Pregnancy and Heart Disease

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Maternal Mortality Rate (MMR)

- U.S. is only industrialized nation with an increasing MMR
- Slowly increasing in the United States from 1987 to present
- U.S. MMR for 2020: 23.8 deaths per 100,000
- In 2020, MMR for non-Hispanic Black women was 55.3 deaths per 100,000 live births, 2.9 times the rate for non-Hispanic White women (19.1)

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CDC Centers for Disease Control and Prevention
CDC 24/7: Saving Lives, Protecting People™
National Center for Health Statistics

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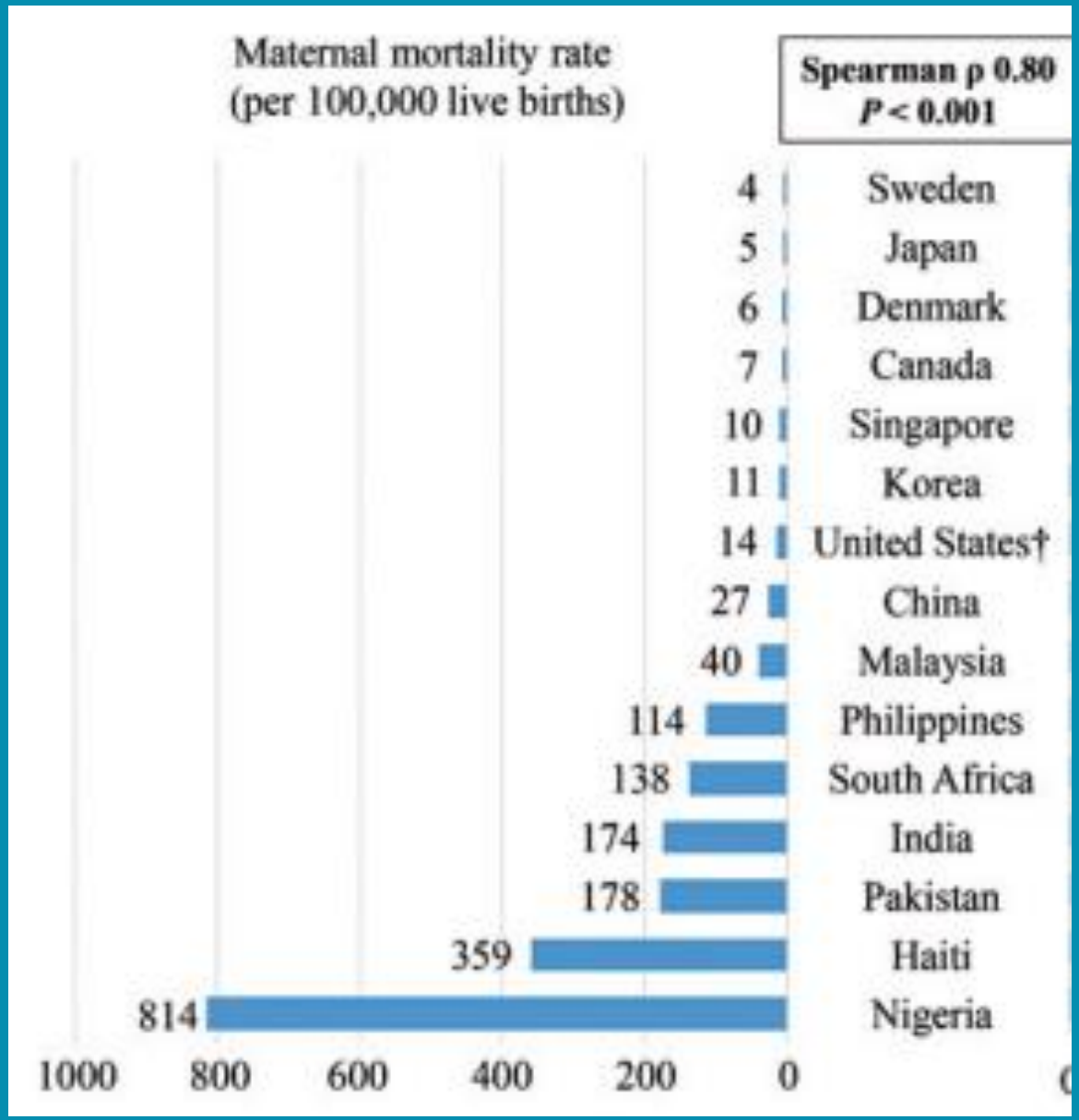

International Heart Journal 2019
Volume 60 Issue 3 Pages 503-511

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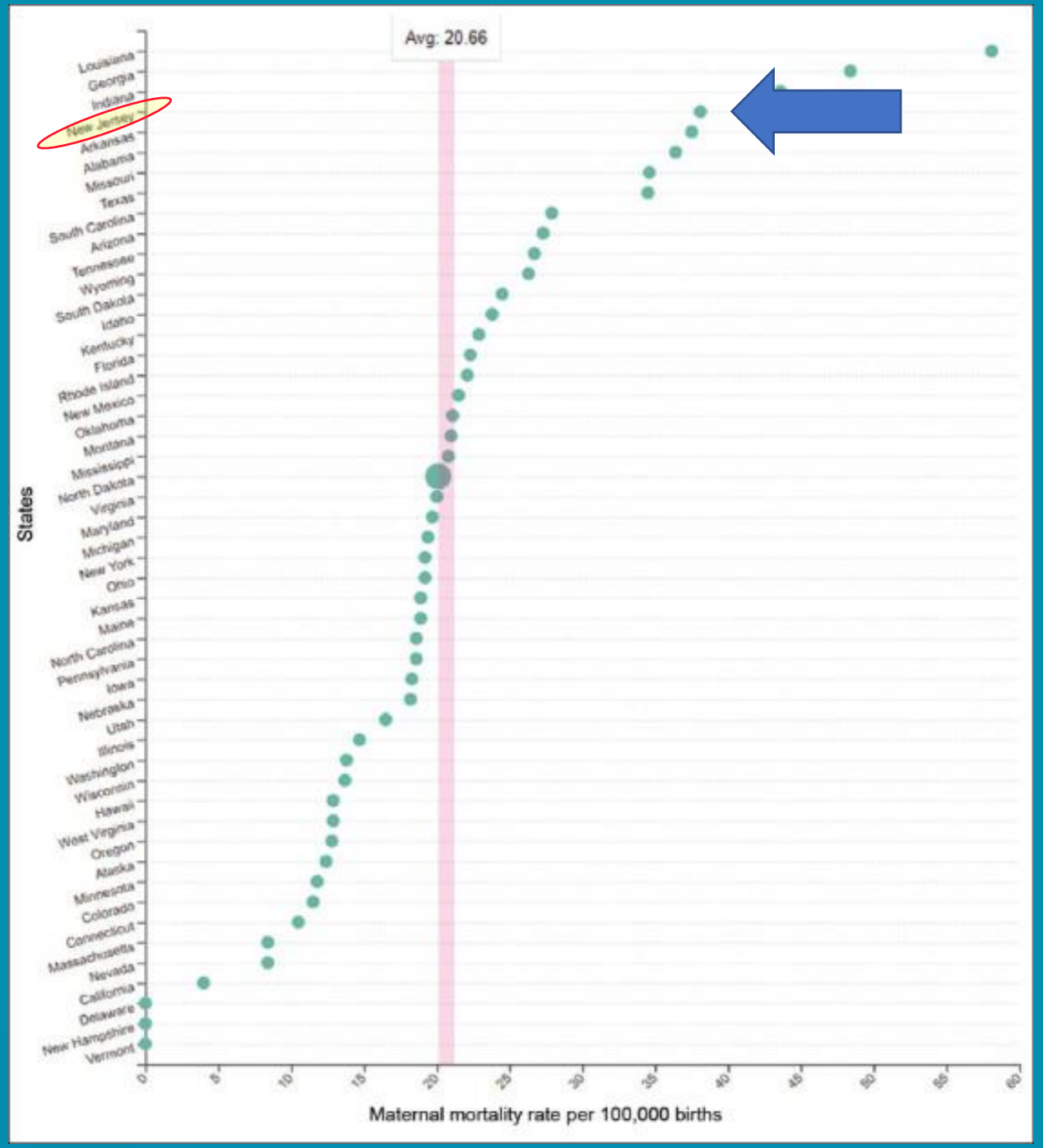

What about
New Jersey?

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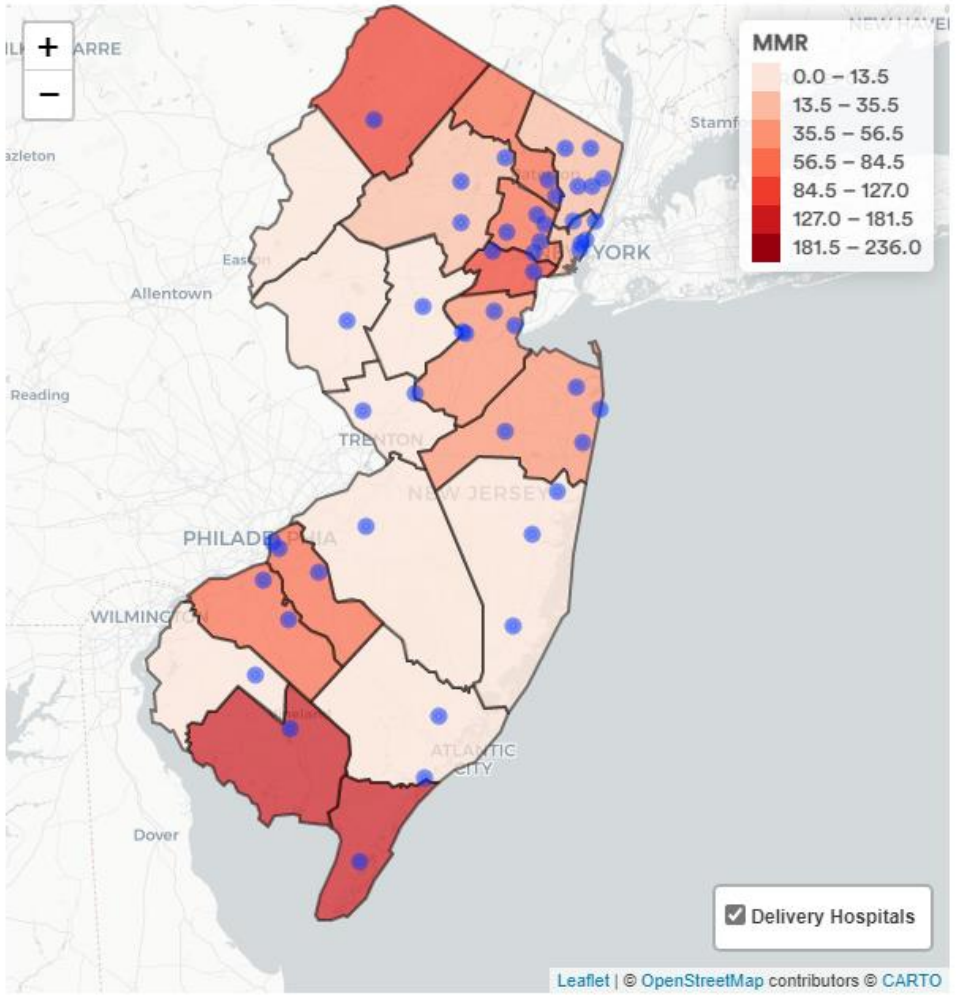
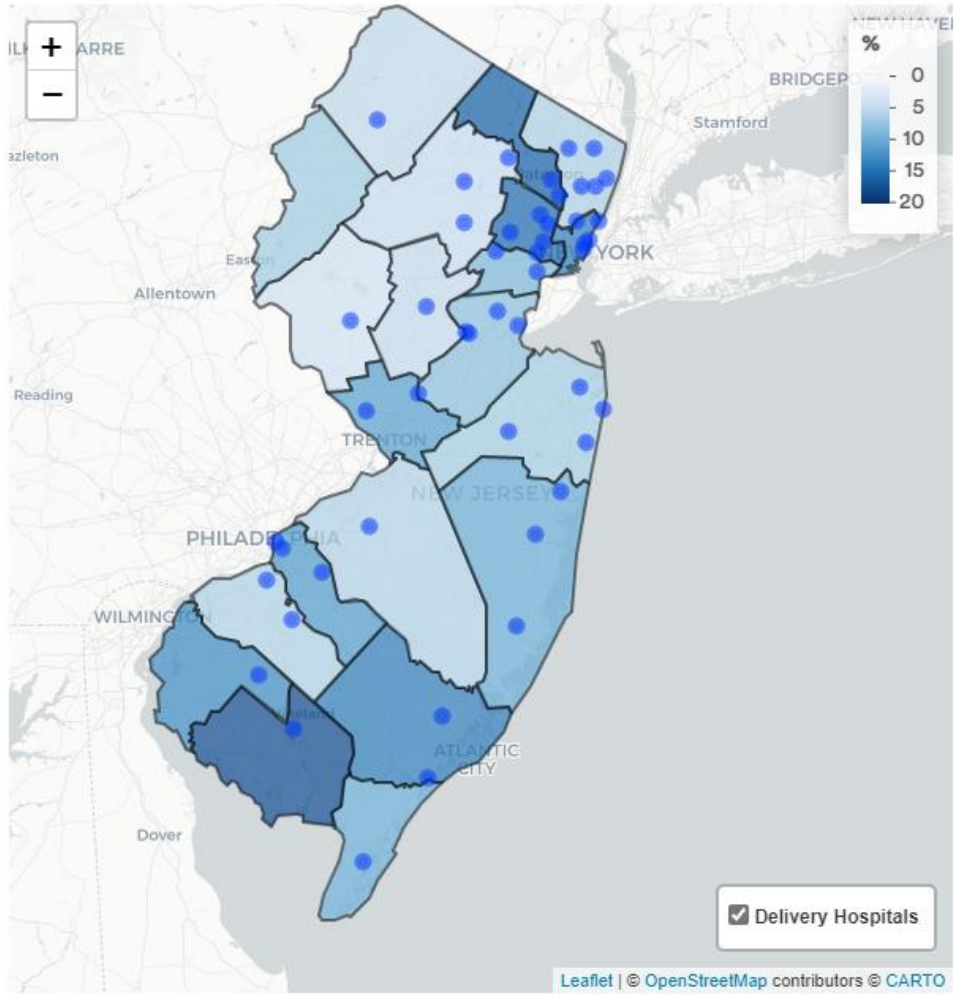
2017 Maternal Mortality Ratio by County



2017 Percent Poverty by County



Overall NJ 2017 Maternal Mortality Ratio

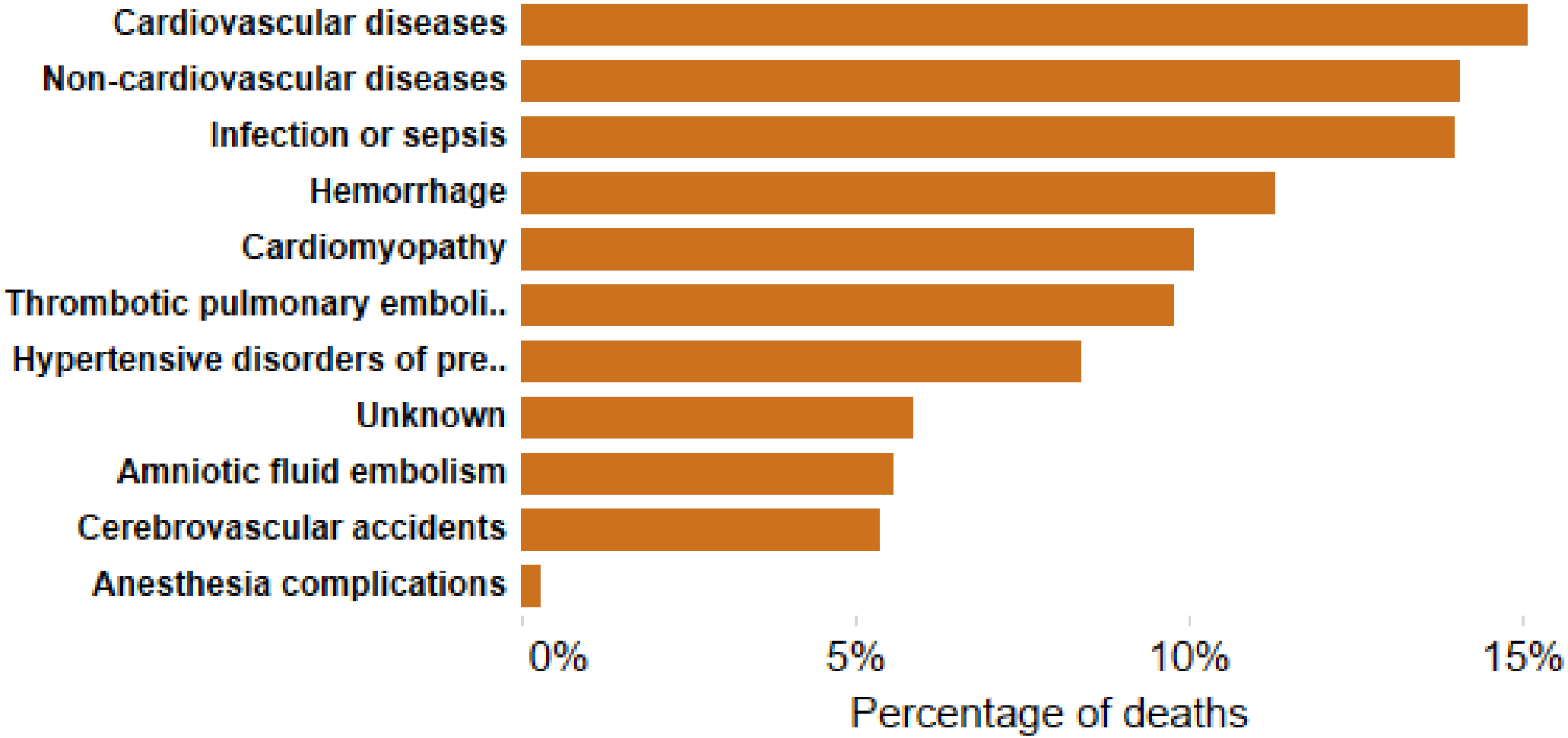
41.7

40 Maternal Deaths
95,949 Live Births

New Jersey Maternal Mortality Dashboard NJMMD

https://johnsonandjohnson.shinyapps.io/njmm

Causes for pregnancy-related deaths in the U.S.



Introduction

- Review normal cardiovascular physiology of pregnancy
- Challenges pregnancy presents for women with congenital or acquired heart disease
- Pre-pregnancy planning and intrapartum risk assessment
- Best practices for intrapartum management of women at higher risk

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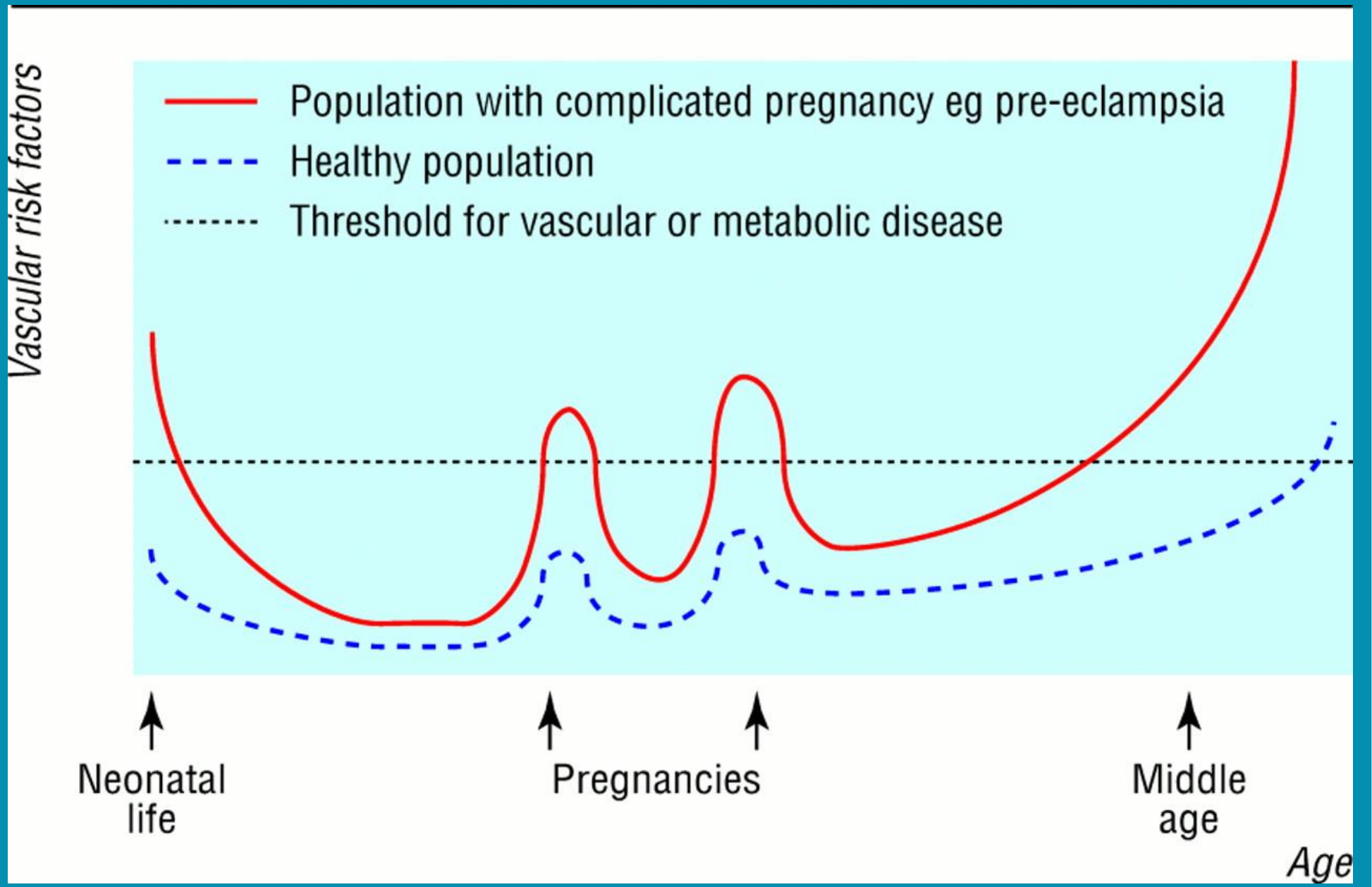
Pregnancy is a Vascular Stress Test



BMJ VOLUME 325 20 JULY 2002

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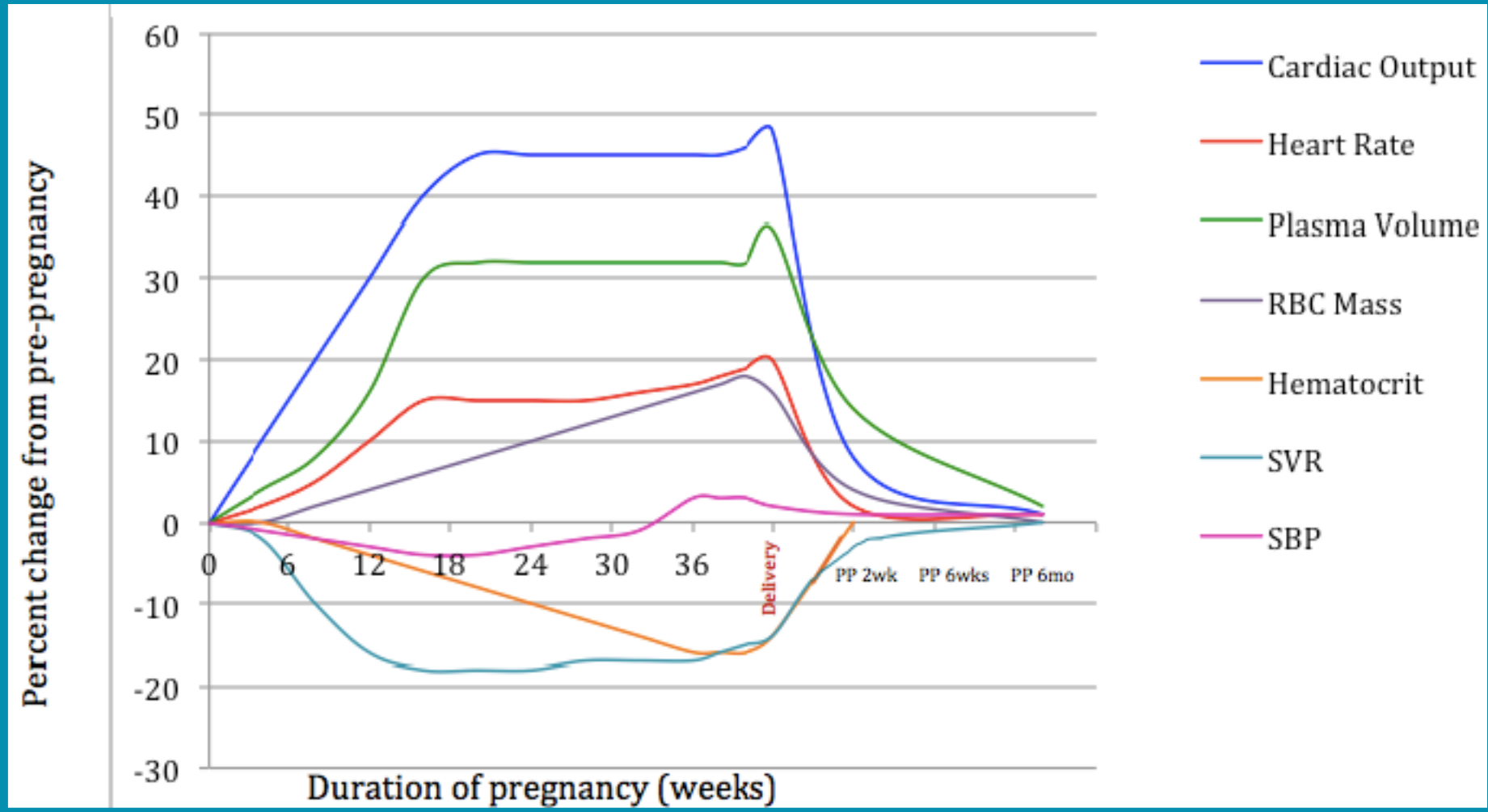
Physiologic Adaptations to the Pregnant State



Yucel, DeFaria Yeh, Curr Tr Opt CV Med 2017

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Physiologic Adaptations to the Pregnant State

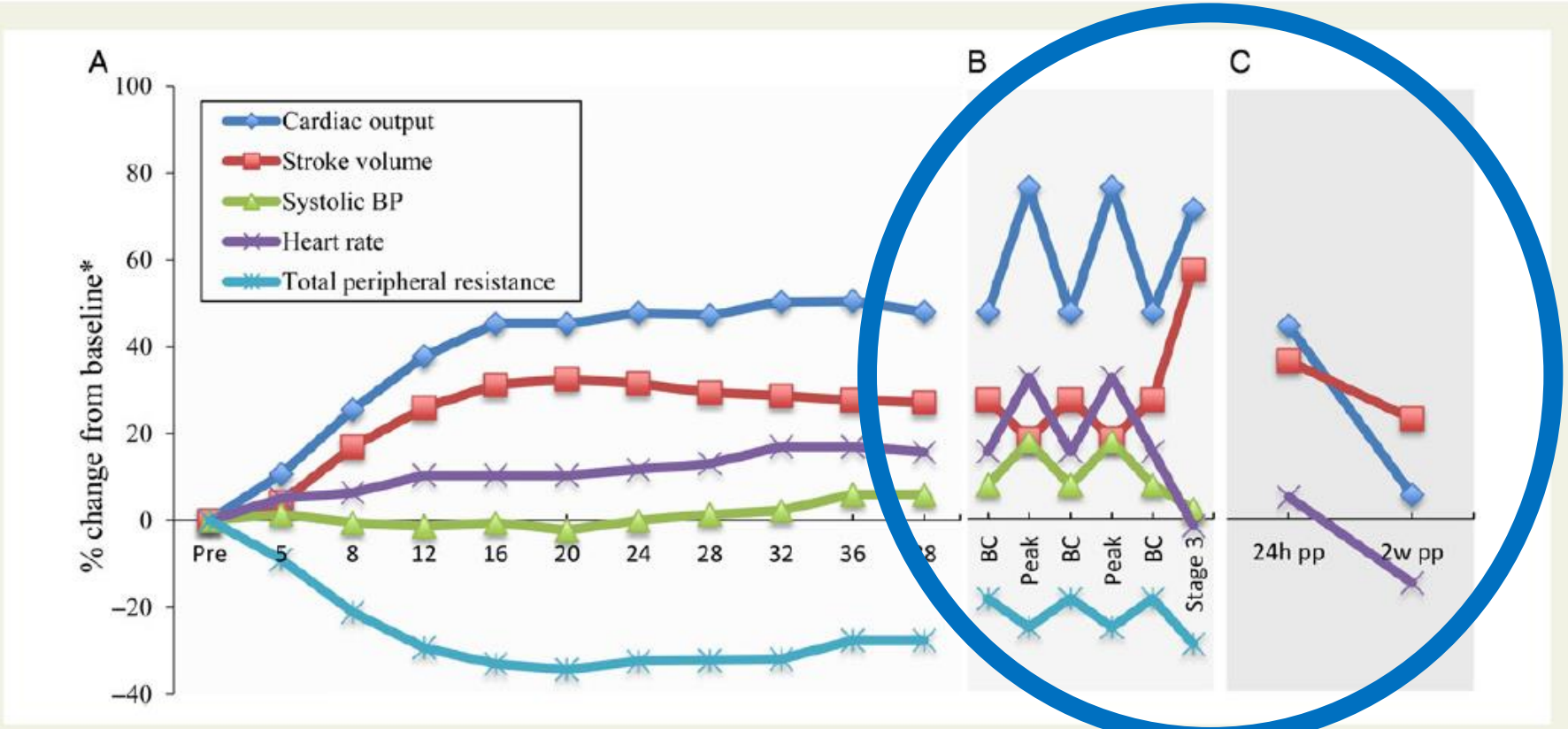

Figure 2 Haemodynamic changes during pregnancy, peripartum, and postpartum. (*A*) Pregnancy (weeks of gestation). Modified from Robson *et al.*[12] (*B*) Peripartum. Modified from: Adams *et al.*[13] BC, between contractions; Peak, at the peak of contraction; Stage 3, at the time of uterine contraction. (*C*) Postportum. Modified from Robson *et al.*[14,15] 24 h pp, 24 h postpartum; 2w pp, 2 weeks postpartum. *For cohorts in (*B*) and (*C*), relative changes from baseline were compared with the baseline values of the cohort from (*A*).

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European Heart Journal (2015) 36, 2491–2499

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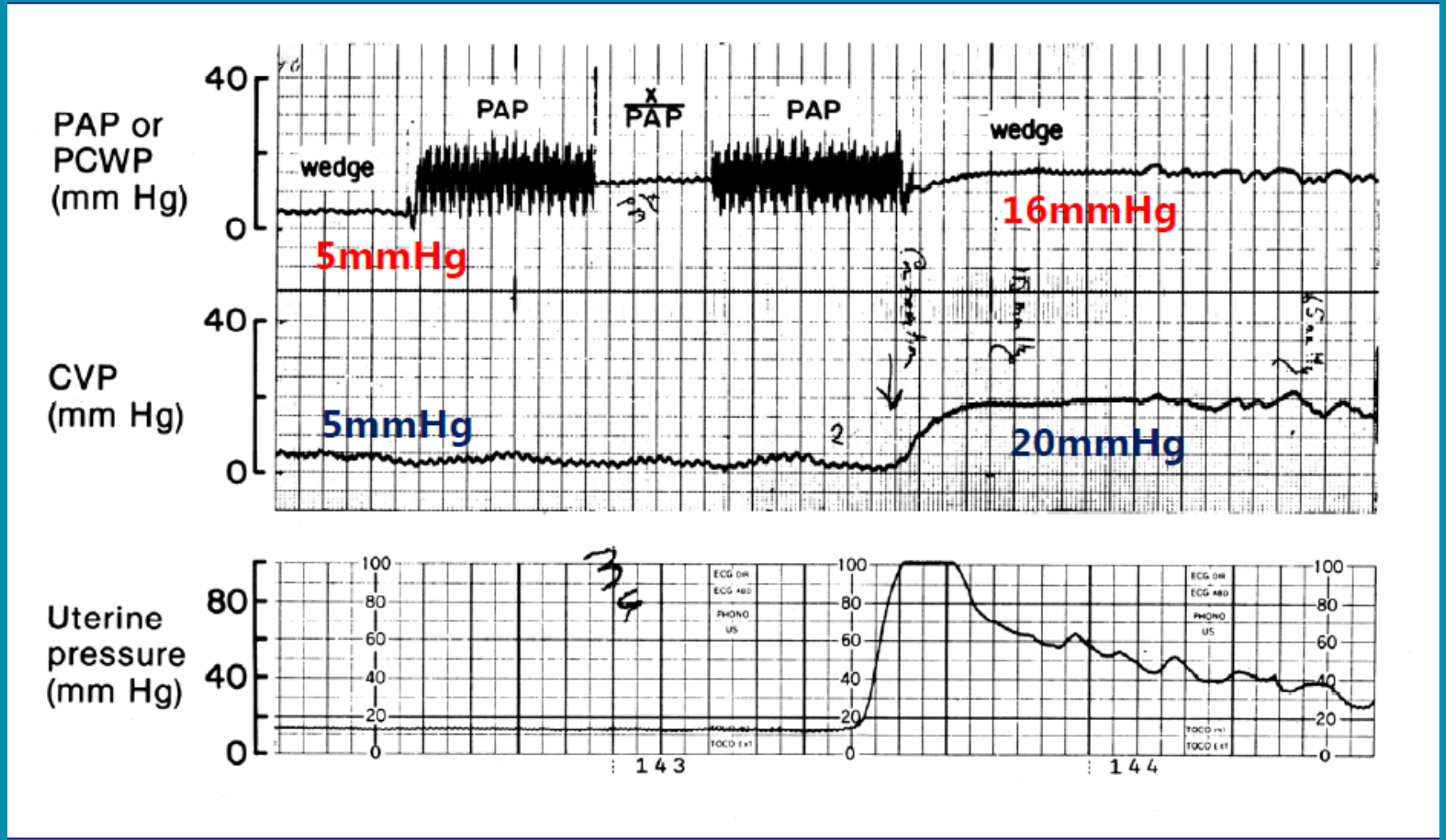
Physiologic Adaptations to the Pregnant State



Hankins GDV, et al. Obstet Gynecol 1985;65:139.

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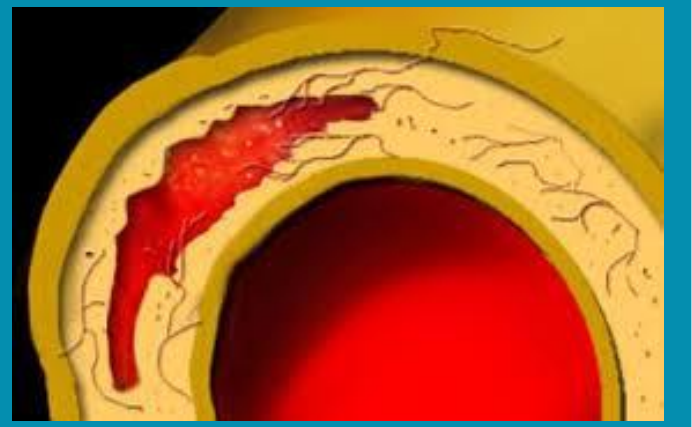
Women at Highest Risk

- Cardiac Output Limitation
  - Reduced systolic function
  - Obstructive lesions
- Inability to decrease systemic vascular resistance
  - hypertension
  - aortopathy
  - Higher risk for pre-eclampsia
- Vulnerable to blood pressure fluctuations
  - Collagen vascular disease
- Chronic Anticoagulation
  - Mechanical valve



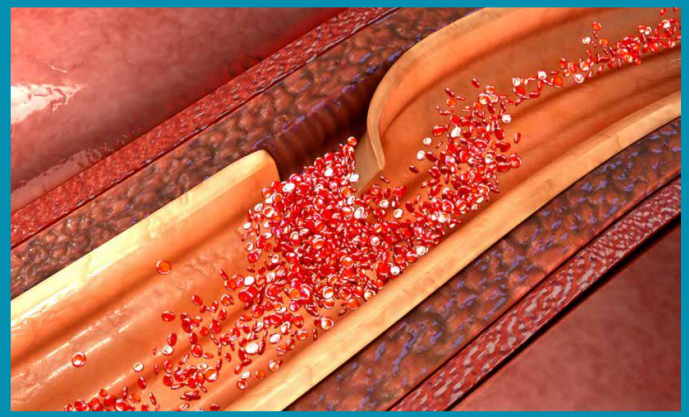


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Table 3 Modified World Health Organization classification of maternal cardiovascular risk

	mWHO I	mWHO II	mWHO II–III	mWHO III	mWHO IV
Diagnosis (if otherwise well and uncomplicated)	Small or mild – pulmonary stenosis – patent ductus arteriosus – mitral valve prolapse Successfully repaired simple lesions (atrial or ventricular septal defect, patent ductus arteriosus, anomalous pulmonary venous drainage) Atrial or ventricular ectopic beats, isolated	Unoperated atrial or ventricular septal defect Repaired tetralogy of Fallot Most arrhythmias (supraventricular arrhythmias) Turner syndrome without aortic dilatation	Mild left ventricular impairment (EF >45%) Hypertrophic cardiomyopathy Native or tissue valve disease not considered WHO I or IV (mild mitral stenosis, moderate aortic stenosis) Marfan or other HTAD syndrome without aortic dilatation Aorta <45 mm in bicuspid aortic valve pathology Repaired coarctation Atrioventricular septal defect	Moderate left ventricular impairment (EF 30–45%) Previous peripartum cardiomyopathy without any residual left ventricular impairment Mechanical valve Systemic right ventricle with good or mildly decreased ventricular function Fontan circulation. If otherwise the patient is well and the cardiac condition uncomplicated Unrepaired cyanotic heart disease Other complex heart disease Moderate mitral stenosis Severe asymptomatic aortic stenosis Moderate aortic dilatation (40–45 mm in Marfan syndrome or other HTAD; 45–50 mm in bicuspid aortic valve, Turner syndrome ASI 20–25 mm/m^2, tetralogy of Fallot <50 mm) Ventricular tachycardia	Pulmonary arterial hypertension Severe systemic ventricular dysfunction (EF <30% or NYHA class III–IV) Previous peripartum cardiomyopathy with any residual left ventricular impairment Severe mitral stenosis Severe symptomatic aortic stenosis Systemic right ventricle with moderate or severely decreased ventricular function Severe aortic dilatation (>45 mm in Marfan syndrome or other HTAD, >50 mm in bicuspid aortic valve, Turner syndrome ASI >25 mm/m^2, tetralogy of Fallot >50 mm) Vascular Ehlers–Danlos Severe (re)coarctation Fontan with any complication

European Heart Journal (2018) **39**, 3165–3241

Maternal Risk Stratification

Table 3 **Modified World Health Organization classification of maternal cardiovascular risk**

	mWHO I	mWHO II	mWHO II–III	mWHO III	mWHO IV
Risk	No detectable increased risk of maternal mortality and no/mild increased risk in morbidity	Small increased risk of maternal mortality or moderate increase in morbidity	Intermediate increased risk of maternal mortality or moderate to severe increase in morbidity	Significantly increased risk of maternal mortality or severe morbidity	Extremely high risk of maternal mortality or severe morbidity
Maternal cardiac event rate	2.5–5%	5.7–10.5%	10–19%	19–27%	40–100%

Events include: Death, CHF requiring treatment, stroke, MI or aortic dissection, the need for urgent or invasive cardiovascular intervention during pregnancy and puerperium, symptomatic arrhythmia requiring treatment, thromboembolic events and worsening of at least two NYHA functional classes

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European Heart Journal (2018) **39**, 3165–3241

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Best Practices to Mitigate Maternal Risk

Table 3 **Modified World Health Organization classification of maternal cardiovascular risk**

	mWHO I	mWHO II	mWHO II–III	mWHO III	mWHO IV
Counselling	Yes	Yes	Yes	Yes: expert counselling required	Yes: pregnancy contraindicated: if pregnancy occurs, termination should be discussed
Care during pregnancy	Local hospital	Local hospital	Referral hospital	Expert centre for pregnancy and cardiac disease	Expert centre for pregnancy and cardiac disease
Minimal follow-up visits during pregnancy	Once or twice	Once per trimester	Bimonthly	Monthly or bimonthly	Monthly
Location of delivery	Local hospital	Local hospital	Referral hospital	Expert centre for pregnancy and cardiac disease	Expert centre for pregnancy and cardiac disease

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European Heart Journal (2018) **39**, 3165–3241

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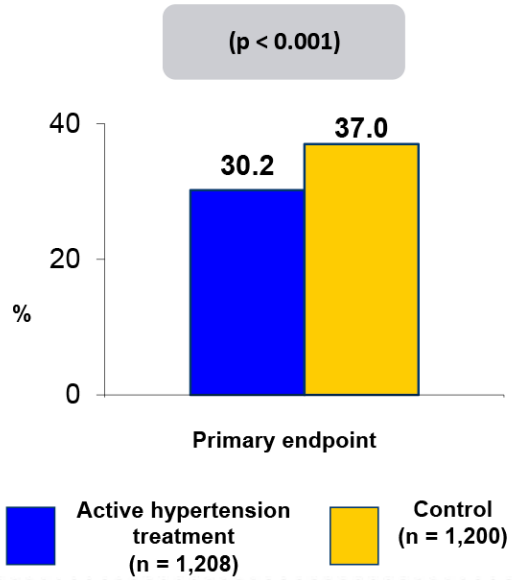
Best Practices to Mitigate Maternal Risk: HTN

CHAP

#ACC22

Trial Description: Pregnant individuals with mild chronic hypertension were randomized in 1:1 fashion to a blood pressure goal of <140/90 vs. control, where antihypertensive therapy was withheld unless blood pressure was ≥160/105 mm Hg.



RESULTS

- Primary outcome, composite of pre-eclampsia with severe features, medically indicated preterm birth at <35 weeks' gestation, placental abruption, or fetal/neonatal death, for active treatment vs. control: 30.2% vs. 37.0% (p < 0.001)
- Safety outcome, small-for-gestational-age birth weight below the 10th percentile for gestational age: 11.2% vs. 10.4% (p = 0.56)
- Pre-eclampsia with severe features: 23.3% vs. 29.1%

CONCLUSIONS

- Antihypertensive therapy improves pregnancy outcomes among pregnant women with mild chronic hypertension
- Treatment of hypertension improved outcomes without increasing risk for low birth weight

Tita AT, et al. *N Engl J Med* 2022;386:1781-92

Developed by Dr. Neil Keshvani in collaboration with the *ACC.org* Editorial Board.

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Best Practices to Mitigate Maternal Risk

- Utilize aspirin 81 mg between weeks 12-36 gestation for those at high risk

- reduction in risk for preterm birth (pooled relative risk [RR], 0.80 [95% CI, 0.67-0.95]; 13 studies; I^2 = 49%)

- reduction in perinatal mortality (pooled RR, 0.79 [95% CI, 0.66-0.96]; 11 studies; I^2 = 0%) in individuals at increased risk for preeclampsia (n = 13 860

- reduction in risk for preeclampsia (pooled RR, 0.85 [95% CI, 0.75-0.95]; 16 studies; I^2 = 0%) with low-dose aspirin use in individuals at increased risk (n = 14 093).

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JAMA. 2021;326(12):1186-1191

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Best Practices to Mitigate Maternal Risk: HTN

Table 1. Clinical Risk Assessment for Preeclampsia[a]

Risk level	Risk factors	Recommendation
High[b]	• History of preeclampsia, especially when accompanied by an adverse outcome • Multifetal gestation • Chronic hypertension • Pregestational type 1 or 2 diabetes • Kidney disease • Autoimmune disease (ie, systemic lupus erythematous, antiphospholipid syndrome) • Combinations of multiple moderate-risk factors	Recommend low-dose aspirin if the patient has ≥1 of these high-risk factors
Moderate[c]	• Nulliparity • Obesity (ie, body mass index >30) • Family history of preeclampsia (ie, mother or sister) • Black persons (due to social, rather than biological, factors)[d] • Lower income[d] • Age 35 years or older • Personal history factors (eg, low birth weight or small for gestational age, previous adverse pregnancy outcome, >10-year pregnancy interval) • In vitro conception	Recommend low-dose aspirin if the patient has ≥2 moderate-risk factors Consider low-dose aspirin if the patient has 1 of these moderate-risk factors
Low	Prior uncomplicated term delivery and absence of risk factors	Do not recommend low-dose aspirin

[a] Includes only risk factors that can be obtained from the patient medical history.

[b] Includes single risk factors that are consistently associated with the greatest risk for preeclampsia. Preeclampsia incidence would likely be at least 8% in a population of pregnant individuals having 1 of these risk factors.

[c] These factors are independently associated with moderate risk for preeclampsia, some more consistently than others. A combination of multiple moderate-risk factors may place a pregnant person at higher risk for preeclampsia.

[d] These factors are associated with increased risk due to environmental, social, and historical inequities shaping health exposures, access to health care, and the unequal distribution of resources, not biological propensities.

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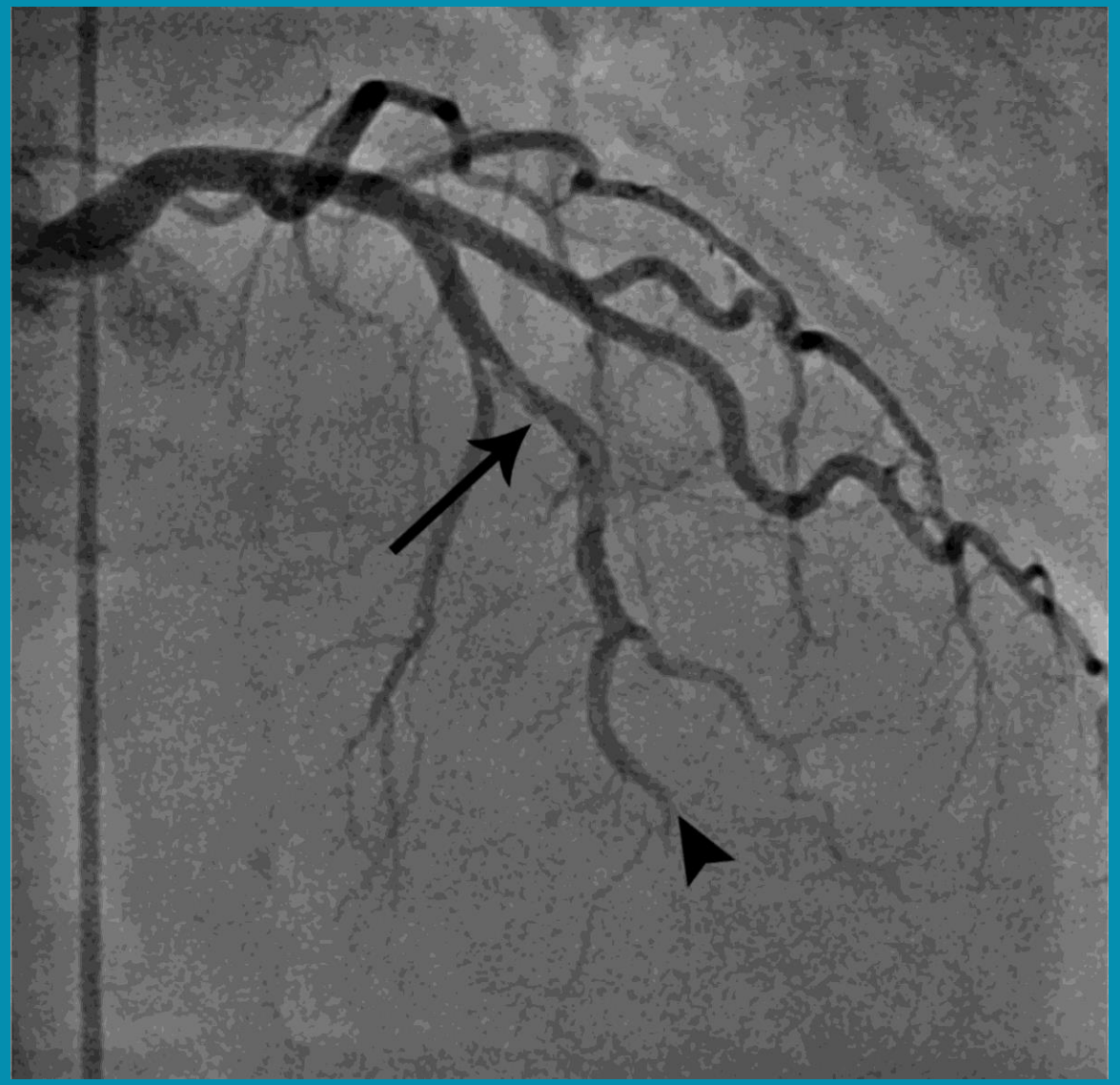
Spontaneous Coronary Artery Dissection (SCAD)



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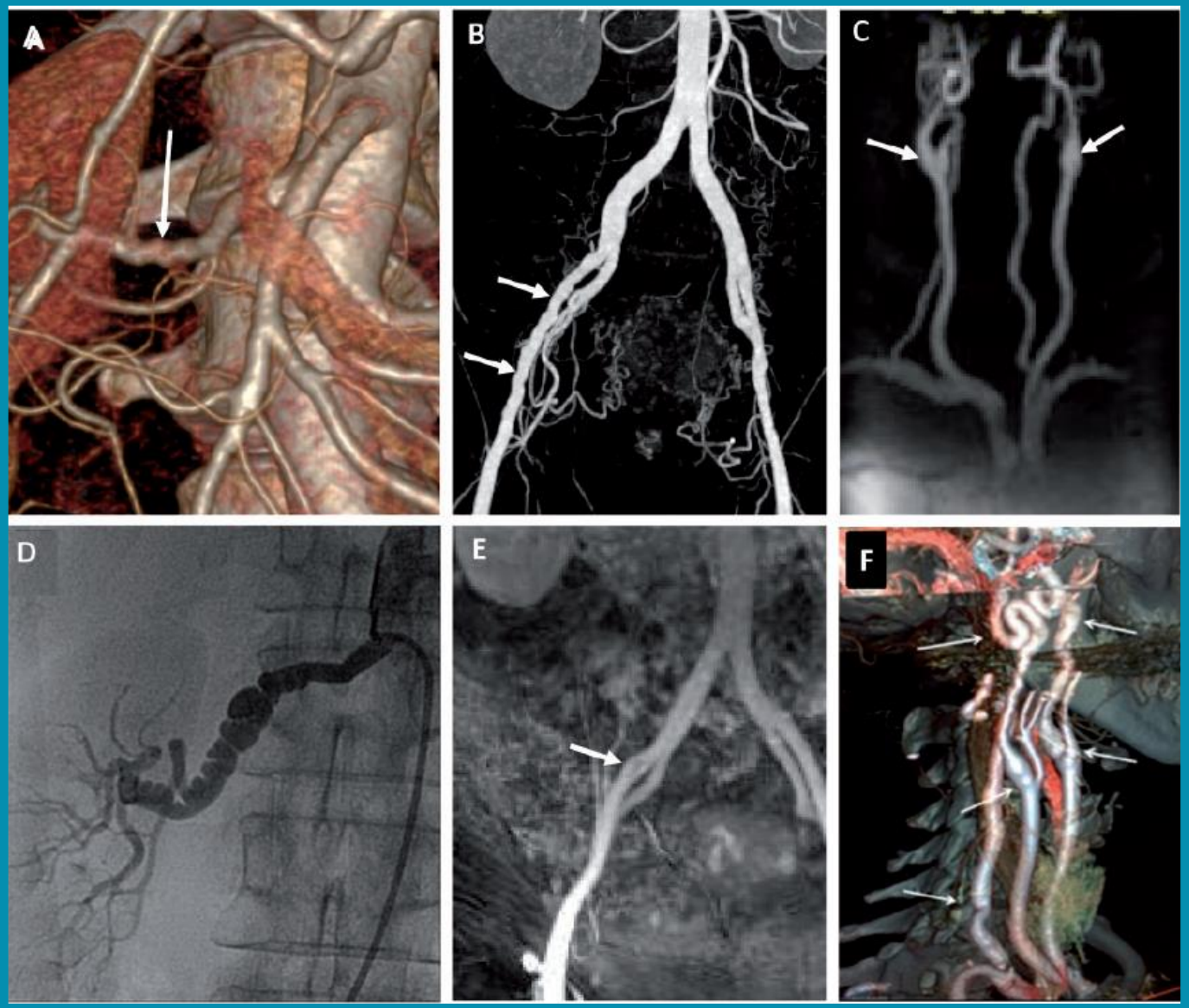
Association with Fibromuscular Dysplasia



European Heart Journal (2018) **39**, 3353–3368

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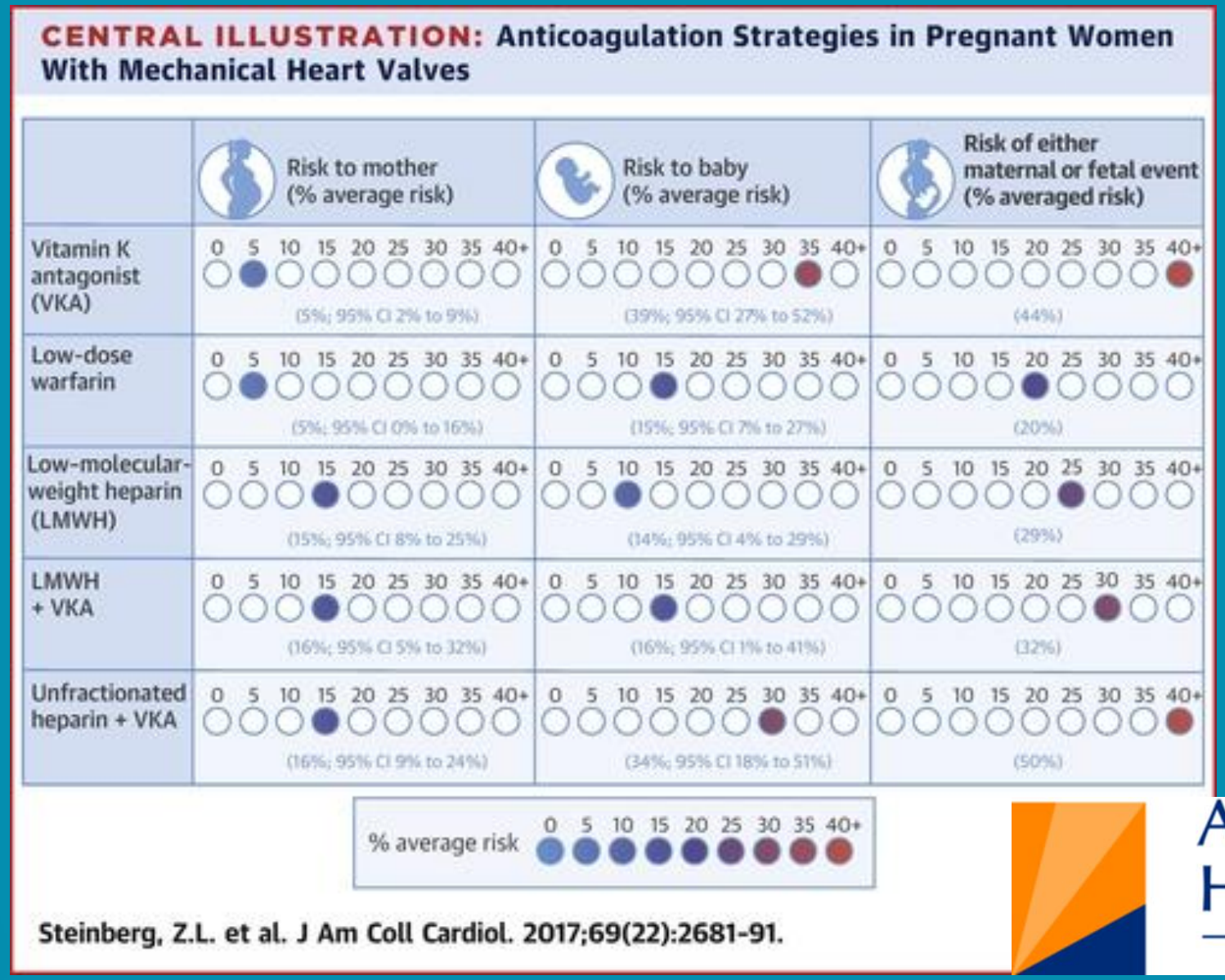
Intrapartum Management
Prosthetic Mechanical Heart Valves



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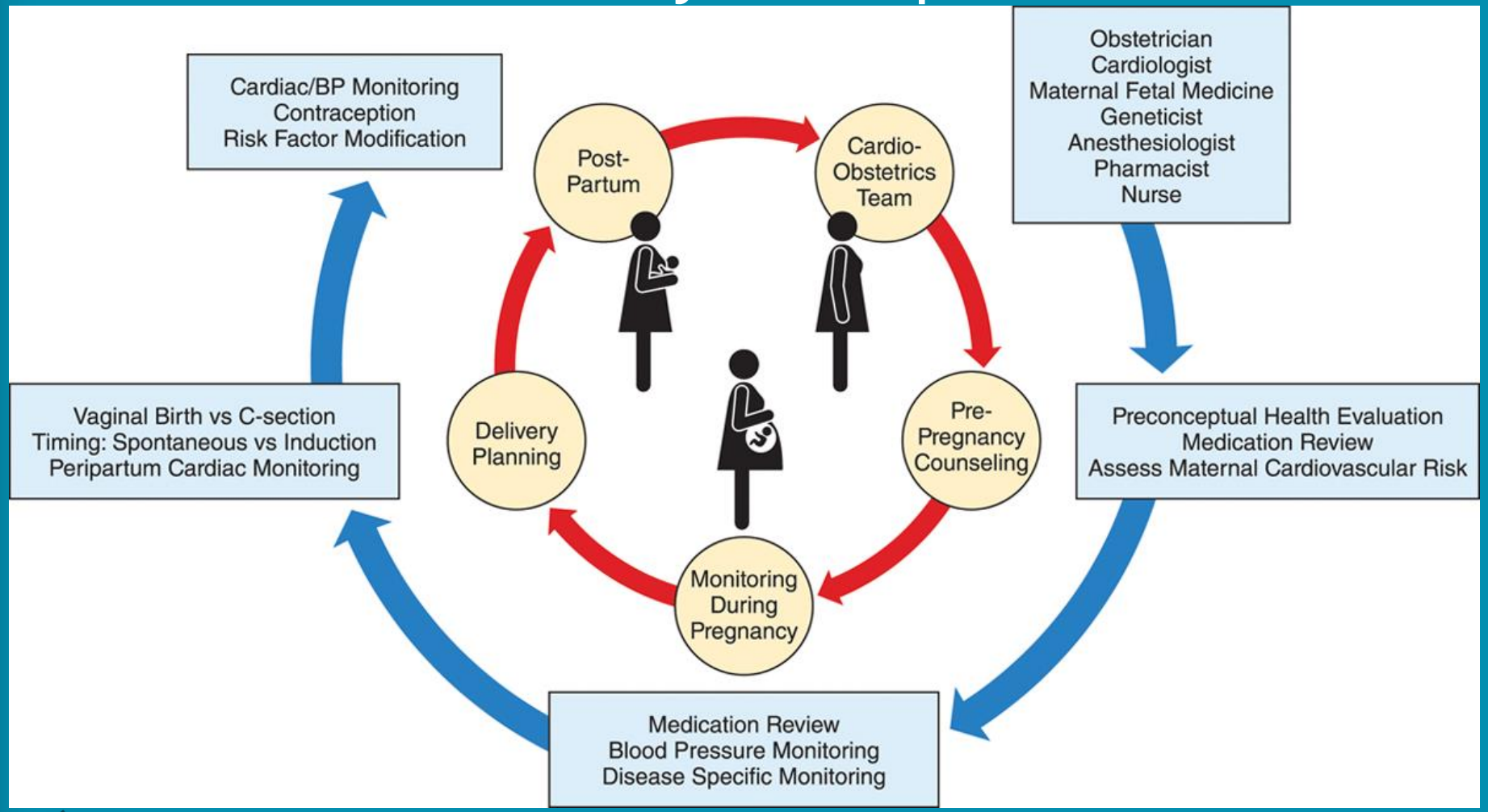
Maternal Mortality Rate: Ways to Improve



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Laxmi S. Mehta. Circulation. Cardiovascular Considerations in Caring for Pregnant Patients: A Scientific Statement From the American Heart Association, Volume: 141, Issue: 23, Pages: e884-e903.

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