conditions that increase future risk of CVD.
- ♥ Knowledge of unique risk factors in women as well as treatment gap is critical in lowering cardiovascular risk in women.



Thank you!

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

