Maternal Mortality in Primary Care

Steve Brumfield, MD
Obstetrics & Gynecology
St. Mary's Medical Center

Objectives

- Understand the problem of pregnancy related deaths in the U.S. including societal determinants of health such as race & socioeconomic status.
- List the disease processes that lead to maternal deaths
- Understand how maternal morbidity & mortality are impacted by primary care providers and are not just problems for obstetrics providers
- Increase familiarity with presentation of conditions that lead to maternal mortality
- Understand the initial evaluation and management of conditions that lead to severe morbidity and mortality in during pregnancy and postpartum

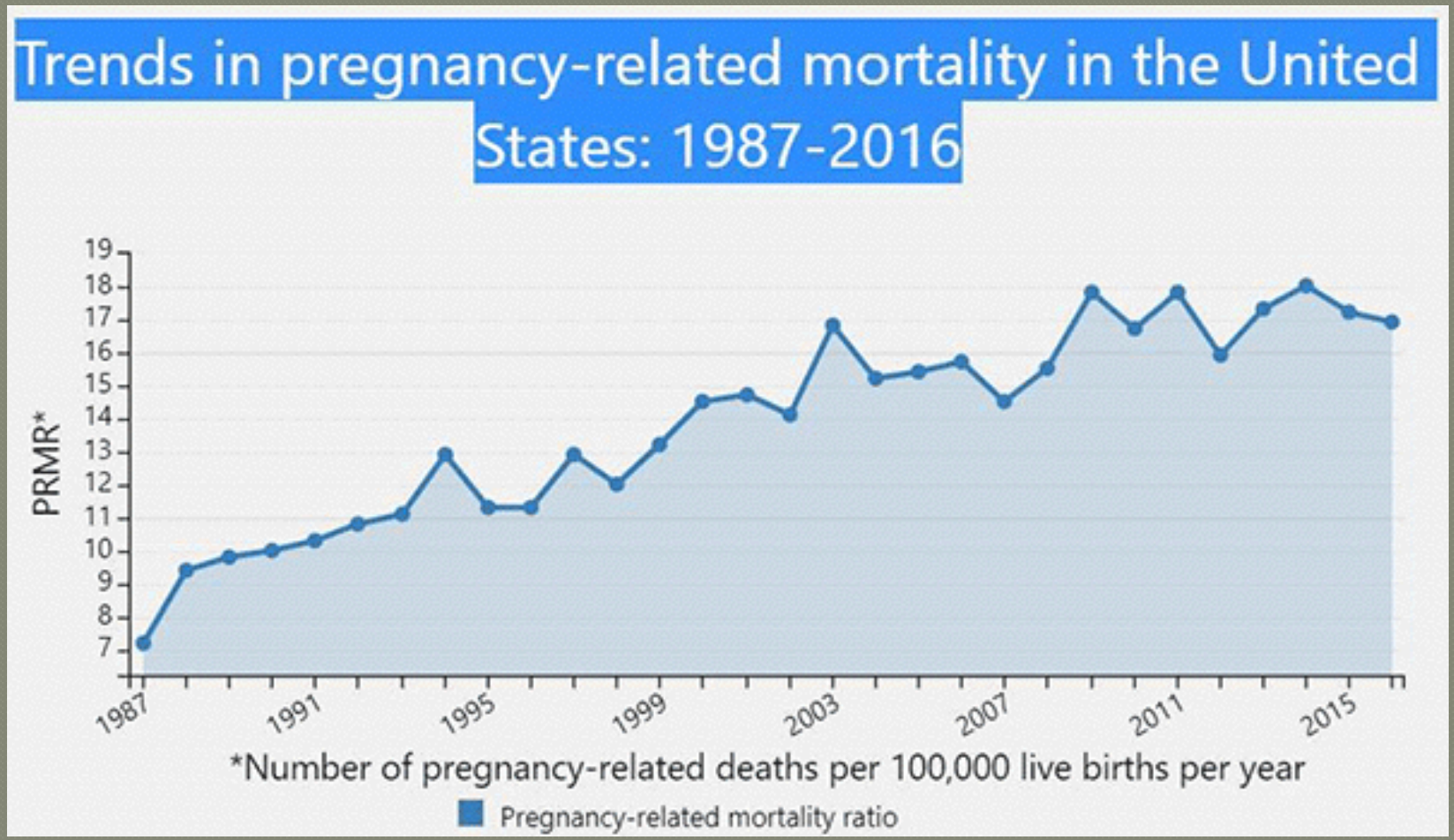
Maternal Mortality

- WHO Definition
  - "The death of a woman while pregnant or within 42 days of termination of pregnancy, irrespective of the duration and the site of the pregnancy, from any cause related to or aggravated by the pregnancy or its management, but not from accidental or incidental causes."
  - CDC extends postpartum period up to 1yr
- Typically reported as ratio per 100K women
- Based on death certificate data
- UN Millennium Development Goal 5a
  - Reduce maternal mortality rate by 75% from 1990 to 2015

Maternal Mortality – The Problem

- In US the maternal death rate has increased by 270%!
  - From 7.8 per 100K women in 1987
  - To 20.1 per 100K women in 2019
- A large part of the increase is improved ascertainment but at least 20% of the increase represents an actual increase in the number of women dying from pregnancy & pregnancy related problems

Maternal Mortality – The Problem



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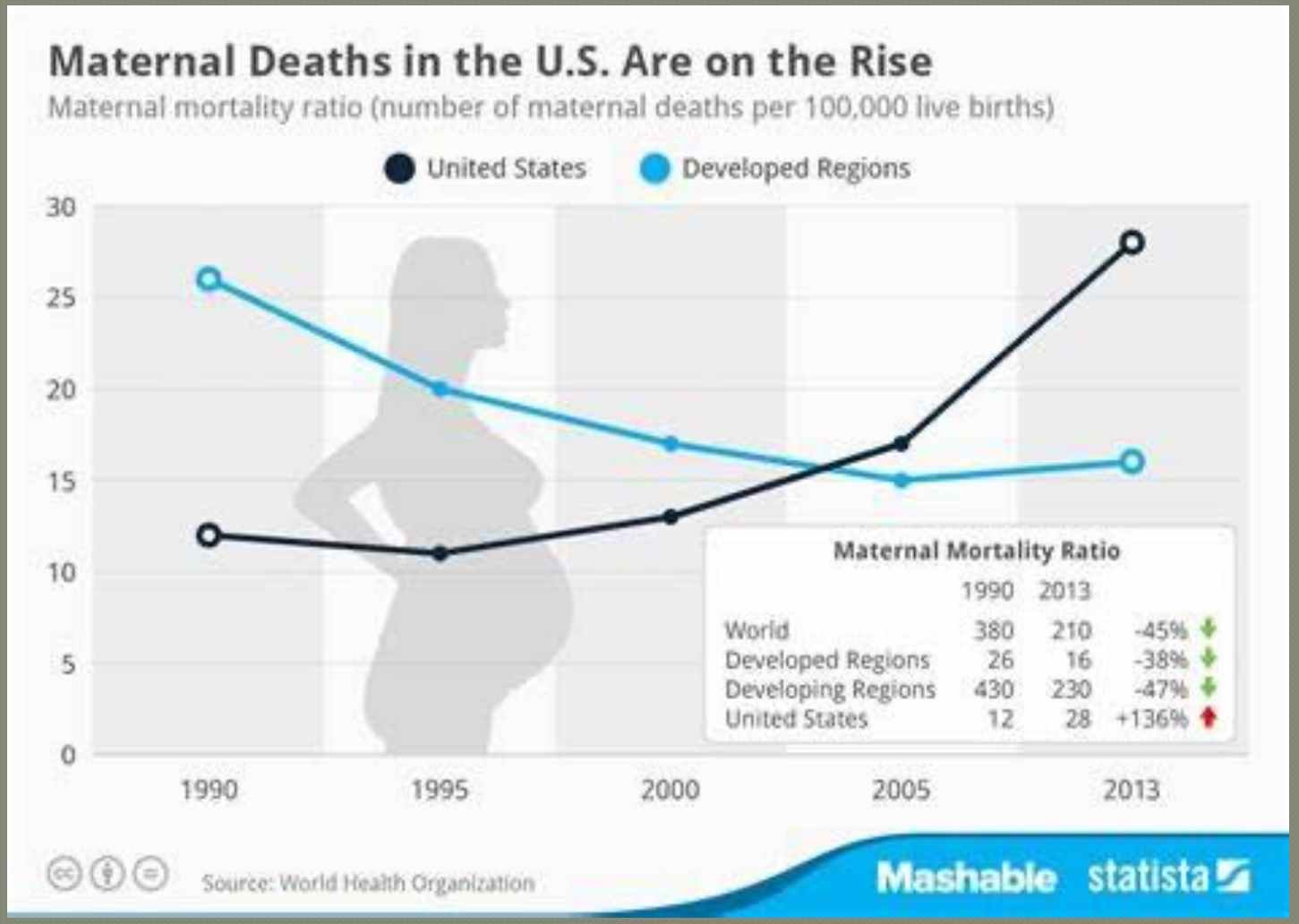

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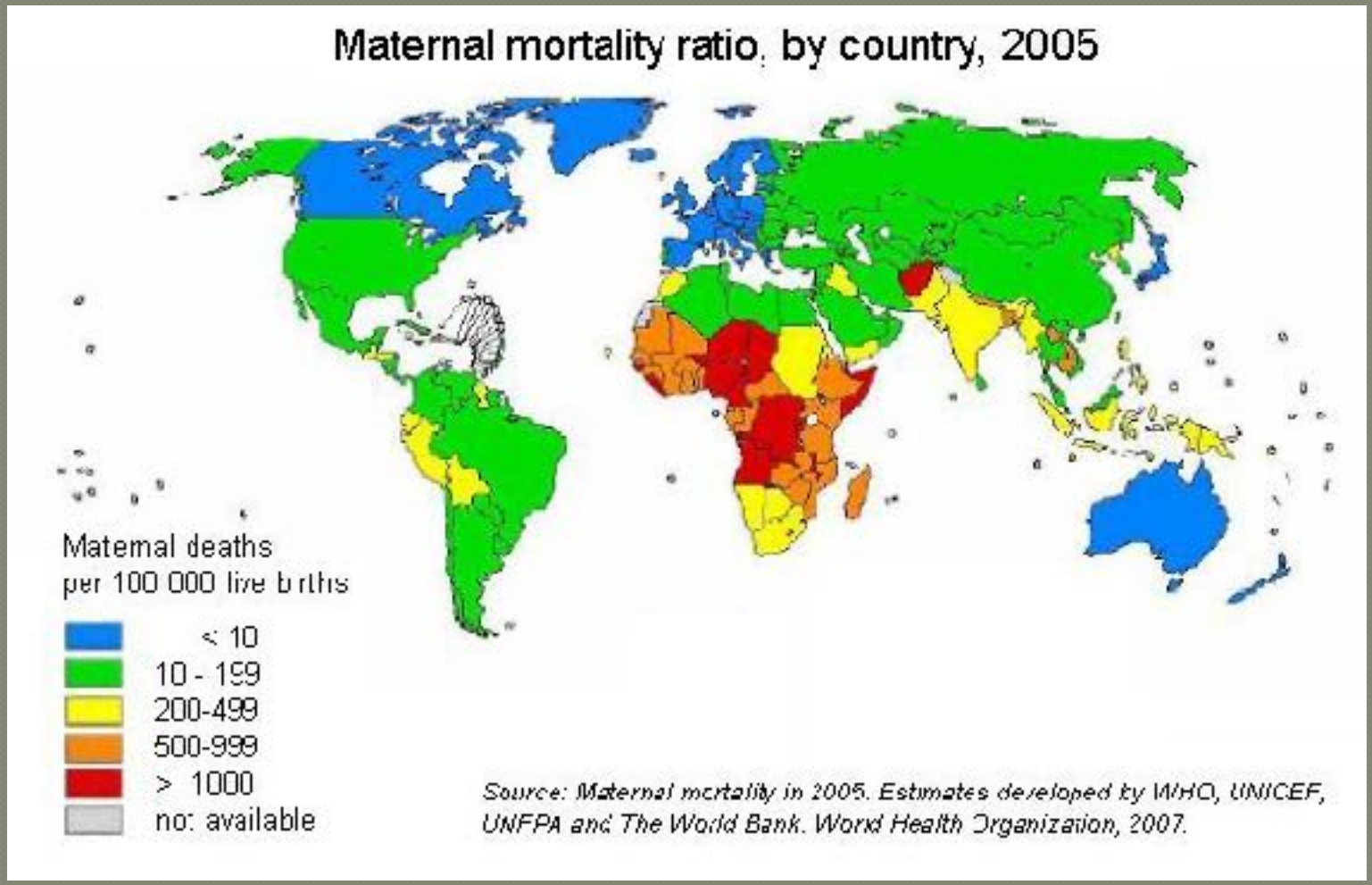

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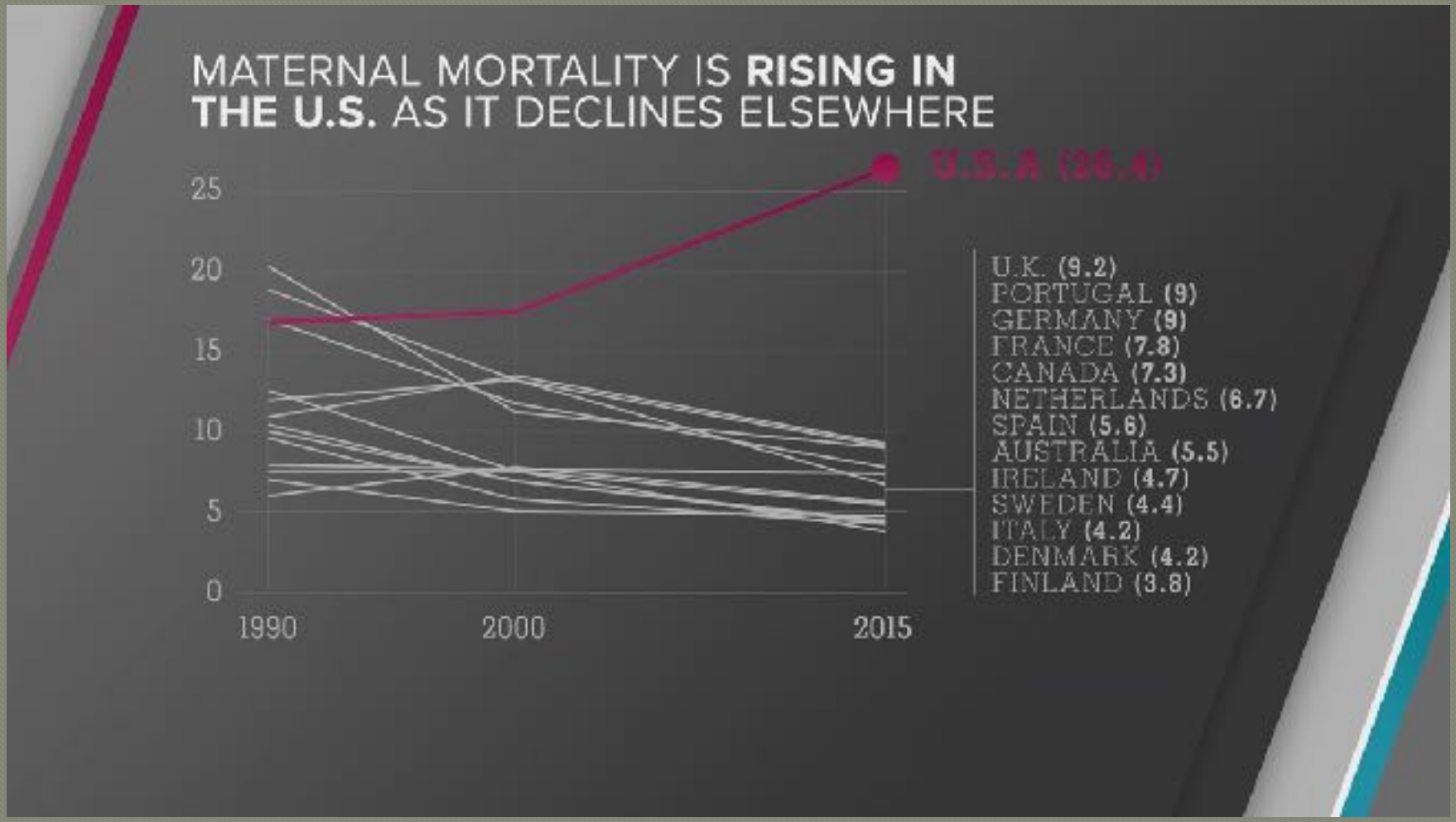
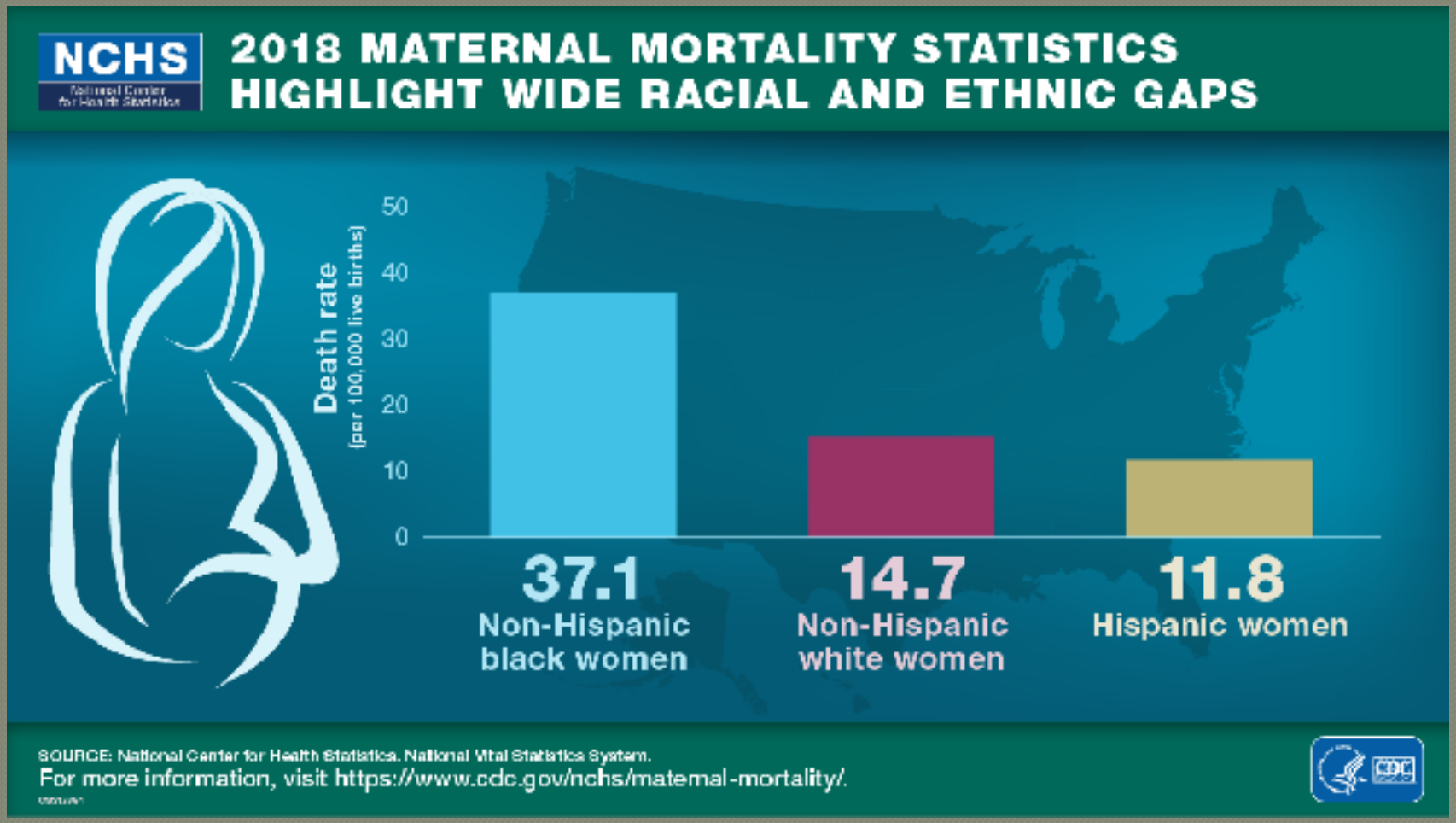
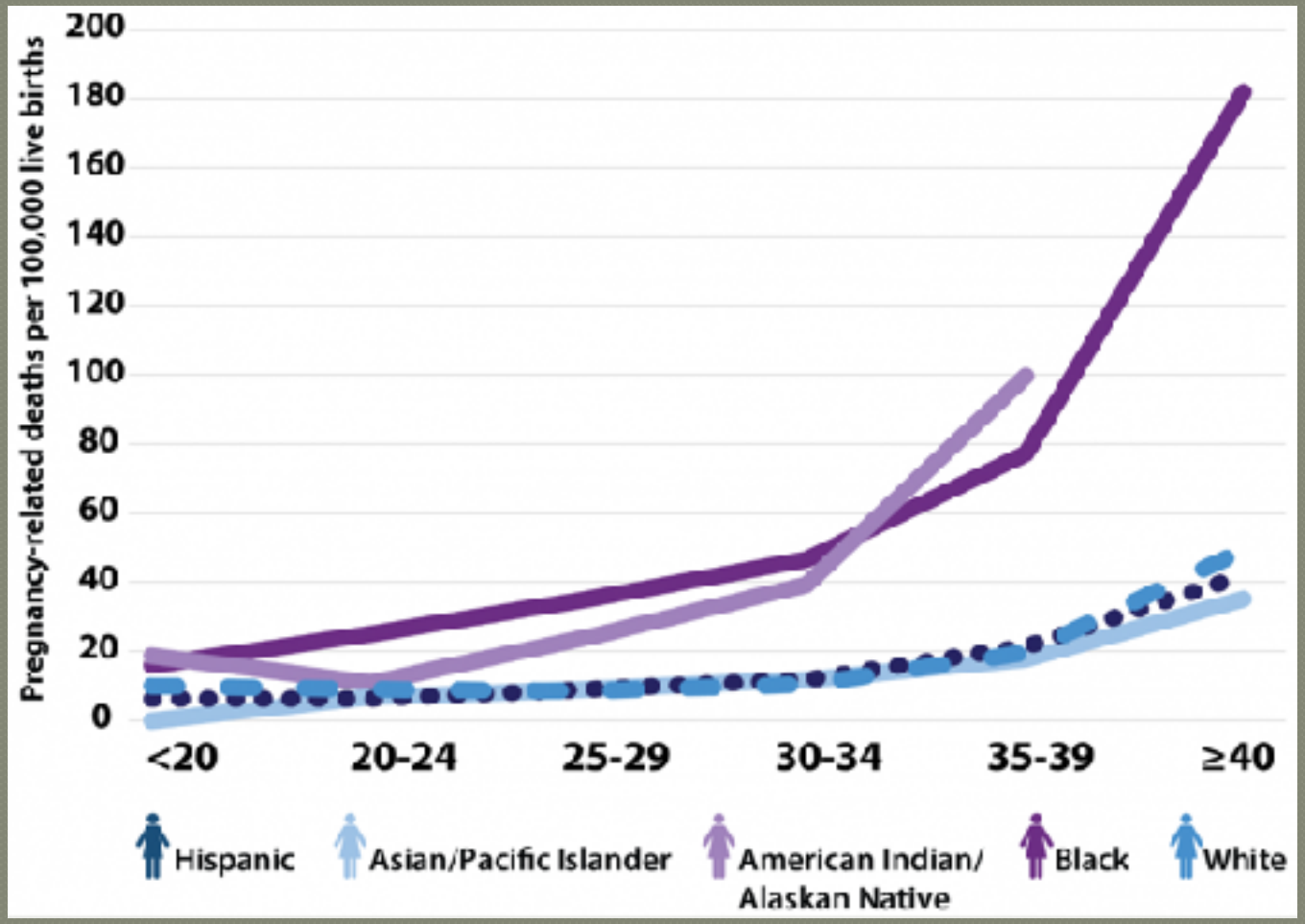


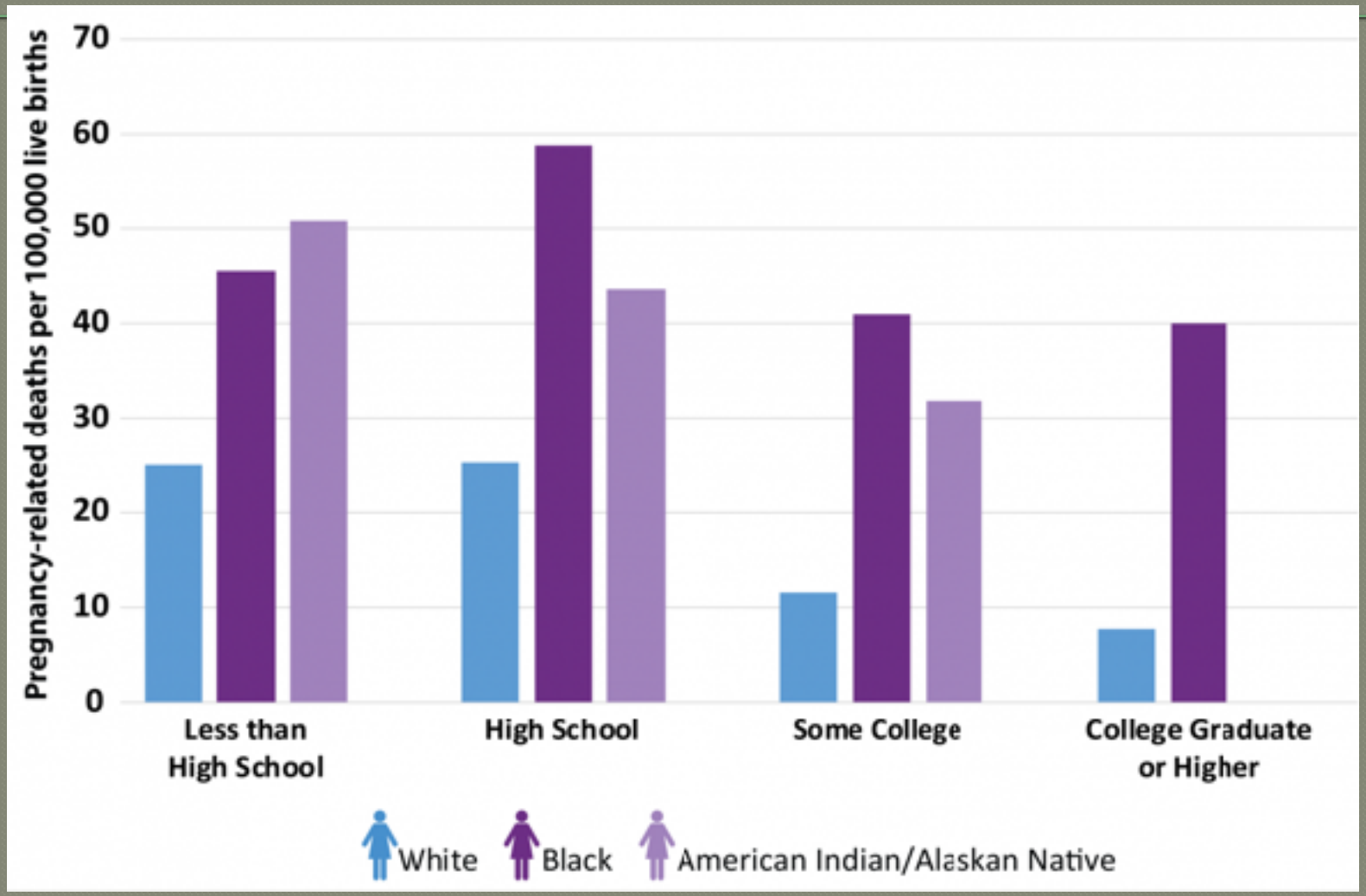
Maternal Mortality – The Race Problem



Maternal Mortality – The Race Problem



Maternal Mortality – The Race Problem



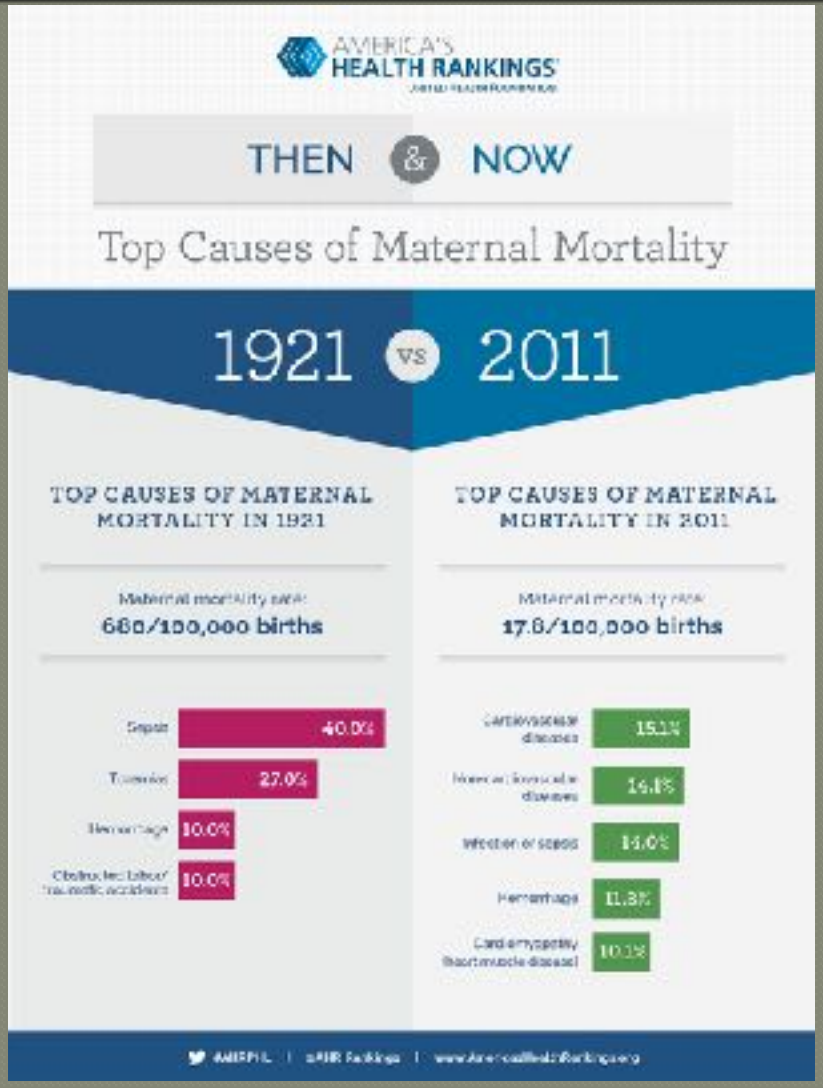
Maternal Mortality – The Race Problem

- Genetics
- Poorer pre-pregnancy health
  - Higher number, more severe co-morbidities
- Less access to nutritious foods
- Less trust in healthcare system
- Lack of access to appropriate care
- Lack of understanding among HCP of culture & biological differences
- Concerns not addressed/dismissed by HCP
- Effect of societal racism and/or implicit bias in HCP
- Lower socioeconomic status

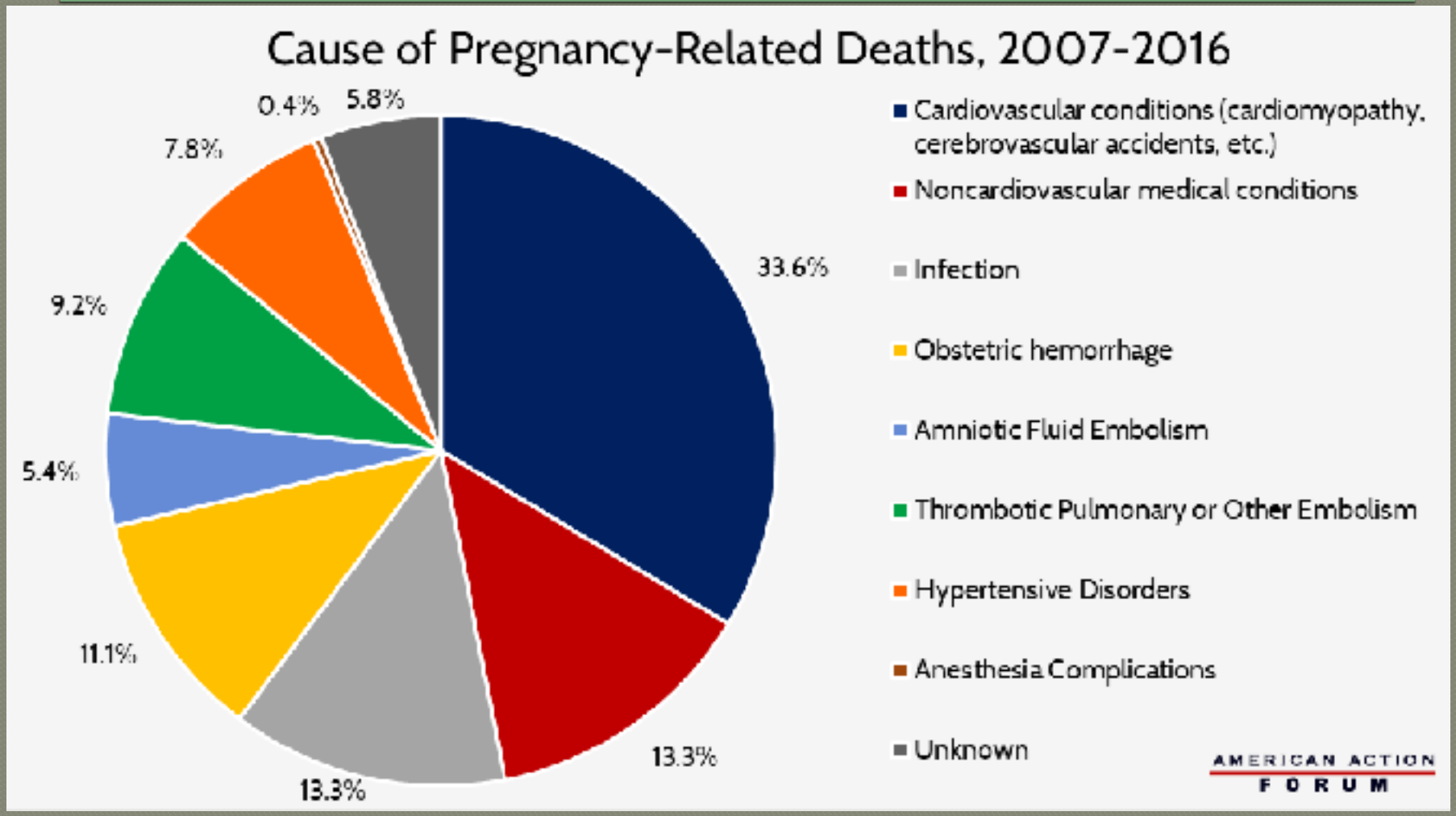
Maternal Mortality – Other Risk Factors & Considerations

- Increasing age
- Obesity
- Substance abuse
- Mental health disorders
- Other medical co-morbidities
- Other barriers to good health
  - Low socio-economic status
  - Homelessness
  - Incarceration

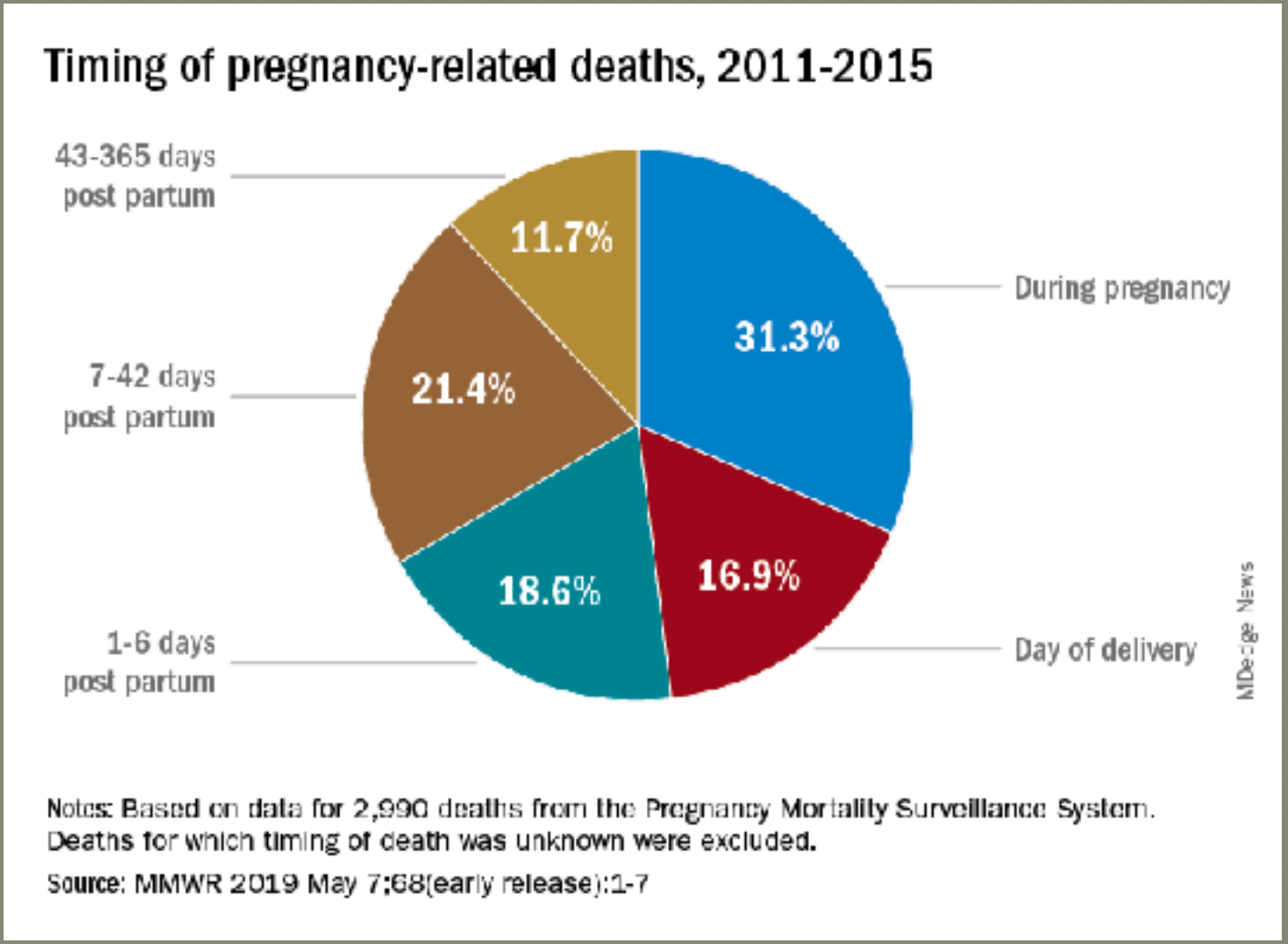
Maternal Mortality - Causes



Maternal Mortality - Causes



Maternal Mortality - Timing



Maternal Mortality – Timing & Etiology

- During pregnancy
  - Infection/Sepsis, CVD, CVA, VTE, COVID-19
- On day of delivery
  - Hemorrhage, Amniotic fluid embolus (AFE), PIH
- Within one week of delivery
  - PIH, Hemorrhage, Sepsis/Infection, CVA, CVD, VTE
- One week to 6wks after delivery
  - PIH, CVD, Infection/Sepsis, thromboembilism, cardiomyopathy, COVID-19
- 6wks to 1yr after delivery
  - Cardiomyopathy, CVD, COVID-19, VTE

Maternal Mortality – General Principles

- Must have a high index of suspicion for conditions with high rates of morbidity & mortality
- Early consultation with obstetrics providers
- Optimize health prior to pregnancy
  - **Consider every non-acute visit with reproductive age female as a pre-conceptual visit**
- **Avoid the "twin devils" of maternal mortality**
  - **DENIAL**
  - **DELAY**

Maternal Mortality – Good News or Bad???

- Review of maternal deaths show that most were preventable
  - Patient non-compliance
  - Patient not seeking care
  - HCP delay diagnosis or intervention

Maternal Mortality – Infection & Sepsis

- Accounts for 13-14% of maternal deaths
- Common cause at all stages of pregnancy / PP but source / type of infection differs
- **Avoid DELAY!!**
  - Mortality rate for sepsis in pregnancy / puerperium is 8% if antibiotics are initiated within 1hr
  - Mortality rate if antibiotics are initiated >1hr from diagnosis is 20%
- Management of sepsis / septic shock is generally the same as in non-pregnant patient
  - With modifications only for altered physiology of pregnancy

Maternal Mortality – Infection & Sepsis Before Delivery

- Septic abortion
  - Induced or spontaneous
  - Typical signs of infection
    - Fever, elevated WBC, elevated lactic acid, etc.
  - Uterine tenderness
  - Possible purulent discharge
  - Perforation of uterus during curettage can even result in peritonitis
  - Treatment
    - Antibiotics with polymicrobial, anaerobic coverage
    - Consult with OB to empty uterus ASAP

Maternal Mortality – Infection & Sepsis Before Delivery

- Pyelonephritis
  - Presents as typical with fever, vomiting, back pain, abnormal UA
  - Admit
    - Predilection for ARDS, bacteremia / sepsis
  - Antibiotics
    - Cephalosporin, aminoglycoside
- Intra-amniotic infection
  - Presents with fever, tachycardia, elevated WBC, elevated fetal HR, uterine tenderness
  - Admit & deliver
  - Antibiotics with polymicrobial & anaerobic coverage
  - Any pregnant woman at or near term experiencing fever without obvious cause has IAI until proven otherwise

Maternal Mortality – Infection & Sepsis Before Delivery

- Pneumonia
  - Typical presentation
  - Beware of cardiomyopathy / failure masquerading as “double pneumonia” on CXR
  - Streptococcus most common bacterial isolate
  - Influenza is a major cause
    - Tamiflu at diagnosis
    - Vaccinate, vaccinate, vaccinate!!
  - **COVID-19**

Maternal Mortality – COVID

- No significant increased risk of infection with COVID in pregnancy
- Definite worsening of clinical course of COVID during pregnancy
  - Pre-eclampsia (RR = 1.76)
  - ICU Admission (RR = 5.04)
  - Assisted ventilation (RR = 3)
  - Maternal Mortality ***(RR = 22.3)***
  - Possible preterm birth & cesarean section
- Even greater risk in those with co-morbidities (DM, obesity, CVD, SCD, etc)

Maternal Mortality – COVID

- Prevention is key!!!
  - VACCINATION!!!
    - ACOG, CDC & SMFM all recommend ALL pregnant women receive COVID vaccination
    - Do they work?
      - At least 78% reduction in any COVID infection
      - Generally, similar efficacy to those non-pregnant but data is limited.
      - Even higher reduction in severe COVID infection
    - Can give in any trimester…the sooner the better!
    - Administer other vaccines (e.g., TDAP, Flu) without regard to timing of COVID vaccines
    - Can receive booster as per routine schedule

Maternal Mortality – COVID

- But are COVID vaccines safe in pregnancy?
  - No increased risk for adverse pregnancy or neonatal outcomes
    - Growth restriction, stillbirth, preterm birth, neonatal morbidity/mortality, or congenital anomalies
    - Includes 139K pregnant patients in CDC V-Safe Reg
    - Risk of miscarriage in vaccinated women was similar to that of non-vaccinated women (12.8%)
  - No virus in vaccines so no risk of acquiring COVID from vaccines.
  - THERE IS NO RISK FOR INFERTILITY OR MISCARRIAGE

Maternal Mortality – COVID

- Management
  - Most pregnant women will still have mild self-limited disease
  - Recommend home monitoring of temperature, symptoms & oxygen saturation if possible
    - Hydration, acetaminophen, rest, regular ambulation
    - Come to hospital for evaluation if:
      - SaO2 <95%
      - Persistent fever despite acetaminophen
      - Dyspnea / dyspnea on exertion
      - Signs/symptoms of VTE
      - Inability to tolerate oral intake
      - Chest pain

Maternal Mortality – COVID

- Can receive monoclonal antibody infusion
  - Is pregnancy enough risk for progression to severe disease to warrant infusion?
- VTE prophylaxis
  - Heparin or LMWH for hospitalized or higher risk patients….maybe for all??
  - At least low dose ASA & frequent ambulation

Maternal Mortality – COVID

- Hospitalization
  - For dyspnea and/or SaO2 <95%
  - Evidence of VTE
  - Inability to tolerate oral intake & meds / dehydration
- Management is SAME AS NON-PREGNANT WOMEN
  - "No diagnostic or treatment modality is off the table."
  - Remdesivir is fine if criteria is met
  - Dexamethasone
  - Supplement oxygen / assisted ventilation
  - Anticoagulation
  - Radiologic studies as needed w/ shielding
- Consult with OB for surveillance for / management of fetal & pregnancy issues

Maternal Mortality – Infection & Sepsis in Labor & Delivery

- Most common cause during labor is intra-amniotic infection
- Postpartum
  - Check "The Five W's"
    - Wind (atelectasis, pneumonia, influenza, COVID, etc)
    - Water (urinary tract infection)
    - Womb (endomyometritis is most common etiology)
    - Wound
    - "Watermelons" (acute mastitis)

Maternal Mortality - Hemorrhage

- Deaths from hemorrhage are decreasing due to
  - Standardized approaches ("bundles") & drills
  - Quantifying blood loss
  - Improved recognition of abnormal placentation
- Delayed Postpartum Hemorrhage
  - Complicates up to 2.5% of deliveries in developed countries
  - Can occur as late as 6-12 wks postpartum

Maternal Mortality - Hemorrhage

- Delayed Postpartum Hemorrhage
  - Causes:
    - Retained placenta
    - Infection
    - Subinvolution of placental bed
    - Hematoma
    - Rare causes:
      - Pseudoaneurysm
      - Spontaneous bleeding diathesis
      - Cancer (cervical, choriocarcinoma)
      - Menorrhagia with resumption of menses
      - Cesarean wound disruption

Maternal Mortality - Hemorrhage

- Evaluation & management of delayed PPH
  - Evaluate hemodynamic status clinically
  - **AVOID DENIAL / DELAY**
  - CBC, PT/PTT/INR, fibrinogen, type & cross
  - Evaluate for retained placenta with ultrasound
    - Treat this ASAP
  - Uterotonic agents if no retained placenta
    - Misoprostol, oxytocin, methylergonovine, carboprost
  - Tranexamic acid parenterally
  - Transfuse proactively

Maternal Mortality – Amniotic Fluid Embolus

- Highly feared condition that probably involves bolus of amniotic fluid entering maternal circulation
- Mortality rate >50%
- Sudden, rapidly progressive cardiopulmonary collapse followed by DIC
- Rare event occurring in 2-6 / 100K deliveries
- Treatment is supportive
  - Aggressive transfusion including FFP, cryoprecipitate
  - Cardiorespiratory support with pressors, assisted ventilation
  - Tranexamic acid to decrease bleeding
  - Ketorolac, ondansetron, atropine
  - Pray!

Maternal Mortality - Thromboembolism

- Occurs at all stages of pregnancy & postpartum
- Prevalence is 1 in 500-2000 pregnancies but is 7th most common cause of pregnancy related death accounting for 9% of these.
- Pregnancy is well known risk factor for VTE & other risk factors magnify this risk
  - Travel
  - Thrombophilia
  - Obesity
  - Smoking
  - Varicosities
  - Prolonged hospitalization
- Most common in postpartum period & left sided

Maternal Mortality - Thromboembolism

- Typical physiologic changes of pregnancy can mimic some signs & symptoms of VTE
  - Edema in lower extremities
  - Mild dyspnea / dyspnea on exertion
  - Tachycardia
- Have high index of suspicion & **avoid DENIAL & DELAY**
- D-Dimer increases during pregnancy & then declines postpartum
  - Positive predictive value is poor
  - Negative predictive value remains good

Maternal Mortality - Thromboembolism

- Diagnosis is essentially same as non-pregnant patient
  - Compression ultrasonography for DVT
  - Chest CT for suspected PE
    - **Do not DELAY this due to concern for radiation exposure**
    - Shield abdomen
- Treatment
  - Anticoagulation
    - Use heparin or LMWH
    - Avoid warfarin
    - Little / no data on use of apixaban (Eliquis) or rivaroxaban (Xarelto) in pregnancy
  - Supportive

Maternal Mortality – Pregnancy Induced Hypertension (PIH)

- PIH associated deaths have decreased due to
  - Standardized, evidence based management "bundles" & drills
  - More aggressive use of antihypertensive meds
  - Regular use of magnesium sulfate for seizure prophylaxis
- Yet PIH still accounts for 7-8% of maternal deaths
- Diagnosis based on SBP $\geq$140 and/or DBP $\geq$90
  - With or without proteinuria
- **Do not DELAY diagnosis because she has already delivered!!**

Maternal Mortality – Pregnancy Induced Hypertension (PIH)

- Severe PIH is SBP $\geq$165 and/or DBP $\geq$110
- Patients often present with other symptoms & are found to have hypertension
  - Headache
  - Visual changes
  - Dyspnea
  - RUQ / epigastric pain
- In a pregnant or postpartum patient ALWAYS assume that headache, upper abdominal pain is caused by hypertension
  - **Avoid the DENIAL that pain has caused the high BP**

Maternal Mortality – Pregnancy Induced Hypertension (PIH)

- Why do women die from PIH??
  - Eclampsia with cerebrovascular complications, aspiration
  - Hypertensive complications
    - Hemorrhagic stroke
    - Aortic dissection
    - Placental abruption with DIC
  - Coagulopathy
    - DIC
    - Thrombocytopenia
  - End organ problems
    - Liver failure / rupture
    - Renal failure
    - Pulmonary edema

Maternal Mortality – Pregnancy Induced Hypertension (PIH)

- Initial evaluation
  - Patient presents with high BP and/or PIH related symptom
  - CBC, CMP, uric acid, urinalysis, urine protein to creatinine ratio
    - Need platelet count, LDH & LFT's to rule out HELLP syndrome
      - Hemolysis, Elevated Liver (enzymes), Low Platelets
    - Evaluate renal function
    - P/C ratio helps diagnosis pre-eclampsia
      - Positive if >0.3
      - Do not discount PIH if this is not elevated.

Maternal Mortality – Pregnancy Induced Hypertension (PIH)

- Initial Management
  - Antihypertensive therapy
    - **Initiate parenteral antihypertensive therapy for SBP > 165 and/or DBP > 110 without DELAY**
    - Continue giving escalating doses until SBP < 165 AND DBP <110.
  - Magnesium sulfate seizure prophylaxis / treatment
    - Generally avoid other anticonvulsants as these are less effective
    - Start 4-6g IV load then 2g/hr
  - Early consultation with OB
  - Replace volume as need but avoid fluid overload

Acute Treatment of Severe Hypertension in Pregnancy

Table 3. Antihypertensive Agents Used for Urgent Blood Pressure Control in Pregnancy

Drug	Dose	Comments	Onset of Action
Labetalol	10–20 mg IV, then 20–80 mg every 10–30 minutes to a maximum cumulative dosage of 300 mg; or constant infusion 1–2 mg/min IV	Tachycardia is less common with fewer adverse effects. Avoid in women with asthma, preexisting myocardial disease, decompensated cardiac function, and heart block and bradycardia.	1–2 minutes
Hydralazine	5 mg IV or IM, then 5–10 mg IV every 20–40 minutes to a maximum cumulative dosage of 20 mg; or constant infusion of 0.5–10 mg/hr	Higher or frequent dosage associated with maternal hypotension, headaches, and abnormal fetal heart rate tracings; may be more common than other agents.	10–20 minutes
Nifedipine (immediate release)	10–20 mg orally, repeat in 20 minutes if needed; then 10–20 mg every 2–6 hours; maximum daily dose is 180 mg	May observe reflex tachycardia and headaches	5–10 minutes

Abbreviations: IM, intramuscularly; IV, intravenously.

Maternal Mortality – Cardiovascular Disease

- As a group, CV diseases now are the leading cause of maternal death, mostly from acquired heart disease
  - Congenital heart disease
  - Myocardial infarction
  - Cardiomyopathy
    - **Causes most maternal deaths of any single condition**
  - Heart failure
  - Aortic dissection
  - Arrythmia

Maternal Mortality – Cardiovascular Disease

- Four key risk factors
  - Black race
    - 3.4 times higher risk of dying from CVD as compared to white & Hispanic mothers
  - Hypertension
    - Chronic / essential or PIH
    - 13 times higher risk for MI & 8 times higher risk for heart failure
  - Age
    - Women over 40 have a 30 times higher risk of maternal cardiac related death than a 20yo
  - Obesity
    - Particularly if associated with sleep apnea

Maternal Mortality – Cardiovascular Disease

- Pregnancy is a "natural stress test"
  - Cardiac output increases markedly throughout gestation
    - Up to 50% increase by term & does not return to normal until 3-6 mos after delivery
  - Heart rate increases
    - 20% increase above baseline by term
  - Blood pressure is dynamic throughout pregnancy
    - Decreases in late 1st & throughout 2nd trimesters
    - Increases in 3rd trimester
  - Plasma volume increases by as much as 50%

Maternal Mortality – Cardiovascular Disease

- Optimize before pregnancy
  - Evaluate cardiac status in women seeking pregnancy
  - Optimize cardiac status in those with known disease and/or hypertension
  - Get consultation prior to pregnancy with OB, maternal fetal medicine specialist, cardiology
  - **Special attention to those with h/o congenital HD and/or pulmonary hypertension**
  - Stop / change teratogenic, dangerous meds
    - Warfarin
    - ACE Inhibitors

Maternal Mortality – Cardiovascular Disease

- Presentation
  - **Avoid DELAY** caused by signs/symptoms of CVD mimicking typical signs/symptoms of pregnancy
  - Typical symptoms are edema, dyspnea / DOE, chest pain, palpitations, fatigue
  - Elevated BP is never "normal"
- Early recognition could have prevented 88% of CV-related maternal deaths!

Maternal Mortality – Cardiovascular Disease

- Initial Evaluation
  - H&P with high index of suspicion, evaluation of risk factors
  - EKG
    - Expect non-pathologic abnormalities such as "non-specific T wave & ST abnormalities"
  - Chest X-ray
    - Do not **DELAY** this due to concern for radiation
    - Shield abdomen if necessary
  - Echocardiogram
    - **WITHOUT DELAY** for those with pathologic edema, dyspnea, orthopnea, or findings suggestive of pulmonary edema

Maternal Mortality – Cardiovascular Disease

- Initial Evaluation – Labs
  - BNP
    - Increase 2x in pregnant women with further increase postpartum, but usually stay within the normal range
    - Can be elevated with pre-eclampsia
    - Remains sensitive & specific marker for failure
    - Concern with level > 100-110
  - Troponin
    - Mildly increased postpartum & with severe PIH
    - Remains gold standard for ACS/cardiac ischemia
  - D-Dimer
    - Not very helpful due to variations with pregnancy & not recommended

Maternal Mortality – Cardiovascular Disease

- Pulmonary Hypertension
  - Very high risk during pregnancy
  - Echocardiogram for anyone at risk, with suggestive symptoms or with known PHTN
    - Cardiac catheterization can be done if needed
  - Generally, pregnancy should be avoided in those with PHTN
    - Provide or consult with OBG for effective contraception
  - Medical therapy is mainstay of treatment

Maternal Mortality – Cardiovascular Disease

- Congenital heart disease
  - More women with h/o CHD are living to reproductive age
  - High risk abnormalities should avoid pregnancy
    - PHTN
    - Severe left sided obstruction or ventricular dysfunction
    - Cyanosis
    - Associated with complex arrhythmias
  - Consult with cardiology specialist on adult CHD
  - Consult with maternal fetal medicine specialist

Maternal Mortality – Cardiovascular Disease

- Noncongenital valvular disease
  - Rheumatic valvular disease
  - Mitral valve prolapse, Aortic stenosis
  - Bioprosthetic valve
  - Valvular disease related to infective endocarditis
- Evaluation
  - Symptoms
  - Echocardiogram
    - Assess severity & for ventricular dysfunction, PHTN
- Consult with cardiology and/or MFM

Maternal Mortality – Cardiovascular Disease

- Mechanical valvular prosthesis
  - Echocardiogram
    - Assess function, severity, LV function & PHTN
  - Anticoagulation
    - Usually with LMWH
      - Do not use warfarin, rivaroxaban, apixaban
    - Always start low dose aspirin
  - Consultation with cardiology and/or MFM
  - Will need endocarditis prophylaxis

Maternal Mortality – Cardiovascular Disease

- Dilated cardiomyopathy
  - Very high risk of major CV event during pregnancy
    - 25-40%
    - Mainly CHF
  - Avoid pregnancy if EF (<30%) is low, class III or IV heart failure
  - Echocardiogram
    - Assess EF, hemodynamics
  - Consultation with cardiology and MFM.
  - Medical management as indicated.

Maternal Mortality – Cardiovascular Disease

- Hypertrophic cardiomyopathy
  - Most common genetic cardiac disease
    - Prevalence about 2%
  - Likelihood of serious cardiac event in pregnancy is increased
    - Strongest predictor is pre-pregnancy status
  - Echocardiogram
  - Consult with genetics, cardiology & MFM

Maternal Mortality – Cardiovascular Disease

- Aortic aneurysm & dissection
  - Most commonly genetic in reproductive age women & most involve ascending aorta
    - Ehlers-Danlos
    - Marfan syndrome
  - Those with vascular Ehlers-Danlos should avoid pregnancy
    - No aortic root size guarantees safe outcome in pregnancy
  - Evaluate with echocardiogram, CT/MRI
  - Consult with cardiology, genetics & MFM

Maternal Mortality – Cardiovascular Disease

- Arrythmia / Dysrhythmia
  - Benign dysrhythmia such as PAC's or PVC's are common during pregnancy
  - Women with complaints consistent with dysrhythmia should be evaluated to determine cause
    - EKG / Holter monitor
    - Echocardiogram
    - Labs: TSH, CBC, electrolytes
  - Prolonged QT syndrome puts woman at risk for ventricular tachycardia, especially postpartum
    - Management with beta blocker
    - Concern with ondansetronalong with torsades de pointe
  - More serious dysrhythmias are usually related to structural heart disease and should prompt evaluation for such
  - Manage acute or prolonged dysrhythmia same as non-pregnant patient
    - Do not **DELAY** acute intervention such as adenosine for PSVT or cardioversion due to pregnancy or for evaluation of fetal status.
  - Consult with cardiology, EP, and MFM

Maternal Mortality – Cardiovascular Disease

- Cardiac ischemia / ACS / MI
  - Uncommon but serious
  - Pregnant & especially recent postpartum (2wks to 2mos) women are at 3-4x risk of non-pregnant cohorts
  - Coronary artery dissection most common cause of ACS
    - Requires coronary angiography for diagnosis
  - Risk factors
    - Older maternal age
    - Black race
    - Pregnancy induced hypertension
    - Recent blood transfusion
    - Typical cardiac risk factors
      - Obesity, smoking, family history, hyperlipidemia, DM
  - Evaluation & management same as non-pregnant women

Maternal Mortality – Cardiovascular Disease

- Peripartum / Postpartum Cardiomyopathy
  - Rare but extremely serious condition occurring in late pregnancy up to first few months postpartum
  - Non-ischemic cardiomyopathy with EF <45%.
    - Incidence of 25-100 / 100K pregnancies
    - Black women have higher incidence and lower rate of full myometrial recovery
    - Other risk factors:
      - Hypertension (chronic or PIH)
      - Older maternal age
      - Multiple gestation
      - COVID-19??

Maternal Mortality – Cardiovascular Disease

- Peripartum / Postpartum Cardiomyopathy
  - Presentation
    - Dyspnea / dyspnea on exertion / cough / hemoptysis
    - Orthopnea / PND
    - Chest discomfort
    - Palpitations / dysrhythmia
    - Fluid retention / pathologic edema
  - Evaluation
    - BNP, troponins, CBC, CMP
    - Chest X-ray
    - EKG
    - Echocardiogram
      - Most vital part of evaluation
      - Avoid **DELAYING** this due to **DENIAL** that an otherwise healthy, young woman has serious cardiac disease!

Maternal Mortality – Cardiovascular Disease

- Peripartum / Postpartum Cardiomyopathy
  - Initial management is similar to any CHF
    - Supplemental oxygen as needed
    - "Optimize preload" - Diuretic therapy for volume overload / pulmonary edema
    - Management of dysrhythmia
    - "Optimize afterload" - Antihypertensive therapy for those with significantly elevated BP
    - Consult with cardiology and obstetrician
    - Transfer to higher level of care if needed
    - Consider ventricular assist devices for most severe cases

Maternal Mortality – Cardiovascular Disease

- Peripartum / Postpartum Cardiomyopathy
  - Long term treatment
    - Same medical therapy as other heart failures
      - ACE inhibitors
      - Beta blockers
      - Diuretics
      - Oxygen
    - Ventricular assist devices, implantable defibrillator, etc.
    - Transplant
  - Prognosis
    - Most recover normal / near normal cardiac function
      - Varies with ethnicity, age, initial severity
    - 20% with history of PPCM will have recurrence in subsequent pregnancy

Maternal Mortality – Cardiovascular Disease

- Peripartum / Postpartum Cardiomyopathy
  - Pitfalls
    - Misdiagnosis or delayed diagnosis
      - Failure to get echocardiogram
      - Asthma, pneumonia, normal physiologic changes of pregnancy
      - Young healthy women RARELY have community acquired double pneumonia
      - Any pregnant or postpartum woman with abnormal lungs on chest X-ray MUST get an echocardiogram without **DELAY**
      - **DENIAL** that reproductive age, healthy woman can have serious cardiac disease
    - Inappropriate or delayed care
      - Failure to consult / follow-up with cardiologist
      - Inadequate medical therapy

Maternal Mortality – Stroke

- Both hemorrhagic & ischemic stroke are more common in pregnant women than in age-matched controls
- Presentation is similar to non-pregnant pt
- Risk factors:
  - Thrombophilia / anticoagulant therapy
  - Hypertension (chronic or PIH)
  - Cerebral aneurysm
  - Smoking
  - Black race
  - Older maternal age

Maternal Mortality – Stroke

- Initial evaluation
  - Do not **DELAY** imaging due to concern for radiation exposure or **DENIAL** that reproductive age, healthy woman may be having CVA
  - Non-contrast CT is first line imaging
    - MRI is reasonable & avoids risk of radiation exposure
- Initial Management
  - Generally same as non-pregnant patients
  - Mechanical embolectomy in IR
  - Reperfusion with tPA

Maternal Mortality – Noncardiovascular Chronic Disease

- Account for significant amount of pregnancy related deaths (13-14%)
- Generally, if patient has poorly controlled, serious condition pregnancy should be avoided until the condition is improved
  - Provide / advise contraception
- Some common non-CV diseases that cause maternal mortality
  - Asthma
  - Diabetes
    - Ketoacidosis
    - Hypoglycemia
  - Sickle cell disease
  - Renal failure
  - Cirrhosis
  - Epilepsy
  - Cancer
  - Other chronic pulmonary disease (e.g., COPD, CF)

Maternal Mortality – Case Studies

- 42yo G2P1 WF enters labor at 38wks.
- BP increases while pushing
- Delivers healthy infant with Apgars 8/9.
- Develops severe mid-epigastric pain.
- BP up to 194/112, attributed to pain by RN's / OB
- Treated with antacids, morphine w/o much improvement & BP still very high
- Develops "dolls eyes" and CT shows large cerebral bleed, felt to be due to persistent severe hypertension
- Despite immediate craniotomy she expires two days later, never having any evidence of CNS function

Maternal Mortality – Case Studies

- Avoidable maternal death??
- DELAY in diagnosis due to DENIAL that BP "was real"
- DELAY in acute treatment for severe hypertension due to misdiagnosis
- DENIAL of severity of her HTN because she had already delivered (cure for PIH)

Maternal Mortality – Case Studies

- 33yo G1P1 BF presents to ER with shortness of breath on PP day #18
  - Had cesarean section for arrested labor during induction for severe pre-eclampsia
- BP is 144/92. Oxygen sat is 92%. HR = 108bpm.
- Chest X-ray read by radiologist as diffuse consolidation in bilateral lower lobes consistent with pneumonia.
- SaO2 improves to 94% with nebulizer tx.
- Treated with antibiotics.
- Readmitted 2 days later with worsening dyspnea
  - Echo shows dilated cardiomyopathy with EF 18%
- Dies on HD #4 from heart failure despite VAD

Maternal Mortality – Case Studies

- Preventable maternal death??
- DELAY in reaching correct diagnosis due to DENIAL that young woman would be likely to have severe cardiac disease
- DELAY in diagnosis due to failure to order echocardiogram
- DELAY in diagnosis due, in part, to failure to consider risk factors

Maternal Mortality – Case Studies

- 36yo G1P1 BF comes to clinic 9 days postpartum complaining of weight gain, headache & malaise. Has history of essential hypertension & is on HCTZ.
- BP is 144/96.
- Told by HCP she is probably just "tired and stressed"
- Acetaminophen & ibuprofen recommended for headache
- Collapses at home 2 days later
- Found to have PLT = 36K, elevated LFT's & hemorrhagic CVA
- Removed from ventilator 9 days later due to no discernible CNS function

Maternal Mortality – Case Studies

- Preventable maternal death??
- DELAY in diagnosis because HCP felt severe disease was unlikely more than a week out from delivery and because BP was not severely elevated.
- DELAY in diagnosis because of failure to identify risk factors

Maternal Mortality - Conclusions

- Rates in USA are rising / have risen to unacceptable levels while most of the rest of the world has seen decline
- Even more importantly this is a devastating outcome for a family!
  - *Check out "Lost Mothers" series from NPR & ProPublica*
- Significant racial & ethnic disparities exist for a multitude of reasons that are not well understood
- This is a problem that goes beyond obstetrics providers in the delivery room
  - **Primary care providers, ER's & urgent cares are vital to solving this problem!!!**

Maternal Mortality - Conclusions

- Maintain knowledge of disease processes that lead to maternal mortality
- Keep a high index of suspicion for these conditions
- Proactively manage conditions before pregnancy
- Avoid **DENIAL & DELAY** when confronted with an ill pregnant or postpartum patient
  - What could this be that would kill her??
  - How do I rule this out??
  - Generally avoid **DELAY** of diagnostic testing or acute interventions due to concern about fetus
- Consult with OB or MFM early & often

Maternal Mortality in Primary Care

QUESTIONS???